ORAL SUBMUCOUS FIBROSIS IN DURBAN, NATAL:

A STUDY OF ITS EPIDEMIOLOGY, AETIOLOGY AND MORPHOLOGICAL FEATURES

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THIS THESIS IS DEDICATED TO MY WIFE

AYESHA

FOR HER INSPIRATION AND ENCOURAGEMENT

AND TO

SORAYA, RIZWANA, AHMED AND SHAMEELA

FOR THEIR LOVING HELP AND INTEREST

CONTENTS

ABSTRACT

There is no satisfactory statistical record of oral submucous fibrosis in the Republic of South Africa or India. The present prevalence study of OSF among Indians in the municipal area of Durban was planned by the Institute for Biostatistics of the South African Medical Research Council. The sampling consisted of a stratified random survey and the total number of subjects examined was 2 058. They were stratified into the age groups: 10-14, 15-24, 25-34, 35-44, 45-54, 55-64, 65+ years and into sexes. Each age group included 294 people (147 males and 147 females). From the 29 suburbs included in this survey 147 points were sampled. The number of sampling points was calculated proportional to the population size. At each sampling point one individual of each sex in each age group was selected i.e. 14 individuals at each sampling point.

Two thousand and fifty-eight subjects were screened. The prevalence rate of chewers in the population was 5%. The prevalence rate of chewers with OSF was 2,3%. The habit is practised more commonly by older people and overwhelmingly by females.

The Durban City Engineer's Department (1984) projected an Indian population of 413 700 for 1984, of which 308 000 were 10+ years. The prevalence rate of chewers with OSF was 2,3% and accordingly there should be 9 515 of both sexes. The female : male ratio was 70 : 1, therefore there should be 9 379 females and 136 male chewers with oral submucous fibrosis amongst the Indians in Durban. When these prevalences are extrapolated to the whole population (1980 census) it is calculated that there would be approximately 38 699 chewers, 37 470 females and 1 723 males. Those with OSF will be 18 884, 18 310 females and 197 males.

A further 129 referred OSF cases were also analysed giving a total of 200 cases of OSF. There was a marked preponderance of females (98%) and 75% fell in the age group 25 - 54 years. The birthplace (whether India or South Africa), marital status, home language, socio-economic status and religion were of no significance. There were 10 oral cancers among the 129 referred OSF cases.

This study strongly incriminates the betel (areca) nut as the most important causative agent of OSF. The development of OSF however, is not dependent on the amount, frequency or duration of betel nut chewing, or on the use of chillies.

This study emphasises the early diagnosis of OSF before fibrous bands become palpable. The oral mucosa must be observed for localised loss of colour (blanching) and the mucosa must be palpated to determine its texture. An early sign is the loss of its smooth velvety feeling to be replaced by a linen-like feeling.

The many clinical findings of various other workers are confirmed. Furrowing of the lower lip has been observed in cases of severely reduced rima oris. Lichen planus, associated with OSF, was seen in six cases.

Blood investigations were performed on 152 patients with OSF and nine chewers without OSF. Unequivocal iron deficiency (serum ferritin 10 ng/ml) was present in 30% of patients with OSF and 75% of chewers without OSF. As anaemia is common among South African Indians, it cannot be implicated as a direct contributory factor to the development of OSF. Eosinophilia was not a feature in this series. The erythrocyte sedimentation rate was increased in 86% of subjects with OSF and 83% of chewers without OSF.

Nineteen of the 105 chewers with OSF had positive parietal cell antibodies. This high prevalence (18%) is much greater than that expected in the general population, indicating an association with betel nut chewing. Polyclonal increase in gamma globulins was present in 68% of subjects. The presence of positive parietal cell antibodies, high ESR and hypergammaglobulinaemia suggest an auto-immune response in the disease. Eight per cent of the subjects had mildly elevated serum bilirubin. Thirty-two per cent of chewers with OSF and 50% of chewers without OSF had mildly elevated serum alkaline phosphatase. There was no evidence of zinc deficiency or syphilis.

In the present study 152 biopsies of patients with OSF were studied under light microscopy. In 104 biopsies atrophic epithelium was observed. The epithelium was unkeratinised in 61% of patients. A definite correlation could not be established between atrophy of the epithelium and changes in the lamina propria. Atypia was observed in 27% of the biopsies. It is open to conjecture as to where exactly accumulation of collagen commences. It was elucidated that the number of blood vessels is significantly decreased in OSF and although the vessel walls are thickened, the vessel diameters remain unchanged. Tissue eosinophilia was not a feature of significance. With regard to electron microscopic changes the collagen fibrils in OSF were denser with no evidence that they were immature. The periodicity of the fibrils was normal.

The autopsy findings in a case of OSF revealed the development of concomitant carcinomas in different locations. The present study supports the evidence incriminating OSF as a precancerous condition. Five per cent of patients with OSF had concomitant carcinoma. Tobacco chewing or other associated habits could not be incriminated as promoting carcinogenesis. The development of concomitant cancer is neither related to the frequency

and duration of betel nut chewing nor to the severity of OSF.

All the patients, except five, had some form of chewing habit. It is difficult to explain the occurrence of OSF in these five subjects. In five families several members were affected. It is postulated that the occurrence of OSF within families is dependent on the betel habit rather than a genetic predisposition. This postulate is further supported by the discovery of three Coloured patients with OSF, who indulged in the nut chewing habit.

Morphological studies of the oral mucosa of chewers without clinical OSF have not been previously undertaken. Nine such subjects were examined, 8 showed hyperplastic/acanthotic epithelium, 4 demonstrated inter-cellular oedema, and definite atypia was present in 3. A moderately dense deposition of collagen in the lamina propria was observed in 5. In 3 the mast cell count varied from eight to 21 per field (400x). The only histological difference between subjects without OSF and patients with OSF was the presence of hyperplastic/acanthotic epithelium in the former and atrophic epithelium in the latter. Clinical evidence of OSF and the so-called "early" burning sensation are, therefore, late manifestations of the disease. In the pathogenesis of OSF it is postulated that epithelial hyperplasia/acanthosis is an early change, progressing to atrophy and dysplasia.

LIST OF FIGURES

LIST OF TABLES

CHAPTER I

INTRODUCTION

The oral mucosa is subjected to a multitude of insults fostered by divergent habits practised by people all over the globe. These habits, in the course of time, will register their marks on the oral mucous membrane. Oral submucous fibrosis (OSF) is one such malady. It silently cripples the oral cavity thereby preventing the patient from maintaining a normal diet and exposing him or her to the hazards of poor oral hygiene and inadequate nutrition.

Oral submucous fibrosis has probably existed for a long time but the condition has only been studied during the last 34 years.

Pindborg and Sirsat (1966) defined oral submucous fibrosis as "an insidious, chronic disease affecting any part of the oral cavity and sometimes the pharynx. Although occasionally preceded by and/or associated with vesicle formation, it is always associated with a juxta-epithelial inflammatory reaction followed by a fibro-elastic change of the lamina propria, with epithelial atrophy, leading to stiffness of the oral mucosa and causing trismus and inability to eat".

The motivation for this study emerged as a result of an impression arising from the number of referred patients with OSF to the King Edward VIII Hospital in Natal. The number of these referrals gave the impression that this condition is particularly prevalent among the Indian population of Durban and available literature seems to confirm this impression. In addition, a number of patients were seen with oral submucous fibrosis and concomitant cancer of the mouth which may indicate a connection between the disease and oral cancer.

Schonland and Bradshaw (1969a) used a sampling technique to define a representative distribution of households in Durban and carried out their prevalence studies on 500 domestic establishments containing 659 families, or 3 678 people. Adjustment was made in relation to Moslem households to increase their numbers interviewed in order to produce a numerically larger sample of Moslems. Of the 500 households 377 were Hindu (2 802 people) and 123 Moslem (876 people). The individuals examined were from 0 to 65 or more years. The manner in which these households were sampled is not described, thus making it difficult from this study to determine the prevalence of upper alimentary tract cancer and the chewing habit amongst the Indians in Durban.

Dockrat and Shear (1969) in their prevalence study in Durban had an unselected sample of 1 200 over the ages of 15. Approximately 800 of these individuals were examined in a door-to-door survey and the remaining 400 at the Out-patient Department of King Edward VIII Hospital. The survey was carried out on consecutive houses and the subjects were chosen consecutively both at home and hospital. In the method of sample selection it is not clear exactly how the sample was chosen; the number of houses samples and the number of patients with oral submucous fibrosis found at home and at the hospital is not recorded.

Shear, Lemmer and Dockrat (1967) in their prevalence studies in the Johannesburg-Pretoria area had a sample size of 1 000 consecutive unselected Indians. Of the total sampled the youngest person was two and a half years and the oldest 80 years. No mention is made of the number of consecutive houses sampled separately in the two municipal areas nor the number of patients found with the disease in each area. This study was carried out on two localised groups of Indians. The sample was not chosen randomly and, therefore, does not project an overall prevalence of chewing habits and OSF among the Indians in the Johannesburg-Pretoria areas.

Randeria (1972, 1977) studied 28 subjects, all of whom were diagnosed cases of OSF, at King Edward VIII Hospital in Durban.

Van Wyk, Staz and Farman (1977) in their prevalence studies, in Cape Town, of a small sample size of 238 examined 59 randomly selected families. Although the sample was randomly selected it was a very small one.

From the above it can be concluded that complete information is still lacking with regard to planned surveys on the prevalence rates of chewing habits and oral submucous fibrosis.

Present knowledge of the aetiology of oral submucous fibrosis is also incomplete and subject to considerable speculation. Some researchers strongly incriminate the betel nut only. Others suggest a host of responsible factors like chillies, betel chewing, lime, tobacco, allergy and collagen disease (now regarded as auto-immune disease). There has been no conclusive findings as far as the aetiology is concerned.

Extensive studies on the microscopic features of oral submucous fibrosis have been carried out and the characteristics of the lesion have been well documented - the most predominant feature being the condensation of collagen fibres in the mucosa juxta-epithelially. Very few electron microscopic studies have been reported with the result that there is insufficient correlation between microscopic and ultra-structural features of the disease.

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CHAPTER II

OBJECTIVES OF STUDY

The following objectives were defined for this study:

To determine:

1 the prevalence rates of betel chewing and of oral submucous fibrosis amongst Indians in the Municipal area of Durban,

2 the relationship between the chewing of betel nut and other habits and oral submucous fibrosis,

3 whether a relationship exists between oral submucous fibrosis and anaemia or liver dysfunction or the immune response, and

4 its microscopic characteristics and ultra-structural features, especially the collagen changes.

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CHAPTER III

REVIEW OF LITERATURE

1 INTRODUCTION

Divergent terminology has been used by different investigators to describe this malady. According to Sirsat and Khanolkar (1962a) Schwartz demonstrated, in 1952, for the first time five Indian women, from East Africa, with "atrophia idiopathica (tropica) mucosa oris". From India, in 1953, came a first report by Joshi, an Ear, Nose and Throat surgeon in Bombay, who coined the term submucous fibrosis of the palate and pillars. Other names that have been suggested are "diffuse oral submucous fibrosis" (Lal, 1953), "idiopathic scleroderma of the mouth" (Su, 1954), "idiopathic palatal fibrosis" (Rao, 1962) and Behl in 1962 referred to it as "sclerosing stomatitis" (Krishnappa, 1967). Pindborg and Sirsat (1966) indicated that strictly speaking, a more appropriate name would be "juxta-epithelial fibrosis".

2 DEMOGRAPHY

2.1 GEOGRAPHIC AND ETHNIC DISTRIBUTION

Oral submucous fibrosis is primarily confined to Indians and people of South Eastern Asian stock i.e. those living in India, Nepal, Ceylon, Fiji Islands, Malaysia, Thailand, Taiwan and South Vietnam.

The disease has also been reported amongst Indians living in such diverse regions as the United Kingdom, Republic of South Africa and the African States of Kenya and Uganda. No case of the disease has been recorded in any of the other group of South Eastern Asians domiciled abroad.

In India oral submucous fibrosis is endemic (see Table 3.1). Pindborg (1972) observed sporadic cases of OSF among non-Indians on his visits to Ceylon, Malaysia, Nepal, Thailand and South Vietnam in 1964. In Malaysia the disease occurred mostly among the Indian population. A typical case was seen in an Indian female student from Uganda (Millard, 1966) and an Indian woman who lived most of her life in Kenya (O'Riordon, 1974). Isolated cases amongst Indians and Pakistanis domiciled in the United Kingdom have been recorded (Rowell, 1967; Kennedy and MacDonald, 1968). According to Sirsat and Khanolkar (1962a) Schwartz in 1952 reported five females with the disease in East Africa (Kenya). During a discussion of Rao and Raju's paper (1954) Lalchand stated that he saw 15 cases in Nepal in a period of 25 days (see Table 3.2).

In the Republic of South Africa (see Table 3.3) the occurrence of the malady exclusively amongst the Indian female population has been reported in Durban (Dockrat and Shear, 1969; Randeria, 1972, 1977), Johannesburg-Pretoria (Shear et al, 1967) and Cape Town Van Wyk et al, 1977).

Although oral submucous fibrosis is generally peculiar to people of Indian origin some exceptions have been noted (see Table 3.2). It has been seen in three Chinese males (Su, 1954), and Shiau and Kwan (1979) reported 35 patients in Taiwan among whom there was only one female. Rao (1962) reports some Europeans with the disease living in Hyderabad in India. Pindborg (1967) observed the condition in two Danish patients suffering from pemphigoid which, clinically and histologically, was indistinguishable from oral submucous fibrosis. Simpson (1969) tells of a case in England of an English woman married to a Pakistani, while Laskaris, Bovopoulou and Nicolis (1981) describe

a case of oral submucous fibrosis in a Greek female. The first recorded case of the disease in a Chinese female in Papua New Guinea was described by Barnes and Duke (1975). Lemmer and Shear (1967) reported a case of a white South African female with oral submucous fibrosis.

TABLE 3.1
DISTRIBUTION OF ORAL SUBMUCOUS FIBROSIS ACCORDING TO GEOGRAPHIC LOCATION, SEX AND AGE IN INDIA

AUTHOR		LOCATION	NO OF CASES	SEX F%	SEX M%	AGE RANGE YEARS
Lal	(1953)	Madhya Pradesh	20	?	?	?
Joshi	(1953)	Bombay	41	54	46	10-60
Rao and Raju	(1954)	Undisclosed	7	86	14	18-20
DeSa	(1957)	Bombay	64	53	47	10-55
Sharan	(1959)	Bihar	21	Males predominated		12-62
Rao	(1962)	Hyderabad	46	63	37	12-64
Sirsat and Khanolkar	(1962a)	Bombay	85	53	47	10-58
Pindborg et al	(1965b)	Lucknow	51	76	24	22-72
Pindborg et al	(1965b)	Bombay	50	32	68	22-72
Pindborg et al	(1966)	Bangalore	18	?	?	?
Zachariah et al	(1966)	Trivandrum	61	?	?	?
Pindborg et al	(1968)	Bihar (Singhbhum)	0	-	-	-
Pindborg et al	(1968)	Andhra Pradesh	4	25	75	39-70
Pindborg et al	(1968)	Bihar (Darbhanga)	7	29	71	32-62
Pindborg et al	(1968)	Gujarat	16	100	0	21-58
Pindborg et al	(1968)	Kerala (Ernakulam)	36	77	23	32-80
Wahi et al	(1970)	Uttar Pradesh	44	38	62	35-70+
Mehta et al	(1972)	Maharashtra	33	88	12	15-74
Akbar	(1976)	Kashmir	30	40	60	28-59
Pindborg et al	(1980)	Parakadavu (1971)	7	?	?	?
Gupta et al	(1980)	Kerala	11	73	27	35-55+
Gupta et al	(1980)	Gujarat	4	75	25	15-55+

TABLE 3.2
DISTRIBUTION OF ORAL SUBMUCOUS FIBROSIS
ACCORDING TO GEOGRAPHIC LOCATION, SEX AND AGE
EXCLUDING INDIA AND THE REPUBLIC OF SOUTH AFRICA

AUTHOR		LOCATION	NO. OF CASES	SEX F%	SEX M%	AGE RANGE YEARS
Schwartz (As quoted by Sirsat & Khanolkar, 1962a)	(1952)	East Africa (Indians)	5	100	0	?
Su	(1954)	China (Taiwan)	3	0	100	30-40
Lalchand (As quoted by Rao & Raju, 1954)	(1954)	Nepal	15	0	100	8-60
Shiau & Kwan	(1979)	China (Taiwan)	35	3	97	17-64

TABLE 3.3
DISTRIBUTION OF ORAL SUBMUCOUS FIBROSIS ACCORDING
TO GEOGRAPHIC LOCATION, SEX AND AGE IN THE REPUBLIC OF SOUTH AFRICA

AUTHOR		LOCATION	NO. OF CASES	SEX F%	SEX M%	AGE RANGE YEARS
Shear et al	(1967)	Johannesburg-Pretoria	5	100	0	18-35
Dockrat & Shear	(1969)	Durban	7	100	0	26-60
Randeria	(1972)	Durban	20	100	0	40+
Randeria	(1977)	Durban	18	100	0	30-?
Van Wyk et al	(1977)	Cape Town	3	100	0	30-45+

2.2 PREVALENCE

Epidemiological studies on the prevalence of oral submucous fibrosis have been carried out by Pindborg et al (1965b; 1966) and Zachariah et al (1966). They examined 35 000 urban Indians seeking treatment at Dental Colleges in Lucknow, Bombay, Bangalore and Trivandrum and found the following prevalence rates - 0,51%, 0,50%, 0,18% and 1,22% (see Table 3.4 for details) in this selected group of patients.

In order to compare the findings in urbanised Indians with those of rural Indians, Pindborg et al (1966; 1968) undertook an epidemiological survey among villagers in India (see Table 3.4). Their

study comprised five districts in four of the States in India. The states were Gujarat, Kerala, Andhra Pradesh and Bihar with its two districts. The villagers were selected on the basis of existing prevalence of chewing and smoking habits and were chosen by random sampling. In this house to house survey about 10 000 individuals, fifteen years and older, were examined in each district. They found the prevalence of oral submucous fibrosis varied from 0% in Singhbum in Bihar to 0,36% in Kerala (see Table 3.4). Wahi et al (1970) in the district of Mainpuri in Uttar Pradesh found a prevalence rate of 0,59%. Mehta et al (1972) in a sample size of 101 000 in Poona, found a prevalence rate of 0.03% and Gupta et al (1980) in a follow-up survey of their base-line studies in Kerala and Gujarat found a prevalence rate of 0,65% and 0,06% respectively.

In the Republic of South Africa (see Table 3.5) Shear et al (1967) in the Johannesburg-Pretoria area found a prevalence rate of 0,5%. Dockrat and Shear (1969) in Durban found a figure of 0,6% and Van Wyk et al (1977) in Cape Town a rate of 1,25%.

TABLE 3.4
PREVALENCE OF ORAL SUBMUCOUS FIBROSIS IN INDIA

	AUTHOR	LOCATION	SAMPLE SIZE	PREVALENCE RATE %
Urban Dental Colleges	Pindborg et al (1965b)	Lucknow	10 000	0,51
	Pindborg et al (1965b)	Bombay	10 000	0,50
	Pindborg et al (1966)	Bangalore	10 000	0,18
	Zachariah et al (1966)	Trivandrum	5 000	1,22
	Pindborg et al (1966)	Bihar (Singhbhum)	10 000	0
	Pindborg et al (1968)	Andhra Pradesh (Srikakulam)	10 000	0,04
	Pindborg et al (1968)	Bihar (Darbhanga)	10 000	0,07
	Pindborg et al (1968)	Gujarat (Bhavnagar)	10 000	0,16
	Pindborg et al (1968)	Kerala (Ernakulam)	10 000	0,36
Rural	Wahi et al (1970)	Uttar Pradesh (Mainpuri)	7 000	0,59
	Mehta et al (1972)	Maharashtra (Poona)	101 000	0,03
	Pindborg et al (1980)	Parakadavu (1971)	5 000	0,14
	Gupta et al (1980)	Kerala (Ernakulam)	7 000	0,65
	Gupta et al (1980)	Gujarat (Bhavnagar)	6 500	0 06

TABLE 3.5
PREVALENCE OF ORAL SUBMUCOUS FIBROSIS
IN THE REPUBLIC OF SOUTH AFRICA

AUTHOR	LOCATION	SAMPLE SIZE	PREVALENCE RATE %
Shear et al (1967)	Johannesburg-Pretoria	1 000	0,5
Dockrat & Shear (1969)	Durban	1 200	0,6
Van Wyk et al (1977)	Cape Town	238	1,25

2.3 INCIDENCE OF ORAL SUBMUCOUS FIBROSIS

Pindborg et al (1980) in their recent study of incidence, the first undertaken, report the yearly incidence of oral submucous fibrosis per 100 000 person years to be 9 for males and 20 for females over a ten-year period in the Ernakulam district of Kerala, South India.

2.4 AGE

Oral submucous fibrosis encompasses a rather wide age range, although a majority of patients are between 20 and 40 years of age (Pindborg and Sirsat, 1966). Paymaster (1956) believed that younger persons are usually affected. The youngest person reported so far was an eight year old Indian boy in Singapore (Pindborg and Sirsat, 1966).

Dockrat and Shear (1969) reported that of their total sample in Durban the youngest person was 15 years old and the oldest 98 years. There were seven patients with oral submucous fibrosis, 26, 27, 29, 32, 35, 43 and 60 years old. The ages of three referred Durban patients (Dockrat and Shear, 1969) and those patients seen in the Johannesburg-Pretoria areas (Shear et al, 1967) all fell within the range 18-60 years.

Randeria (1972) found all her Durban patients to be above 40 years; and in a later study (1977) the age range to be 30-35+ years. Van Wyk et al (1977) showed an age range 30-45 years.

2.5 SEX

As regards the sex distribution of oral submucous fibrosis opinions vary without a definite pattern. One group of authors (Rao and Raju, 1954; Rao, 1962; Pindborg et al, 1965b, (Lucknow); Pindborg et al, 1968 (Kerala-Ernakalum); Simpson, 1969; Mehta et al (1968) and all authors in the Republic of South Africa (see Table 3.3)) found that females were predominant. Schwartz (1952) (as reported by Sirsat and Khanolkar, 1962a); Pindborg et al (1965b) (Bombay); Wahi et al (1968) (Bihar-Darbhanga); Akbar (1976) and Shiau and Kwan (1979) found a preponderance of males. According to Su (1954) and Lalchand (1954) (as reported by Rao and Raju, 1954) there was a 100% male distribution. On

the other hand, Joshi (1953), DeSa (1957), and Sirsat and Khanolkar (1962a) showed an equal distribution. According to Wahi et al (1966a) the male to female ratio was 2:1.

2.6 RELIGIOUS DISTRIBUTION, OCCUPATION AND SOCIO-ECONOMIC LEVELS.

Oral submucous fibrosis has been reported to occur in all communities, irrespective of their religion, caste and social status (Joshi, 1953; DeSa, 1957; Sirsat and Khanolkar, 1962a; Akbar, 1976).

In all the Indian series the disease is confined almost exclusively to the Hindu and Muslim communities. According to Wahi et al (1966b) the Hindu male was more susceptible than the Muslim male. Pindborg and Sirsat (1966) state that no caste or religious community is particularly affected with the malady.

According to Dockrat and Shear (1969) the Hindu and Muslim ratio was 4 : 3; and that of Randeria (1972) the ratio was 3 : 2. There were no Christians or other group with the disease. Schonland and Bradshaw (1969b) found slightly more Muslims to be betel chewers but there was no significance except in the case of males under 20 years old to have a tendency to adopt the habit at an earlier age.

DeSa (1957), Wahi et al (1966b) and Pindborg and Sirsat (1966) reported that the malady affected people at all socio-economic levels. Wahi et al (1966b) mentioned that the majority of patients belonged to the lower socio-economic group.

2.7 GENETIC TENDENCY AND FAMILIAL PATTERN

Caniff et al (1983) in their preliminary study of 23 Indian immigrants with oral submucous fibrosis living in London and the Home Counties,

showed a statistically significant relationship between the disease and the DR3 antigen, indicating a genetic basis. There is no report of the familial pattern of OSF in the literature.

3 AETIOLOGY

3.1 CHILLIES

Hot spicy foods containing chillies have been long regarded as an important aetiological agent (Sirsat and Khanolkar, 1960b and c; Wahi et al, 1966b; Pindborg and Sirsat, 1966; Hamner et al, 1971). Since the condition is localised to the upper alimentary tract it is reasonable to suspect component(s) of the diet as being related to the aetiology. Sirsat and Khanolkar (1960b) painted the palate of Wistar rats with capsaicin, the active ingredient in chillies, and found that if the rats were protein depleted or if there was a Vitamin B deficiency, there was a response similar to that found in oral submucous fibrosis, clinically and pathologically. Shiau and Kwan (1979) reported that none of their patients ate chillies often and it seems reasonable to believe that hot spicy foods are not the causative agents of OSF in Taiwan.

3.2 THE BETEL NUT

3.2.1 Betel Chewing Habits

The earliest record of betel chewing is contained in the Maharamsa, a Ceylonese document of the Year 504 B.C., in which it is said a princess pleasured her nurse with a present of the chew (Burton-Bradley, 1980). The habit seems to be rather ancient, and it is difficult to trace its origin. The proverb 'taking a paan', meaning to undertake a difficult task, is still prevalent in many Indian languages.

This habit is practised widely and has been reported in the primitive race in New Guinea, Australia (Bjerre, 1956). The Black women in Mozambique and the Zanzibari community in Chatsworth, Durban, indulge in this habit. Although the habit has been reported in other parts of the world, we do not have sufficient information.

3.2.2 Leaf

The Indian name for the betel leaf is paan. The leaves are derived from the betel vine (Piper betle). Different varieties of betel leaves are used in various parts of India (Mehta et al, 1971). Locally, chewers use betel leaves grown on special farms in Verulam, an area to the north of Durban.

It is probable that some of the agriculturists among the indentured Indians brought from India vegetable seeds which they cultivated here but it is unlikely that the betel plant, which is vegetatively propogated, was brought by these people. The passenger Indians who went back and forth to India and Natal were the more likely introducers of the plants. The plants are found in Mauritius and some of the betel plants may have originated from there, having been picked up from the island by the merchants on their way to Natal.

3.2.3 Nut

The Indian name for the betel or areca nut (Areca catechu) is supari. The nuts are imported from India. The betel nut is also chewed alone. Mehta (1971) state that the usage of the areca nut differs in three ways:

1 In most places in India baked areca (black) nut is used.

2 In the States of Bihar and Gujarat the boiled areca (white) nut is used.

3 In the State of Kerala, which is the main centre for the production of areca nuts, the raw areca nut is preferred.

The white areca nut (boiled) is known as "Falsha"; the black (baked) as Madras nut and when cut into pieces it is called the "Chippia" or mad nut because of its euphoric properties. Schonland and Bradshaw (1969b) mention that the black nut is the driest and hardest.

3.2.4 Lime

The Indian name for lime is chunam. Mehta (1971) state that in Kerala mostly shell lime, i.e. lime made from sea shells, is used while elsewhere in India stone lime is used. In Durban chewers obtain the lime from limestone found locally.

3.2.5 OTHER INGREDIENTS

3.2.5.1 Catechu

The Indian name for catechu is katta kambu. This substance is extracted from the leaves of the shrub Uncaria gambir. The leaves are bound, steamed and steeped in boiling water. On cooling, catechin crystallises out, leaving the more soluble catechu tannic acid in solution. Bran is added to catechin, and then made into little cakes. The catechu cakes are imported from India.

3.2.5.2 Tobacco

Schonland and Bradshaw (1969b) state that in Durban a dried leaf grown in the Transvaal is used. It is coarsely shredded and a few flakes are added by a small proportion of chewers who use it. In India, various types of tobacco are used and different methods of curing these have been described.

4 COMPOSITION AND EFFECTS OF CONSTITUENTS OF THE BETEL PACKAGE

4.1 The leaf

Mature leaves of the betel vine contain volatile oils (eugenol, an unsaturated aromatic phenol and terpenes), potassium nitrate and small quantities of sugar, starch and tannin. It has a carminative effect, sweetens the breath, and is a gentle stimulant (Schonland and Bradshaw, 1969b).

4.2 The Nut

The dried areca nut contains many alkaloids (arecoline, arecaine, guvacaine, arecolidine, guvacoline, iso-guvacaine and choline) chief among which is arecoline, which has a muscarinic (cholinergic) effect (Pheiffer, Beck and Goldstein, 1967) which is glandular secreting, gut-stimulating, a vasodepressant and which has a direct cortical arousal effect.

Also present are tannin, the glycerides of lauric, oleic and myristic acids, and a little sugar. By itself the areca nut is highly acidic and astringent to the taste. The addition of lime not only neutralises this to a large extent, as can be easily demonstrated in vitro, but also promotes the appearance of a red dye (Muir and Kirk, 1960). They also state that it is sialogogic and diaphoretic, and that very large amounts depress the central nervous system. Schonland and Bradshaw (1969b) observed that it is likely that the soothing, stimulating and diaphoretic effects, reported by Natal chewers, are due to the nut alkaloids and the frequently made claims that it is good for digestion may be an expression of the carminative effect. Arecoline is probably absorbed in quite large amounts by regular chewers as 0,1% of the dried nut is arecoline. In habitual chewers of the nut there is marked attrition of the teeth. The main effects of chewing are:

1 To satisfy the hunger sensation.

2 To promote digestion.

3 To increase salivation.

4 To product a slight euphoric effect.

5 THE HABIT

The prepared betel leaf quid is a package of a fresh mature betel leaf (with the undersurface smeared with lime) containing betel nut, catechu and at times tobacco (Fig. 3.1). Many other innocuous condiments, sweetening and flavouring agents such as fennel seeds, nuts, spices, cardamon, cloves, aniseed, honey and coconut are sometimes added. The composition varies according to custom, individual taste and economic status.

The betel package or the betel nut alone is normally chewed after meals. The bolus formed as a result of chewing is swallowed and if it contains tobacco it is spat out. The bolus is kept in the mouth for prolonged periods of time, sometimes even during sleep. When the nut alone is chewed it may also be retained in the buccal sulcus for prolonged periods of time, sometimes even during sleep. When the nut alone is chewed it may also be retained in the buccal sulcus for prolonged periods and the "juice" is usually swallowed. Schonland and Bradshaw (1969b) report that evidence suggests that the betel-chewing habit is addictive, in the same way that tobacco-smoking is. They interestingly observed that almost 30% of males and females preferred to chew the nut only and that the younger people also preferred the nut only.

6 PREVALENCE OF CHEWING IN THE INDIAN POPULATION

Schonland and Bradshaw (1969b) report that more female Indians chewed betel than males and this was significant. Of the 1 842 females of all ages, 30,7% were chewers, while of the 1 836 males, 5.5% were chewers. The percentage of chewers increased with age in both male and female groups. Thus, 10,3% of males and 71,9% of females, in the age group 60 years or more, chewed betel. There are far more female chewers than male chewers at each age level.

6.1 FREQUENCY OF BETEL CHEWING

Schonland and Bradshaw (1969b) found that more females were heavy chewers (four or more times a day) and more males are light (one to six times a week) or occasional chewers (once a week).

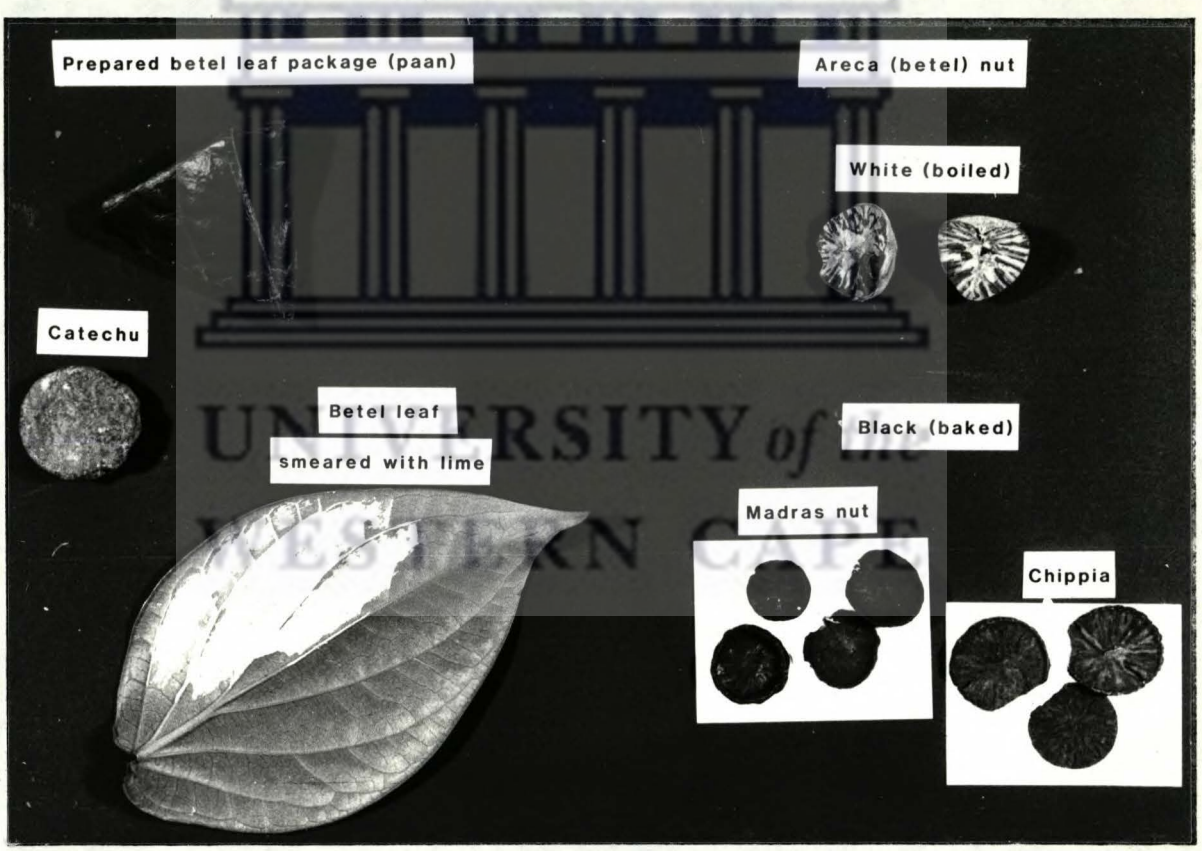

FIGURE 3.1 COMPOSITION OF PAAN (BETEL PACKAGE)

6.2 DURATION OF BETEL-CHEWING HABIT

Schonland and Bradshaw (1969b) observed that there are no sex differences in the duration of habit and the mean duration of chewing was 17,6 years in Indian males and 17,09 years in females.

7 EVALUATION OF THE CAUSAL AGENTS OF ORAL SUBMUCOUS FIBROSIS

Lal (1953) believed that addiction of betel nut chewing could be the causative agent of oral submucous fibrosis by:

1 Producing continuous irritation of the mucosa, and

2 A specific chemical action of the betel nut on the mucosa.

Su (1954) incriminates betel chewing as the aetiological factor. The pathogenic role is attributed to:

a The high tannic acid (14-18%) content and the arecoline of betel nut.

b The influence of the mixed slake lime, and

c The continuous and prolonged action of arecoline contained in the betel nut, affecting the vascular nerves of the oral mucosa and causing neurotrophic disorders.

DeSa (1957), in his series of 65 patients mentions that six patients gave a history of eating spicy foods, 11 were addicted to chewing of "paan" and 9 to chewing betel nut, and five were smokers.

Sharan (1959) also reported the high incidence of betel nut chewing among his 21 patients. He strongly believed that trivial mechanical and chemical injury as a result of chewing betel nut, initiates degenerative changes in the connective tissue of the oral mucosa, followed by fibrosis.

Sirsat and Khanolkar (1962b), however, carried out experiments on rats with arecoline and came to the conclusion that it played no significant role.

Dockrat and Shear (1969) conclude that the use of the hard nut may produce abrasion of the mucosa and this may render such mucosa more susceptible to the assumed fibrogenic action of either the juice from the nut or (if the assumption of Pindborg and Sirsat, 1966 is correct) from chillies which are a regular part of the diet of most Indians.

Scutt et al (1983) showed that hydrolysis of arecoline to arecaidine may be necessary for the stimulation of fibroblasts by areca nut alkaloids and this may be a major factor in the accumulation of collagen in OSF.

Awang, Scutt and Caniff (1983) believe that the variations in nut alkaloids and tannin content are probably due to plant variability and to different cooking procedures and may contribute to the regional differences in the prevalence of OSF.

Shiau and Kwan (1979) in their report of 35 cases in Taiwan suggested betel nut chewing as a significant contributory cause and they observed that none of these patients consumed chillies.

Pindborg et al (1980) observed that in their three new cases all three chewed the betel (areca) nut.

Paissat (1981) states that the betel nut appears as a common denominator in the occurrence of severe changes in the oral mucosa both in India and Papua New Guinea and this should be recognised as a carcinogen until proven otherwise.

7.1 Lime

Orr (1933) considered lime to be an injurious ingredient in betel chewing (shell-lime more so than stone-lime). He stated that lime catalysed the liberation of carcinogenic alkaloids from tobacco of the quid. Muir and Kirk (1960) felt that lime, in the small quantities used, served merely to neutralise the acid taste of the nut. Schonland and Bradshaw (1969b) reported that in Natal, the action of lime on tobacco is not in question and the quantity added to the quid is very small. It is, therefore, difficult to say whether the lime is a suspect ingredient, either by its own action or as a catalyst, for releasing possibly carcinogenic alkaloids from the areca nut. Paissat (1981) concludes that among the coastal people of Papua New Guinea, the betel chewing habit containing lime (either coral or shell) is endemic and oral carcinoma is the most common malignancy among Papua New Guinea nationals. However, there is not a single recorded case of oral submucous fibrosis in this population.

7.2 Tobacco

Mehta et al (1971) report that in Bhavnagar (Gujarat) the 16 individuals with oral submucous fibrosis, who were all females, did not indulge in any kind of tobacco habit. Marsden (1960) concluded that the tobacco is the carcinogen in a betel quid, and this explains why betel cancer is only a disease of Indian labourers in Malaya and not of betel chewers generally. Schonland and Bradshaw (1969b) do not consider tobacco or catechu to be hazardous because very few people add these, and their use is losing popularity among young chewers. Randeria (1977) found that only two of her 18 cases used tobacco in their paan.

8 ORAL SUBMUCOUS FIBROSIS WITH NO CHEWING HABITS

Mehta et al (1972) reported that it was interesting to note that three of the 33 patients with oral submucous fibrosis did not have any chewing or smoking habit. Paissat (1981) in New Papua Guinea recorded the only case of OSF occurring in a Chinese lady who, incidentally, did not chew the betel.

9 CLINICAL PRESENTATION

The onset of the condition is insidious and may take many years to develop but is often of two to five years duration. According to the majority of authors the most common initial symptom is a burning sensation in the mouth often experienced when the patient is eating spicy food (Joshi, 1953; Paymaster, 1956; DeSa, 1957; Pindborg and Sirsat, 1966; Mehta et al, 1971).

A number of patients with oral submucous fibrosis present with vesicles which are usually found in areas of redness in the soft palate, the anterior faucial pillars, the buccal mucosa or the mucosal surfaces of the lips (especially the lower lip) (Pindborg and Sirsat, 1956). Others present with ulceration or recurrent stomatitis (Joshi, 1953; DeSa, 1957; Rao, 1962; Pindborg et al, 1964). The vesicles are painful and on rupturing give rise to painful, small ulcerations. Cultures of the vesicular fluid failed to reveal any specific organism (DeSa, 1957). Although the appearance of vesicles is considered an initial presentation, vesicular eruptions have been reported to occur in a later phase of the disease during acute exacerbations (Pindborg et al, 1964).

According to Pindborg et al (1964) the palate and faucial pillars, buccal mucosa and lips may be affected at an early stage and is revealed as blanching. As the disease progresses the mucosal blanching

becomes more pronounced, slightly opaque, and white fibrous bands appear. The blanching is striking, for the normal Indian oral mucosa is usually pigmented. Oral submucous fibrosis is often associated with pigment changes (Mehta et al, 1971). There is loss of pigmentation often occurring in spots, and the mucosa develops a marble-like appearance. Bilateral dark brown hyperpigmentation of the commissure of the mouth may also occur (Su, 1954).

While some patients complained of excessive salivation (Pindborg and Sirsat, 1966), defective gustatory sensation and dryness of the mouth (Su, 1954) has also been reported to occur in the early stages of the disease. Occasionally, fiery red, erythroplakic areas have been observed to occur (Pindborg and Sirsat, 1966).

Previously it was thought the palate and the faucial pillars were the areas primarily affected. Today it is known that the buccal mucosa and the lips may also be affected at an early stage (Pindborg et al, 1964).

The oral mucosa is usually involved symmetrically, but DeSa (1957) reported a case in which there was deviation of the mandible to the left side due to involvement of the right side only. Dockrat and Shear (1969) also reported a right side involvement only. Wahi et al (1966a) observed a case in which the right half of the hard palate was involved.

In the soft palate, the fibrous bands radiated from the pterygomandibular raphe or the anterior faucial pillar producing a scar-like appearance. Fibrous bands around the pterygomandibular raphe resulted in varying degrees of trismus (DeSa, 1957). The uvula is

markedly involved. It shrinks and takes on the appearance of a small fibrous bud (Pindborg and Sirsat, 1966). In the later stages the entire isthmus faucium is greatly reduced and the mobility of the soft palate is markedly impaired (Pindborg and Sirsat, 1966). The faucial pillars become thick, short and extremely hard (Pindborg and Sirsat, 1966). The tonsils may be compressed between the fibrosed pillars (Joshi, 1953). Fibrosis may also spread past the pharynx and down into the pyriform fossa (Pindborg and Sirsat, 1966). All observers have noted the frequency with which the tongue becomes progressively immobile and shows a diffuse papillary atrophy, and the surface of the tongue becomes smooth (Pindborg, 1966; Mehta et al, 1971; Hamner, Looney and Chused, 1974).

In the lips the circular band of fibrosis may extend around the entire mouth. There is atrophy of the vermilion border (Millard, 1966; Pindborg, 1966). Clinically, the changes are especially marked in the lower lip (Pindborg et al, 1964). The gingivae and the floor of the mouth may be affected (Pindborg and Sirsat, 1966).

When the fibrosis reaches the pharynx the patient may experience referred pain in the ears (Rao, 1962). The same author also finds deafness due to occlusion of the eustachian tube in one-third of his patients. DeSa (1957) and Millard (1966) mention nasility of the voice as one of the later symptoms in some patients.

Mathew et al (1967) subjected 11 cases of oral submucous fibrosis to oesophagoscopy. The oesophageal biopsies showed clinical and histological evidence of the disease involving the oesophageal mucosa with varying degrees of intensity.

Balkrishnan, Narendranathan and Moni (1979) undertook a detailed gastro-intestinal tract evaluation of 10 patients with biopsy proven oral submucous fibrosis and found the oesophagus to be involved with the disease process in one case. In established cases the patient has:

a Difficulties in opening the mouth.

b Inability to whistle or to blow out a candle.

c Difficulties in swallowing.

9.1 Trismus

Most authors have found a reduced mandibular opening (DeSa, 1957; Rao, 1962; Hamner et al, 1974; Barnes and Duke, 1975). DeSa (1957) reported the average opening in oral submucous fibrosis to be 2,6 cms.

9.2 Focal vascular dilatations and petechiae

The presence of reddish spots on the oral mucosa has been mentioned by Joshi (1953) who described it as "granulating red spots on the palate" and Krishnappa (1972) who mentioned "tiny red granular islands". Bhonsle et al (1981) reported nine cases, with reddish-blue spots, among whom eight were females and the most favoured sites were the tongue, buccal mucosa and the lips. The spots were associated with numerous endothelial-lined lumina which were located juxta-epithelially and which were interpreted as widely dilated capillaries. In the process of dilatation, the thin-walled vessels appeared to rupture and to produce petechiae. Vascular dilatations of this kind often result from a loss of connective tissue support.

10 HISTOLOGICAL FINDINGS

Joshi (1953) reported the occurrence of a certain amount of fibrosis in the submucous layer. Lal (1953) described the epithelium to be normal in some cases and atrophic in others. He also found that the

sub-epithelial layer was completely replaced by dense acellular, inelastic, collagenous material with varying amounts of lymphocyte and plasma cells. Su (1954) and Sharan (1959) described a hyaline degeneration of the sub-epithelial zone with disappearance of mucous glands.

10.1 EPITHELIUM

In more than 90% of the cases the oral epithelium is markedly atrophic (Pindborg, 1966). The rete pegs are completely lost (Pindborg et al, 1965a). The buccal mucosa, normally unkeratinised, is subject to varying degrees of keratinisation in 64% (Pindborg, 1966), a finding attributable to the widespread Indian habit of chewing tobacco and smoking strong indigenous cigarettes. The atrophic epithelium in oral submucous fibrosis also exhibits:

a Intercellular oedema in 18% of cases.

b Signet cells in 13%, and

b Epithelial atypia (focal dysplasia) in 7% (Pindborg, 1966).

The atrophy of the oral epithelium is probably secondary to the connective tissue changes (Pindborg, 1966). Su (1954) also mentioned that the underlying muscle was normal and the epithelium acanthotic and hyperkeratotic. Shear and Lemmer (1967) found the epithelium to be narrower than normal and rete pegs absent. Mani and Singh (1976b) mentioned that there was a tendency towards epithelial atrophy associated with hyperorthokeratosis and pyknotic changes in the nuclei of the basal cell layer. Hyperplasia of the epithelium associated with hyperkeratosis was also noticed. Mehta et al, (1971) state that marked atrophy of the oral epithelium was the outstanding feature in the histopathology of oral submucous fibrosis. Shiau and Kwan (1979)

demonstrated atrophy of the epithelium, loss of the rete pegs, intracellular oedema and keratinisation of the normally non-keratinised buccal mucosa. Hydropic degeneration of basal cells was also noted.

10.2 CHANGES IN THE LAMINA PROPRIA AND SUBMUCOSA

Pindborg and Singh (1964) reported that the vesicles before they ruptured, showed that they were caused by a sub-epithelial accumulation of fluid. An inflammation exhibiting a number of eosinophilic cells is present in the lamina propria below the vesicle.

Except in cases which begin with vesicles, oral submucous fibrosis starts in the connective tissue. Sirsat and Pindborg (1967a) described four consecutive stages, based upon sections stained with hematoxylin and eosin. The very early stage is characterised by a finely fibrillar collagen, dispersed with oedema. The fibroblastic response is strong, with plump young cells containing abundant cytoplasm. The blood vessels are sometimes normal, mainly polymorpho-nuclear leukocytes with an occasional eosinophil, are present. In the early stage the juxta-epithelial area shows early hyalinisation. The collagen is still seen as separate bundles, which are thickened. Plump young fibroblasts are present in moderate numbers. The blood vessels are often dilated and congested. The inflammatory cells now are mostly mononuclear lymphocytes, eosinophils, and an occasional plasma cell. In the moderately advanced stage the collagen is moderately hyalinised, the amorphous change starting from the juxta-epithelial basement membrane. Occasionally, thickened collagen bundles are still seen separated by slight residual oedema. The fibroblastic response is less marked, the cells present being mostly adult fibrocytes with elongated spindle-shaped nuclei and scanty cytoplasm. Blood vessels are either

normal or constricted as a result of increased surrounding fibrous tissue. The inflammatory exudate consists of lymphocytes and plasma cells, although an occasional eosinophil is seen. In the advanced stage the collagen is completely hyalinised and is seen as a smooth sheet, with no separate bundles discernible. Oedema is absent. The hyalinised areas are devoid of fibroblasts, although a thin, elongated cell or vestigial nucleus is seen at rare intervals along the fibre bundle. Blood vessels are completely obliterated or narrowed. The inflammatory cells are lymphocytes and plasma cells. Biopsies from different parts of the oral cavity may show different stages of the disease. In a subsequent paper, Sirsat and Pindborg (1967c) described the blood vessels. They found normal, dilated and constricted blood vessels, often in combination in the same section. In the early stages there was extreme dilatation and narrowing in the more advanced stages.

Shear and Lemmer (1967) found a dense fibrosis of the lamina propria and submucosa. Collagen fibres are deposited around muscle fibres, blood vessels and mucous glands. All cases had a plentiful blood supply. Elastic tissue, although present in all cases, is bound up in dense collagen.

Mehta et al (1971) state that one of the most interesting histo-pathological features is an amorphous change in the connective tissue, commencing downwards from the epithelial basement membrane. The Rinehart and van Gieson stains showed that in contrast to the collagen found in the normal buccal mucosa, which exhibit an undulated bundle pattern, the juxta-epithelial connective tissue band in oral submucous fibrosis was quite amorphous, non-bundular, and stained a faint greyish-pink, rather than the customary deep red. As oral

submucous fibrosis reaches a more advanced stage, much of the connective tissue appears hyalinised without discernible collagen bundles.

Mani (1977) noticed a marked increase in the collagenous tissue. Dense and coarse collagen fibres associated with hyalinisation and fragmentation were more marked in severe cases. Varying degrees of chronic inflammation, a relatively small number of blood vessels and an occasional sub-epithelial vesicle was also observed.

Shiau and Kwan (1979) demonstrated hyalinisation of the collagen fibres and these were seen as a smooth sheet without discernible separated bundles. The dense collagen filled almost the entire sub-mucosal layer.

Fullmer (1966) studied 20 cases. Only one showed changed staining of collagen and elastic fibres.

10.3 INFLAMMATORY CELLS

The predominant inflammatory cell in the early and very early oral submucous fibrosis is the polymorphonuclear leucocyte. As the disease progresses to the moderately advanced stage, the eosinophil count progressively rises in the tissues and in the blood. In the very advanced stage the lymphocyte is the predominant cell. The lymphocytes have a trephocytic (storage of protein) role and may be associated with fibroplasia and probably the production of tissue immunity (Sirsat and Pindborg,1967a). Rao (1962), Sirsat and Khanolkar (1962a) and Pindborg et al (1964) have observed that there is a marked eosinophilia in the majority of cases of oral submucous fibrosis and feel it is due to histamine release from the mast cells.

10.4 MAST CELL RESPONSE

In early oral submucous fibrosis and increasing number of mast cells are observed perivascularly (Bhatt and Dholakia, 1977; Sirsat and Pindborg, 1967b). In more advanced stages the count diminishes which is contrary to the behaviour of mast cells in inflammation. In acute inflammation the mast cells decrease and increase as the reaction becomes chronic. In addition, Sirsat and Pindborg (1967a) state that the overall sub-epithelial change, in conjunction with peculiar mast cell response and the changes in the inflammatory cells and the presence of gamma globulinaemia, suggest that the pathogenesis of oral submucous fibrosis might be in the realm of immunopathology.

11 EXFOLIATIVE CYTOLOGY

Oral exfoliative cytology studies have been carried out and earlier signs of oral submucous fibrosis include pleomorphism and prominent nuclei. However, these are not pathognomonic and a definite diagnosis requires a biopsy (Pindborg, 1965).

Mehta et al (1971) in 36 cases studied cytologically found 30 as normal and six atypical. Mani and Singh (1976) noticed an increase in the number of keratinised cells in advancing lesions of oral submucous fibrosis and concluded that smears have not shown any cellular changes of diagnostic value or any changes suggestive of malignancy. Randeria (1982) showed an increased exfoliation of intermediate cyanophils in cases of oral submucous fibrosis.

12 ELECTRON MICROSCOPY

The collagen fibrils appear abnormal being fragmented and bent at odd angles showing much amorphous debris, although the repeating cross striations are retained (Sirsat and Khanolkar, 1957; 1960b). Binnie

and Cawson (1972) found that the collagenous fibrils are thinner than in normal connective tissue, are of embryonic type and that the defect may lie in polymerisation and maturation. There is excess production of young collagen fibrils showing increased argyrophilia.

13 ASSOCIATION OF ORAL SUBMUCOUS FIBROSIS WITH OTHER DISEASES

13.1 Collagen Disorder

Most authors and workers involved with oral submucous fibrosis at one stage or another attempted to relate this disease with the collagen group of diseases.

Rao (1962) suggested that this was a localised collagen disease of the oral cavity comparable to Dupuytren's contracture, keloid, Peyronie's disease and idiopathic retroperitoneal and mediastinal fibrosis.

Sirsat and Khanolkar (1960a) detected degraded collagen fibres with amorphous material on electron microscopy. The similarity between the appearance and that observed in other connective tissue disorders led them to believe the possible 'Collagen disease' causation.

13.2 Vitamin B deficiency

Chronic deficiency of Vitamin B group may play a role. Joshi (1953) and Wahi et al (1966b) have attributed oral submucous fibrosis to vitamin deficiencies and local irritation.

13.3 Protein deficiency

Sirsat and Khanolkar (1960b; 1960c) in their experiments showed that capsaicin aroused only a limited connective tissue response in the unimpaired animal, but in protein-depleted or Vitamin B-deficient animals the response was more widespread.

13.4 Anaemia

This may be an important factor in the aetiology of oral submucous fibrosis, because a high percentage of the people in India, including males, suffer from anaemia as a result of a deficient diet (DeSa, 1957). Mayet (1976) found that the prevalence of anaemia in Indian women in Durban was 38% and that it was mostly due to iron deficiency. DeSa (1957) and Sirsat and Khanolkar (1962a) cite a marked anaemia in patients with the disease. Rao (1962) noted a microcytic anaemia in half of his patients and Paymaster (1956) only a moderate anaemia. Pindborg et al (1964) reported that a third of their cases suffered from anaemia. MacPhail et al (1981) in their studies on the iron status of Indian women living in Chatsworth, Durban, found that more than 20% of the subjects had evidence of iron deficiency, while a further 17,5% had depleted iron stores. The prevalence of all grades of iron deficiency fell off with age, so that less than 7% of women over 45 years had iron deficiency anaemia. Although different criteria were used the results suggest that there has been some improvement in the iron status of women living in Chatsworth since the studies conducted by Mayet (1976) and Mayet et al (1972). The sample in Chatsworth was not randomly chosen and may, therefore, not reflect the overall situation.

14 ORAL SUBMUCOUS FIBROSIS AND CONCOMITANT LESIONS

14.1 Leukoplakia

Sirsat and Khanolkar (1962a) observed six cases of leukoplakia among 85 patients with oral submucous fibrosis. Pindborg et al (1964) reported seven patients having leukoplakia in the areas of fibrosis and in one patient a papilloma had developed, which on histological examination, proved to be a carcinoma. His epidemiological studies among urban Indians in North India (1965) revealed leukoplakia in

26,9% of 101 patients with oral submucous fibrosis. In contrast only 3% of 19 899 patients with oral submucous fibrosis were affected by oral leukoplakia. Mehta et al (1971) record five individuals with simultaneous leukoplakia.

14.2 Lichen planus

Pindborg, Mehta and Daftary (1970) state that a new and interesting finding was the observation of three cases of lichen planus super-imposed on oral submucous fibrosis. Mehta et al (1971) found four cases associated with oral submucous fibrosis. The diagnosis of lichen planus is difficult to make on histological grounds alone in cases of oral submucous fibrosis, as the two conditions resemble each other histologically (Moos and Madan, 1968). Consequently, lichen planus should be diagnosed only when the clinical changes are typical with the presence of Wickham's striae (Pindborg et al, 1970). Daftary et al (1980) describe a lichen planus-like lesion which has a characteristic appearance of fine white lines which did not overlap or criss-cross as in classical lichen planus corresponding to the area where the Betel quid is kept and was found mostly among Betel-tobacco chewers with significant female predominance. Mehta et al (1971) report that a number of cases of leukoplakia and lichen planus showed histological features typical for oral submucous fibrosis.

14.3 Pemphigus vulgaris

Hay and Calnan (1979) describe a 43 year old Indian woman, who has oral submucous fibrosis in combination with pemphigus vulgaris.

14.4 Pemphigoid

Pindborg (1967) noticed pemphigoid in two Danish patients concomitant with oral submucous fibrosis.

14.5 Leukoedema

Mehta et al (1971) diagnosed leukoedema only on the buccal mucosa and mostly among smokers. Many investigators regard leukoedema as a variation of the normal (WHO Collaborating Centre for Oral Precancerous Lesions, 1978).

14.6 Erythroplakia

Occasionally fiery red, erythroplakic areas appear (Pindborg and Sirsat, 1966). Undoubtedly erythroplakia represents the most severe of the oral precancerous conditions (Mehta et al, 1971).

15 ORAL SUBMUCOUS FIBROSIS AND SCLERODERMA

Both show clinical and histological similarities but differences in distribution and prognosis. So far there has been no evidence of any connection between these diseases. Though the ultimate cause of progressive systemic sclerosis (scleroderma) and of oral submucous fibrosis probably differ it seems likely that they share a defect of collagen polymerisation and maturation which gives rise to a clinically similar picture (Binnie and Cawson, 1972).

16 OCCURRENCE OF EPITHELIAL ATYPIA IN ORAL SUBMUCOUS FIBROSIS

Among the six cases described by Lemmer and Shear (1968) one showed dyskeratosis with atypia. The basal cells were pleomorphic and hyperchromatic and there was loss of polarity and foci of individual cell keratinisation. Pindborg in 1966 showed a frequency of epithelial atypia in 7% of his 110 biopsy investigations whereas in 1972 among 220 biopsies from 186 patients collected in various parts of India varied from 7,7 to 23,8 with an average of 13,2%. Pindborg et al in 1967 from their histological examination of biopsies demonstrated that 30 out of the 40 patients with simultaneous cancer and oral submucous

fibrosis had epithelial atypia in 11,5% in areas of OSF remote from the cancer and in 1970 from their 53 biopsies 22,6% had epithelial atypia. Wahi, Luthra and Kapur (1966) found, among 104 cases of OSF, 14,4% with an atypical epithelial hyperplasia. Mehta et al (1971) observed that the atypias in oral submucous fibrosis rarely exhibit signs of basal cell hyperplasia : instead they are primarily characterised by a markedly irregular epithelial stratification (often aggravated by the atrophic condition of the epithelium) nuclear pleomorphism and a pronounced intercellular oedema. They diagnosed epithelial atypia when two or more of the following features were present:

1 Irregular epithelial stratification.

2 Increased density of the basal cell layer, or prickle cell layer, or both.

3 Increased number of mitotic figures (a few abnormal mitosis may be present)

4 Increased nuclear-cytoplasmic ratio

5 Loss of polarity of cells

6 Nuclear pleomorphism

7 Hyperchromatism

8 Keratinisation of single cells or cell groups in prickle cell layer

9 Spongiosis in the basal part of the epithelium.

17 ORAL SUBMUCOUS FIBROSIS AS A PRECANCEROUS CONDITION

A vast amount of evidence has been collected to incriminate oral submucous fibrosis as a precancerous condition and the frequent finding of epithelial atypia lends support to the premalignant nature of the lesion. Paymaster (1956) was the first to mention this. One-third of the cases of oral submucous fibrosis developed a

slow-growing squamous-cell carcinoma in the affected region. Sirsat and Khanolkar (1962a) also working among Bombay patients could not support Paymaster's findings and felt that the incidence was much lower. Pindborg and Zachariah (1965) examined 100 patients with oral cancer and noticed that 40 had clinical signs of oral submucous fibrosis. Shiau and Kwan (1979) report that eight of the 35 patients revealed oral malignant lesions as well, all of which were found to be epidermoid carcinoma. The prevalence of OSF with oral malignancy was 23%. Mehta et al (1981) in Ernakulam, among three individuals with oral submucous fibrosis, diagnosed one carcinoma. McGurk and Craig (1984) have reported on two immigrant women, one Indian and one Pakistani, who had OSF with a concomitant oral carcinoma of the buccal mucosa. Pindborg et al (1984) observed oral cancer in 13% of the 89 patients with OSF.

The probable pathogenesis (Pindborg and Sirsat, 1966) is that the oral epithelium becomes atrophic and more vulnerable to carcinogens-chemicals like tobacco, paan, etc. The atrophic epithelium first becomes hyperkeratotic (clinically leukoplakic); later inter-cellular oedema and basal-cell hyperplasia develop, and eventually epithelial atypia with moderate epithelial hyperplasia. A carcinoma may develop at any time after this stage has been reached.

Pindborg (1972) suggests that oral submucous fibrosis starts in the connective tissue. An initial inflammatory reaction occurs followed by a fibro-elastic degeneration of the juxta-epithelial connective tissue giving rise to degenerative changes in the overlying epithelium which becomes atrophic and as a consequence becomes more vulnerable to the action of carcinogens which are so often present in tobacco.

18 LABORATORY INVESTIGATIONS

There are no characteristic laboratory findings. The erythrocyte sedimentation rate is raised in the majority of patients with oral submucous fibrosis (DeSa, 1957). A normocytic anaemia is frequently present (DeSa, 1957; Paymaster, 1956; Rao, 1962; Sirsat and Khanolkar, 1962b; Pindborg et al, 1964). DeSa (1957) and Sirsat and Khanolkar (1962a) demonstrated an increased gamma globulin level in these patients whereas Rao (1962) and Pindborg et al (1964) found normal values. All investigators agree that there is an eosinophilia in patients with oral submucous fibrosis (Pindborg and Sirsat, 1966). DeSa (1957) found an increased eosinophilia (5-20%) in 39 of his cases.

19 TREATMENT

The treatment of oral submucous fibrosis has been empirical. It has in the main concerned itself with the improvement of trismus. No attention has been given to early detection and treatment. Once the condition develops, there is no regression nor is there any effective treatment. The treatment to date has been conservative, i.e. to stop the habit, treat the anaemia, encourage a balanced diet and, most important, regular review. Corticosteroids have also been tried but this only helps to alleviate the burning sensation within the mouth. Surgical treatment results in the formation of further fibrous tissue so that an initial dramatic improvement eventually leads to a more severe trismus. Improved grafting techniques in conjunction with the histological picture may improve the prognosis after surgery and this may ultimately become the treatment of choice in established cases. Yen (1982) reports to have successfully treated a patient by surgical excision of the fibrotic bands and grafting with a split-thickness skin graft.

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CHAPTER IV

METHODS AND MATERIALS

1 THE POPULATION FROM WHICH THE SAMPLE WAS DRAWN

1.1 HISTORY

The Indians in South Africa owe their existence to the system of indenture between British India and the British Colonies which commenced in 1837 and ended in 1917. Slavery had been legally terminated in 1834 and the indenture system was introduced to continue the economic exploitation of the tropical and sub-tropical colonies. The system saw about five million Indians leaving their homeland for over a dozen countries to work there in conditions no better than the system it replaced. These were not willing immigrants. They were victims of a politico-socio-economic condition which had reduced them to a bare subsistence level that made them fall victims of the indenture system (Brooks and Webb, 1979).

The first batch of Indians to arrive in Natal on the paddle-ship Truro was in November 1860. The last consignment arrived in 1911. The total number that arrived during this period was 152 184, all of them recruited as labourers (Choonoo, 1967).

Barely 17 years after the arrival of the indentured labourers the so-called passenger Indians - largely Muslim traders - began to arrive. They came at their own expense and were mostly Gujarati speaking Indians from Kathiawad, Surat and Porbandar.

Over the 51 year period that the indenture system flourished nearly two-thirds had embarked from Madras made up mostly of the three main

Dravidian groups, Tamil, Telegu and a sprinkling of Malayalam. Half of these were agriculturists and labourers and the others were artisans, traders and high caste Hindus. The other third were shipped from Calcutta, having been recruited in the main from Uttar Pradesh in the Ganges basin and from the towns and villages of Bihar. The majority of those from the north were Aryans and spoke Hindustani. They were of lighter complexion and differed physically from the Dravidians of the South. About 12% of all the indentured Indians were Muslims. A small number of Christians came from the South - about five percent.

The term of indenture was for five years and at the wage of 10 shillings per month with board and lodging and free medical care. As cost minimisation was generally pursued by the planters and rations were low there was much malnourishment. The housing was poor. After this period and a further five years of free labour (not under indenture) a return passage was available to them back to India. Up to 1890 the labourers could exchange return passage for a plot of land, but this was rarely done (Tayal, 1980).

Of the total number of Indians shipped to Natal under indenture about 48% stayed in the Colony. Nearly 50 000 returned to India or left the province by 1911. During the entire period over 22 000 died (Tayal, 1980).

In Natal, apart from being indentured in the sugar plantations on the coast, some of the labourers were indentured to wattle plantations in the midlands of Natal and coal mines and farms in the upper regions of the province. A fair number were hired by the catering industry and by individuals as domestics. After their term of indenture had expired a vast number of them remained employed in the fields in which they were

originally employed. Some became small holders and cultivated vegetables, others did general farming in a small way and yet others became petty merchants, fishermen and hawkers and were economically integrated into the structure of Natal's economy (Brooks and Webb, 1979).

A hundred years after their first arrival nearly 60% of the Indians were factory workers and in the manufacturing trade and only about 20% in commerce as owners and assistants. Agriculture only attracted 6% and the Public Service about 11% (Joosub, 1978). By 1913, Indian immigration was prohibited by law with the result that today, with few exceptions, Indian South Africans are South African citizens by birth. Many circumstances have slowed down their economic advancement and thrown most of them into menial and less lucrative situations. A large body of them are still landless, semi-skilled and unskilled labourers.

1.2 SOCIO-ECONOMIC STATUS

The Indians of South Africa constitute a heterogenous society composed of not one, as is frequently believed, but many distinct ethnic groups differing from one another in many respects, e.g. anthropological characteristics, dietary habits, marriage and other social customs, cultural activities, religion, place of origin in Indian etc. (Mistry, 1965).

The South African environment compressed peoples who had been widely dispersed into comparatively restricted geographical areas, and drew them into close neighbourliness. Their feeling of common identity was to an important extent thrust upon them by their very precarious position as a minority. Surrounding non-Indians saw them as a single

cultural group and the government treated them as a single political and status entity.

Class barriers evident in early South African Indian life coincided with the circumstances of the immigration to the country whether passenger or indentured. Today economic position is the prime index of upper class status and the very small South African Indian elite is composed of as many descendants of passenger Indians as of indentured Indians.

Though the Indians in Durban, area of the present survey, are wholly integrated into the highly cosmopolitan urban economy, many of their attitudes and patterns of social life tend to be characteristically traditional. This is most evident in the religious ceremonials and the network of relations which prevail in the family. Although urbanisation has intensified modifications in the traditional patterns of family life, they have by no means nullified them. It is generally the economically secure groups, and in particular the Gujaratis, who have succeeded best in retaining their pattern. The families of professionals and semi-professionals show the greatest westernisation and relations between spouses and between parents and children come close to the urban model. The poorer groups, by contrast, are not so well protected and the old pattern suffers conflict with the new.

Though the Indian economic position is low, almost 23% of the working population in Durban is in white collar jobs, indicating the favourable extent to which they participate on the higher levels of the economic scale.

The vast majority of all gainfully employed Durban Indians (60%) are engaged as unskilled and semi-skilled workers in industry, commerce, transport and service, as operatives, labourers, assistants to skilled tradesmen, clerks, messengers, waiters and drivers. A small proportion are skilled workers (10%) occupied as painters, printers, bricklayers, jewellers, carpenters, cabinet makers, watch repairers, tailors, chefs, supervisors and foremen. A still smaller proportion (5%) are in such privileged positions as teachers, doctors, lawyers, business executives and shopkeepers. About 10% are agricultural workers and fishermen. There are some very wealthy Indians - industrialists, merchants and the very successful professionals, but these are a fraction of a percent (Meer, 1969).

In 1974 males accounted for 78% of the labour force. Thirty three percent of the labour force is under the age of 25 years and 31% between 26 and 35 years - a youthful labour force. Females were younger, 74% being under 35 years of age (Sugden, 1978).

Indian women are less involved in the hurly-burly of urban life. Although as indentured labourers, they were gainfully employed in the fields of domestics, within a generation the tendency developed for them to retire into the privacy of their homes. In 1960 only 10,5% (Meer, 1969) of employable Indian women were recorded as gainfully occupied in South Africa. The proportion of gainfully employed women is rising rapidly.

By and large the Indian families show the effects of westernisation and the close family units are disappearing fast. Originally there was a kinship system of several nuclear families hierarchically arranged by male superiority. Marriages were usually arranged by parents of the

couples and the children of the marriages were looked after by the unit. There were also economic obligations attached to the system. The joint or extended family system formed either by choice or economic necessity was the norm originally and continued until recently and it still influences Indian attitudes and sentiments to a considerable degree and shapes relationships within the community. Normally habits and influences are, therefore, acquired from the older generations (Meer, 1969).

Sugden (1978) noted that the younger age groups of Indians in both sexes exhibited relatively high levels in life tables and, therefore, mortality for these ages was assumed to decrease slowly in future. More rapid decrease in mortality was considered likely for the middle-aged and older groups.

1.3 RELIGIOUS AND LANGUAGE DISTRIBUTION

The majority of South African Indians are Hindus. In Durban, 74% of the Indian population subscribe to that faith, 16% are Muslims, and 7% Christian (Meer, 1969). The Hindus are divided into four language groups - two of South Indian Dravidian origin, Tamil and Telegu, and two of North Indian Sanskrit origin, Hindustani and Gujarati. According to Meer (1969) 38% of Durban Indians may be classified as Tamil-speaking, and about 12% as Telegu-speaking, 25% speak Hindustani, and less than 2% Gujarati. The Muslims speak Urdu and Gujarati. At one time a considerable number of Muslims spoke Tamil, but owing to the impact of Islamic mission and educational movements, they now speak Urdu. Today most of the South African Indians can speak either or both the official languages of the country, English and Afrikaans. There is a tendency, most marked among the younger Indians,

to speak English or Afrikaans at home instead of their Indian home language.

1.4 CENSUS FINDINGS

According to the 1980 census (Durban, City Engineer's Department, 1980) in the municipal area of Durban, 68% of the Indians were not economically active (see Table 4.1). Of the remainder, 15% were active in the mining and manufacturing industries and less than 1% in the professional, administrative and managerial class. Thirty-seven percent of the residents were married and 4% widowed (see Table 4.2). With regard to the religious distribution, 75% were Hindus, 13% Muslims and 12% Christians (see Table 4.3). Ninety percent of the Indians in the municipal area of Durban spoke English as their home language. Only about 9% used the Indian dialect at home (see Table 4.4). The age distribution of the South African Indian population in 1980 is depicted in Fig. 4.1. It has a structure intermediate between the White and Black populations. It is calculated that there were 413 140 females and 408 180 males.

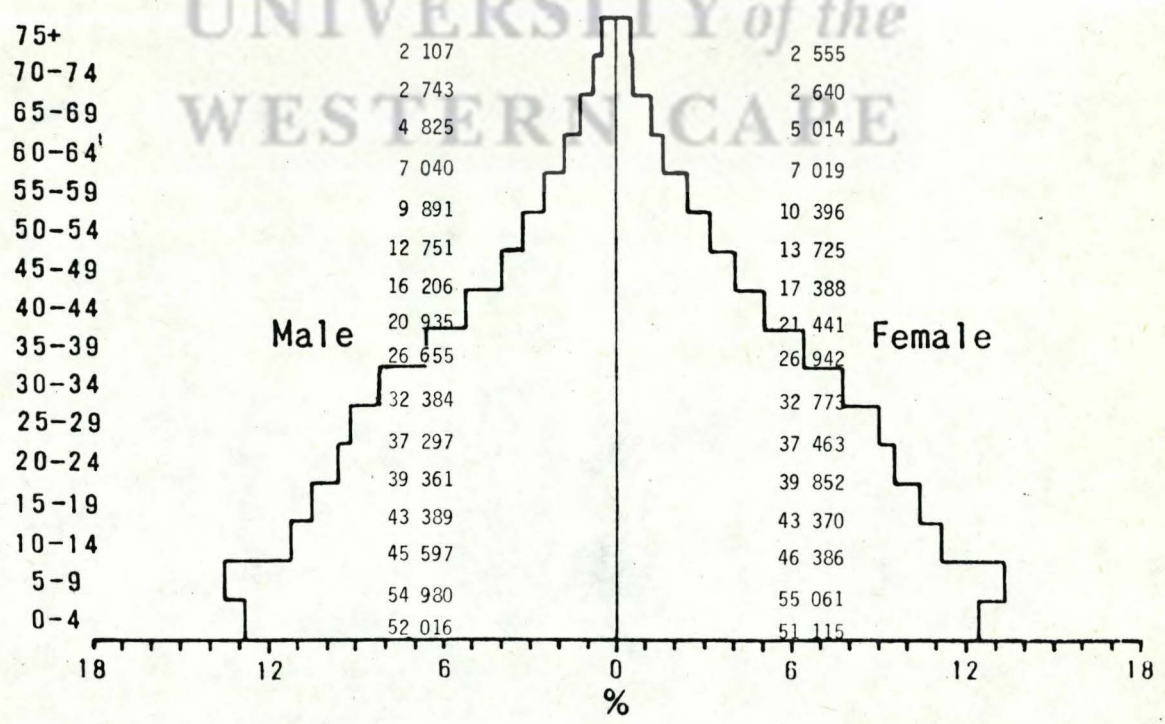


FIGURE 4.1 THE AGE DISTRIBUTION OF THE SOUTH AFRICAN INDIAN POPULATION IN 1980

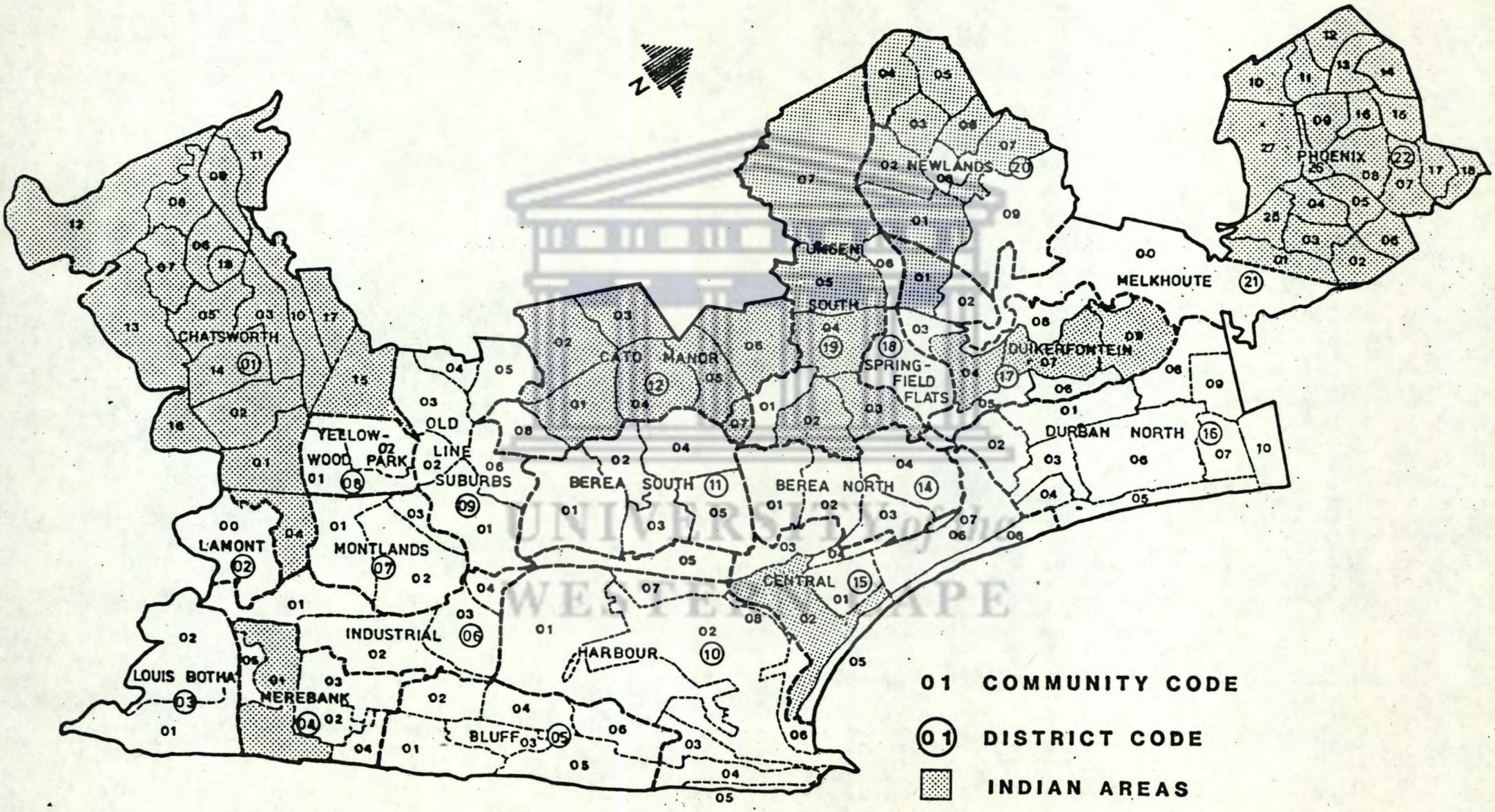


FIGURE 4.2 THE MUNICIPAL AREA OF DURBAN SHOWING INDIAN SUBURBS

TABLE 4.1
POPULATION DISTRIBUTION (1980) ACCORDING TO OCCUPATION
IN THE MUNICIPAL AREA OF DURBAN

OCCUPATION	NUMBER	%
Professional	1 500	0,40
Technician, Artist, Sports	8 760	2,33
Administrative, Managerial	1 500	0,40
Clerical & related workers	24 180	6,43
Sales workers	10 500	2,79
Service workers	7 800	2,07
Agriculture, Forestry, Hunting	1 100	0,29
Mining & Manufacturing	57 040	15,16
Unclassified	6 520	1,73
Not economically active	257 420	68,40
T O T A L	376 320	100,00

TABLE 4.2
POPULATION DISTRIBUTION (1980) ACCORDING TO MARITAL STATUS
IN THE MUNICIPAL AREA OF DURBAN

MARITAL STATUS	NUMBER	%
Unmarried (never married)	216 460	57,50
Married	140 580	37,34
Living together	1 960	0,52
Widow/Widower	15 200	4,04
Divorced	2 240	0,60
T O T A L	376 440	100,00

TABLE 4.3
POPULATION DISTRIBUTION (1980) ACCORDING TO RELIGION
IN THE MUNICIPAL AREA OF DURBAN

RELIGION	NUMBER	%
Hindu	263 700	75,26
Muslim	45 730	13,05
Christian	40 960	11,69
TOTAL	350 390	100,00
NON-RESPONDENTS	47 320	13,50

TABLE 4.4
POPULATION DISTRIBUTION (1980) ACCORDING TO HOME LANGUAGE IN THE MUNICIPAL AREA OF DURBAN

HOME LANGUAGE	NUMBER	%
English	341 160	90,45
Afrikaans	1 390	0,37
Tamil	9 900	2,62
Hindi	9 380	2,49
Telegu	2 020	0,54
Gujarati	5 600	1,48
Urdu	6 840	1,81
Other	900	0,75
T O T A L	377 190	100,00

2 THE GEOGRAPHIC AREA OF THE POPULATION

Durban is a seaport on the East coast of the Republic of South Africa in the Province of Natal. It is situated 29°52'S; 31°1' E. The climate is humid and subtropical with a mean annual temperature of about 21°C and an annual rainfall of about 1 500 millimetres.

The projected population for 1984 for the Durban municipal area was 677 300, of whom 211 700 were Whites, 51 900 Coloureds and 413 700 Indians (Durban, City Engineer's Department, 1984). Of this Indian population 308 000 were 10+ years, of which 156 500 were females. Now no Blacks reside in the municipal area of Durban.

Basically, groups of people have been separated into areas predominantly White, predominantly Coloured, predominantly Black and predominantly Indian.

3 THE SUBURBS WHERE INDIANS RESIDE

For the purpose of this survey the study area (see Fig. 4.2) because of easy spatial reference and homogenecity of dwelling types i.e. public sector or private sector, was sub-divided into four sections - Durban proper, Chatsworth proper, Chatsworth area and Phoenix.

Durban proper consists of the following suburbs:

Merewent was established 25 years ago on 334 ha. with public sector dwelling types catering for about 32 000 people. It is eight kilometres from the centre of Durban. It is a low-class area occupied mostly by Hindus speaking either Tamil or Hindi.

Clairwood. Indian pioneers settled in Clairwood some 90 years ago, the chief occupation at that time being market gardening. It is approximately eight kilometres to the South of Durban. About 30 years ago Clairwood was regarded as the largest Indian settlement area in the Republic of South Africa with a population of 40 000 people. Today, however, the population has dwindled to 6 880. Now there are mostly Hindi-speaking Hindus belonging to the low income group living there. Bendheim (1981) found that 43% of Clairwood residents are below the age of 18, which represents a young population. Fifty one percent of the population are female, the remaining 49% are male. Clairwood occupies an area of about 258 ha.

Central Business District. A small area known as the Grey Street Complex in the Central Business District in the centre of the city is occupied by about 7 000 Indians. It is a high income area with a predominance of Muslims mainly living in flats.

Warwick plus A.K. comprises of Warwick Avenue and a Block called A.K. In Warwick Avenue most of the buildings have been demolished for road purposes and the present population of about 600 live mostly in flats. They belong

to the low income group. A.K. Block has been demolished for future industrial development.

Red Hill is a relatively well-developed residential area established about 50 years ago on about 197 ha. occupied by middle-class families with a population of 600. The majority are Hindus with some Muslims and Christians. Hindi is mainly spoken.

Parlock occupies 163 ha. with a population of 4 600. It is well developed in a hilly terrain. It is a middle-class area occupied mainly by Muslims speaking Urdu or Gujarati. Established in 1960.

Hippo Road, Peter Road. This area is ear-marked for industrial development and road expansion. Market gardeners are in occupation with little or no income. Mostly Hindi-speaking Hindus live there. The area is in a state of flux.

Sea Cow Lake. A pioneer Indian area which is to become industrial with the result that people are moving to Phoenix. It is occupied by a low income group mostly Hindi-speaking Hindus.

Kenville is a middle-class area occupied mostly by Hindi- and Tamil-speaking Hindus. The terrain is hilly of about 242 ha. with a population of 8 360. It was established about 50 years ago.

Avoca. A pioneer Indian area with a hilly terrain was established in 1932 and at one time was occupied by market gardeners. The suburb is in the process of development as the shacks are being replaced. This is predominantly a middle-class area with Hindi- and Tamil-speaking Hindus with a population of 7 340. Avoca occupies an area of about 237 ha.

Sydenham is the nearest residential area to the city for Indians with a population of about 24 000. It occupies an area of about 225 ha. There has been a rapid development during the past 15 years with high-rise buildings of mostly middle-class occupation. People of all religious denominations live here.

Springfield is a very old Indian area of about 174 ha. where the original municipal housing scheme was first established about 52 years ago. It is in close proximity to the city and is occupied by people of the lower middle and low income groups. There is a preponderance of Hindi- and Tamil-speaking Hindus. It has a population of 8 720.

Clare Hills is occupied by Hindi-speaking Hindus belonging to the low and middle income groups. It is an original Indian area of about 254 ha. with a population of 5 840. It is situated in close proximity to the city and was established about 50 years ago.

Palmiet Recreation is fast becoming depopulated as the area is to eventually disappear for the extension of recreational facilities and parks.

Reservoir Hills was established in 1945 and occupies an area of about 861 ha. The population is 17 525 and belongs to the high income group. They are mostly Hindi- and Tamil-speaking Hindus and a fair number of Muslims.

Chatsworth proper. Chatsworth lies to the South of Durban, 16 kilometres radius from the centre of the city. Chatsworth proper has public sector dwelling houses and consists of recognised communities with a total of 11 i.e. Havenside, Bayview etc. Chatsworth is established on 2 000 ha. and has 20 495 units with only 81 units still to be built (Oosthuizen and Hofmeyr,

1979). Estimates suggest that it now carries a population of more than a quarter million. The first batch of houses in Chatsworth was completed in 1963. Seventy six percent of the residents of Chatsworth are Hindus, 16% Christians and 8% Muslims. The income level of people living in Chatsworth is very low.

Chatsworth area. Chatsworth area has private sector dwelling houses and comprises of Silverglen, Umhlatuzana and Kharwastan. It is adjacent to Chatsworth proper. This is a very hilly terrain where middle class Indians have built their homes. They are predominantly Hindus. Chatsworth area was established in 1950 on 638 ha. and has a population of 21 060.

Phoenix. Phoenix lies to the North of Durban, about 24 kilometres from the centre of the city. The first residents moved into Phoenix in late 1975. At present there are approximately 60 000 people living there (Household Subsistence Level in Phoenix 1980). They occupy seven community areas and others are in the process of being built. At completion Phoenix will be made up of about 20 community areas, housing an estimated 250 000 people. Phoenix was established by the Durban City Council as a low cost housing scheme for Indians. The people who have moved into Phoenix have come from places like Cato Manor, Springfield, New Farm, etc.

The report on the Household Subsistence Level in Phoenix (1980) found:

1 The sex distribution about equal.

2 Comprised largely of a young population with 53,4% below the age of 20 years and 83,3% below the age of 40 years.

3 Their 1978 study revealed the religious distribution as Hindu 72,3%, Muslim 11.1% and Christian 16,6%.

4 EPIDEMIOLOGIC SURVEY - THE POPULATION SAMPLE

It was decided to carry out a stratified survey in order to determine the age and gender related prevalence rates in the population.

The sampling procedure was planned by the Institute for Biostatistics of the South African Medical Research Council. At the time of planning the survey only the 1970 population census figures were available. In 1970 the population of Durban was 736 852 of whom 203 322 were Blacks, 191 667 Whites, 44 067 Coloureds and 297 796 Indians (South Africa, 1977, Dept of Statistics). Of the Indian population 149 681 were females and 148 115 males. However, the Durban City Engineer's Department (1978) projected an Indian population of 364 752 in 1978 and it was this information from this department which was utilised for the final planning.

From maps available from the Municipality of Durban, 38 Indian suburbs could be identified. However, as a result of population resettlement some areas could not be included in the survey because of too small a population size. The following areas were excluded:

1 1204 Wiggins Road and 0012 Welbedacht which is to be developed as a White area.

2 1800 Springfield Flats have been extensively demolished for development into an industrial area.

3 0113 Klaarwater and 0116 Bulbul had too small a population to allow for even one sampling point.

4 Six suburbs had a very small population and as they were in adjacent areas they were combined.

Since it was originally planned to examine 2 400 people for the sample from 38 areas, owing to the above exclusion it was decided to reduce the number and to cover 30 areas. Subsequently the 1608 Red Hill sampling area was

excluded because of redevelopment which further reduced the sampling area to 29 and a sample size of 2058.

As it is known that the chewing habit is almost exclusively practised by adults and very infrequently by children, it was decided to include only those subjects 10 years and older in this survey. The sample was then stratified into the following age groups: 10-14, 15-24, 25-34, 35-44, 45-54, 55-64 and 65+ years and to include equal individuals of each sex in each age group. It was calculated from the sample that there should be 294 people in each age group.

TABLE 4.5

SAMPLING AREAS AND SAMPLING POINTS IN THE MUNICIPAL AREA OF DURBAN

COMMUNITY AND DISTRICT CODES (SEE FIG. 4.1)	SUBURBS SAMPLED	1978 POPULATION ESTIMATE	NUMBER OF SAMPLING POINTS	NUMBER (%) OF POPULATION ESTIMATE	(%) OF TOTAL SAMPLE
	DURBAN PROPER				
0401	Merewent	23,778	10	140 (0,59)	(6,80)
0603	Clairwood	13,941	6	84 (0,60)	(4,08)
1502	Central Business District	6,162	3	42 (0,68)	(2,04)
1503	Warwick plus A.K.	2,919	1	14 (0,48)	(0,68)
1608	Red Hill	2,465	-	-	-
1701	Parlock	4,790	2	28 (0,58)	(1,36)
1702,	1703 Hippo Road, Peter Road	2,773	1	14 (0,50)	(0,68)
1704	Sea Cow Lake	6,602	3	42 (0,64)	(2,04)
1707	Kenville	8,418	3	42 (0,50)	(2,04)
1709	Avoca	8,014	3	42 (0,52)	(2,04)
1902	Sydenham	27,988	12	168 (0,60)	(8,16)
1903	Springfield	12,058	5	70 (0,58)	(3,40)
1904	Clare Hills	6,657	3	42 (0,63)	(2,04)
1905,	1906 Palmiet Recreation	9,257	4	56 (0,60)	(2,72)
1907	Reservoir Hills	13,138	5	70 (0,53)	(3,40)
	CHATSWORTH PROPER				
0101	Havenside	12,577	5	70 (0,56)	(3,40)
0102	Bayview	18,362	8	112 (0,61)	(5,44)
0103	Westcliff	22,628	9	126 (0,56)	(6,12)
0104	Mobeni Heights	6,522	3	42 (0,64)	(2,04)
0105	Croftdene	14,945	6	84 (0,56)	(4,08)
0106	Arena Park	9,194	4	56 (0,61)	(2,72)
0107	Montford	24,581	10	140 (0,57)	(6,80)
0108	Risecliff	18,561	8	112 (0,60)	(5,44)
0109	Moorton	10,131	4	56 (0,55)	(2,72)
0110	Woodhurst	10,023	4	56 (0,56)	(2,72)
0111	Crossmoor	13,559	6	84 (0,62)	(4,08)
	CHATSWORTH AREA				
0114	Silverglen	6,083	3	42 (0,69)	(2,04)
0115	Umhlatuzana	6,879	3	42 (0,61)	(2,04)
0117	Kharwastan	4,416	2	28 (0,63)	(1,36)
2200	PHOENIX	25,641	11	154 (0,60)	(7,48)
	TOTAL	354,770	147	2058 (0,58)	(99,96)

Accordingly 14 individuals were necessary for each age group at each sampling point (see Table 4.5).

Special maps were obtained from the Durban Municipality which show the respective density of the population of the various areas in which the Indians in Durban reside. These maps were of the scale, of one in six thousand and one in fifteen thousand and showed all the streets and plot numbers to determine the sampling points. A grid was placed over a specific area of the map and two numbers from a set of random numbers were then selected. The first number was used as a co-ordinate on the X-axis and the other on the Y-axis. The sampling point was taken where the projections met. This procedure was repeated until all sampling points had been selected.

If the sampling point was located in a street where the houses were only on the one side the procedure was as follows: The sampling point house was identified and then facing the sampling house every alternate three houses on the right and three on the left were selected for the survey. If these were not sufficient to obtain 14 people, the procedure was extended to alternate houses on the right and left further along the street (see Fig. 4.2).

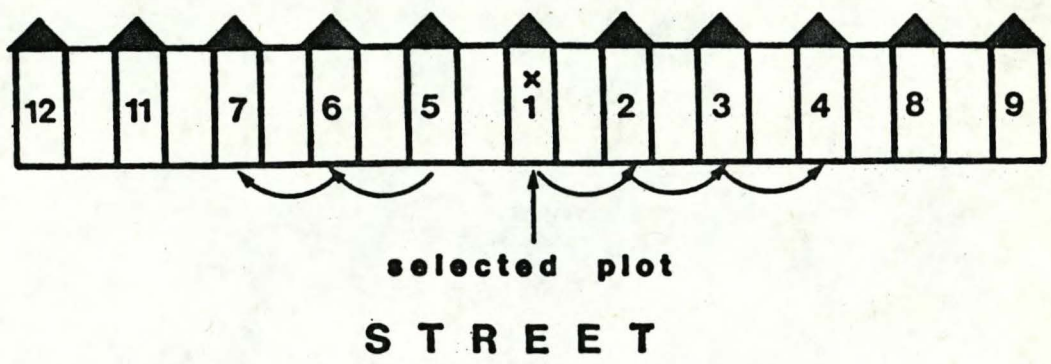


FIGURE 4.2 THE SAMPLING PROCEDURE WHERE THERE WERE HOUSES ON ONLY ONE SIDE OF THE STREET. THE NUMBERS INDICATE THE ORDER IN WHICH THE SAMPLING WAS DONE

If there were houses on both sides of the street the pattern was as follows: the sampling point house was identified and then facing the sampling house every alternate three houses on the right were selected. Then the house on the other side of the street exactly opposite the sampling point house was identified. Facing this house the adjacent house on the right side was selected for the survey followed by two alternate houses. If there were insufficient subjects three alternate houses were selected on the left side of the original sampling point house. If still insufficient the procedure was repeated on the left side of the identified house on the opposite side of the street (see Fig. 4.3).

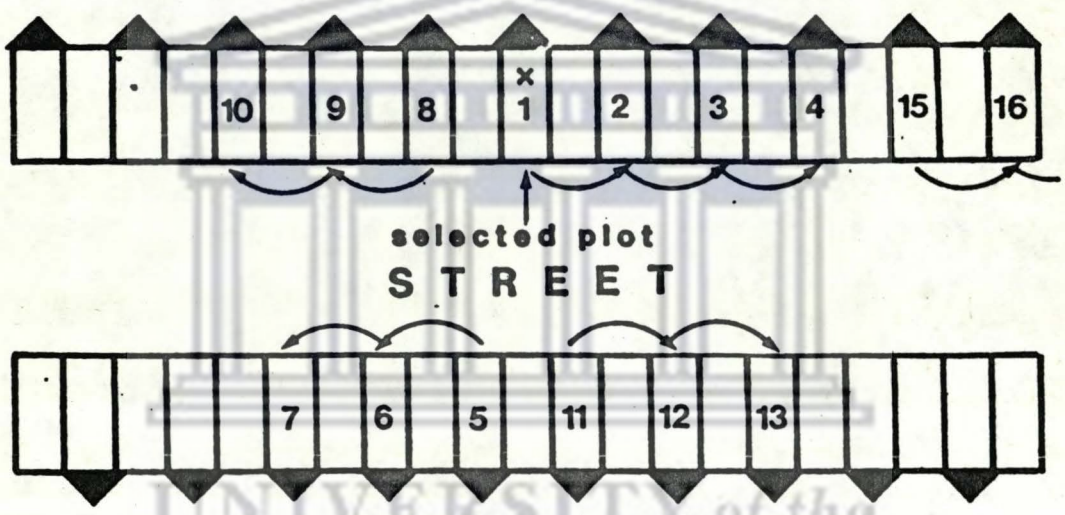


FIGURE 4.3 THE SAMPLING PROCEDURE WHERE THERE WERE HOUSES ON BOTH SIDES OF THE STREET. THE NUMBERS INDICATE THE ORDER IN WHICH SAMPLING WAS DONE

If the sequence was interrupted by an intersection the pattern was continued around the corner into the adjacent street. The sequence was only interrupted if an area boundary was encountered or if another sampling point's sampled houses were encountered. The same procedure was followed in a block of flats.

5 HOUSE INTERVIEW

This consisted of a screening interview and an intra-oral examination, if required.

A Screening Questionnaire was completed by the author (Appendix I and II) of each subject detailing the age, sex, marital status, occupation (Appendix III), birthplace (India or South Africa), home language (vernacular), religion and indulgence in the betel chewing habit.

The intra-oral examination consisted of a visual inspection and palpation. The examination was carried out under natural light near a window or by the doorway. A pencil torch was utilised when there was insufficient natural light.

Features by which oral submucous fibrosis was diagnosed at home.
A case of OSF was diagnosed on the following criteria: The patient must have a history of chewing and must have some or all of the following symptoms and signs -

1 Must have a history of burning sensation on eating spicy foods. This should be a new symptom for people who are used to eating spicy foods.
2 The mucosa should have localised blanching in the palate, faucal regions and the cheeks.
3 On palpation the smooth silky mobile feel of the mucosa should have changed to a linen-like and leathery-like feel.
4 Complaint of inability to open the mouth.

On completion of this home examination all chewers with or without OSF were referred to King Edward VIII Hospital, Durban. Those subjects who fell in the survey and were not available were subsequently followed up at home in the evenings or during the weekends.

6 HOSPITAL EXAMINATION

This Interview Questionnaire (Appendix IV) for specific information was completed by the author detailing the chewing habits, consumption of chillies, smoking, alcohol intake, complaints, features with examination, intra-oral examination and finally, the medical history.

The hospital examination comprised of two types of patients:

1 Those selected individuals referred from the survey, who kept their appointments.

2 Those referred by dental and medical practitioners and from other departments of the hospital because oral submucous fibrosis was diagnosed.

For all these patients the Screening Questionnaire (Appendix I) was also completed by the author in hospital. An examination was then carried out in a dental chair with standard lighting.

One hundred and seventy patients were examined at King Edward VIII Hospital. They consisted of:

1 One hundred and twenty nine referred patients by colleagues who had diagnosed the disease.

2 Thirty two patients with features of oral submucous fibrosis diagnosed during the survey.

3 Three chewers from the survey without the disease and six chewers without clinical signs of OSF who were referred by colleagues.

7 SPECIAL EXAMINATIONS

7.1 Measurement of mouth opening.

To evaluate the range of mouth opening the patient was asked to open the mouth as widely as possible and with the aid of callipers the distance between the incisal edges of the upper and lower central incisors of the same side were recorded. Where the patients was edentulous, the measurement was taken from the crest of the ridges at the labial frena regions. If the upper incisor was missing a deduction of 10 millimetres was made; if the lower incisor was absent a deduction of 9 millimetres was made. The depth of the overbite was not taken into account.

7.2 Protrusion of tongue

Measurements were recorded with the aid of a metal ruler from the buccal aspects of lower incisors or edentulous ridge to the maximally protruded tip of the tongue.

7.3 Rima oris.

With the ruler the distance was measured from the commissure to the commissure of a closed mouth where there was reduced rima oris.

7.4 Contracted isthmus faucium.

This was a visual recording as examination depended upon the degree of mouth opening. Where there was banding of the faucial pillars with reduction of the tonsillar fossa at times, it was noted as a contracted isthmus faucium.

7.5 Intra-oral pigmentation.

Intra-oral pigmentation in involved areas was recorded in a subjective manner as present or absent.

7.6 Dimpling.

Dimpling was recorded as an oval or circular depression of variable size occurring bilaterally and posteriorally to the angles of the mouth.

Clinical features of the condition were recorded by using a colour film - A.S.A. 64 Kodachrome with a ring flash.

Failure to keep hospital appointments

To those chewers with or without oral submucous fibrosis who failed to keep their appointments, further appointments were sent. Those who failed this appointment had to be traced at home to complete the Interview Questionnaire (Appendix IV).

8 BIOPSY SPECIMENS

The lesional areas were anaesthetised with a local anaesthetic. The solution was injected a distance from the area of the biopsy site. A wedge-shaped specimen was taken from the most representative area with a scalpel and an attempt was made to include muscle and salivary gland from the submucosa in the specimen. Where access to the mouth was reasonable a biopsy specimen was taken from the right cheek and where a reduced rima oris was present biopsy was performed in the inner aspect of the right side of the lip. If there were any concomitant lesions they were also biopsied. The biopsy was divided forthwith, one half was kept for histological and the other for electron microscopic observations.

For light microscopy studies the specimens were fixed in Bouin's solution and paraffin sections were prepared. These were stained according to Culling (1974) with haematoxylin and eosin as a general purpose stain (p. 211); for collagen, Weigert and Van Gieson's technique (p. 219); for elastic fibres, Verhoeff's technique (p. 420-1); and for mast cells the

Toluidine blue method (p. 273). One hundred and seventy-eight biopsies were carried out on 162 patients. Electron microscopy was carried out on five specimens.

8.1 Additional material examined.

One of the referred patients with oral submucous fibrosis died as a result of a concomitant squamous, infiltrating carcinoma of the right cheek. A limited autopsy was allowed and specimens were obtained from various locations of the oral cavity.

9 ELECTRON MICROSCOPY

For electron miscroscopy the tissues were fixed in Karnovsky's fixative and left overnight in a refrigerator. The next morning the fixative was replaced with 0,2m sodium cacodylate buffer and the specimen returned to the refrigerator until airfreighted to the Department of Oral pathology of the University of Stellenbosch. The specimen was then post-fixed in 1% osmium tetroxide, washed in cacodylate buffer, dehydrated in graded series of acetone and embedded in an epoxy resin according to Spurr (1969). Toluidine blue sections were prepared from each specimen block and those which showed examples of the various features observed microscopically, were selected for electron microscopy. The ultra thin sections were double-stained with uranyl acetate and lead citrate.

10 BLOOD INVESTIGATIONS

Blood investigations were carried out on chewers with and without OSF. Venous blood samples were obtained from the ante-cubital veins and forwarded to various laboratories.

Full blood counts were performed by the Haematology Laboratory, King Edward VIII Hospital, using the "Coulter S-Plus" counter. The blood smears were reviewed by a single haematologist and a 200-cell differential white cell count was performed on each specimen. The erythrocyte sedimentation rate at one hour was carried out using the Westergren method.

The Chemical Pathology Laboratory, King Edward VIII Hospital, carried out serum assays of ferritin, iron, total iron binding capacity, folic acid, vitamin BI2 and zinc. Liver function tests, performed on the "Technicon Auto-analyser II" include total serum proteins, serum albumin and globulin, bilirubin and alkaline phosphatase. The serum protein electrophoresis was carried out using cellulose acetate strips.

Serum immunoglobins viz. IgG, IgA and IgM were assayed by the Microbiology Laboratory, King Edward VIII Hospital. Other investigations done at this laboratory include the rheumatoid factor and the serological test for syphilis.

The Natal Institute of Immunology examined sera from subjects for the presence of anti-nuclear factor as well as for smooth muscle, parietal cell and mitochondrial antibodies.

11 HISTOLOGICAL EVALUATION

All the sections were assessed by the author and the supervisor of this study until consensus was reached. Constant reference was made to the control sections (vide infra) for the evaluation of the variables studied. The sections were evaluated on the following criteria:

11.1 EPITHELIUM

1 Normal epithelium

The epithelium was considered normal if it was unkeratinised, of normal thickness and when rete pegs were present.

2 Atrophic epithelium

The epithelium was regarded as atrophic when the rete pegs appeared reduced in height or totally absent.

3 Hyperplastic/acanthotic epithelium

The epithelium was regarded as hyperplastic when there was hyperplasia of the prickle and/or basal cells producing enlarged rete pegs. When these rete pegs assumed a broad and flattened shape they were described as acanthotic.

11.1.1 KERATINISATION

1 Orthokeratinised epithelium

Orthokeratinised is regarded as epithelium showing a granular and keratin layer. If thicker than normal it is described as hyperorthokeratosis and if it occurs on normally non-keratinised epithelium it is described as abnormal orthokeratosis.

2 Parakeratinised epithelium

Epithelium with a keratin layer containing the nuclei of cells and not having a granular layer.

11.1.2 CELLULAR OEDEMA

1 Intra-cellular oedema

This is an accumulation of fluid intra-cellularly causing swelling of cells and/or compression of the nucleus giving the cell a signet-ring appearance.

2 Inter-cellular oedema

Inter-cellular oedema is an accumulation of fluid between cells forcing them apart. Spongiosis is an example of inter-cellular oedema.

11.1.3 ATYPIA

The following features are recognised as atypia (WHO Collaborating Centre for Oral Precancerous Lesions, 1978):

1 Loss of polarity of basal cells

2 The presence of more than one layer of cells having a basaloid appearance

3 An increased nuclear-cytoplasmic ratio

4 Drop-shaped rete processes

5 Irregular epithelial stratification

6 Increased number of mitotic figures.

A mitotic index was established for each patient by examining a representative section of the biopsied material. This was carried out by defining adjacent fields at 40x, without overlap (Fig. 4.4). Each field was then screened under 400x magnification and the area with the highest number of mitotic figures was counted. The mean for all the fields was accepted as the mitotic index for the particular case.

7 The presence of mitotic figures in the superficial half of the epithelium.

8 Cellular pleomorphism.

9 Nuclear hyperchromatism.

10 Enlarged nucleoli and multiple nucleoli

11 Reduction of cellular cohesion

12 Keratinisation of single cells or cell groups in the prickle layer.

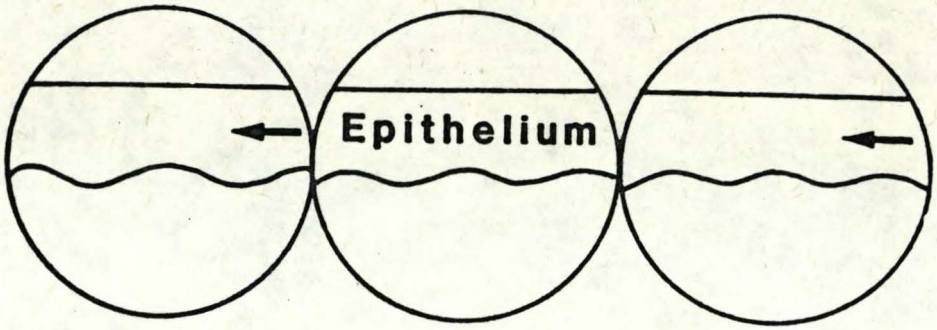


FIGURE 4.4 THIS DIAGRAM ILLUSTRATES THE POSITION OF ADJACENT FIELDS AT 40x MAGNIFICATION FOR THE ESTABLISHMENT OF THE MITOTIC INDEX

11.2 LAMINA PROPRIA

The following parameters were recorded:

11.2.1 State of collagen (H&E and van Gieson). Density of fibres, arrangement of fibres, amorphous appearance of collagen and the extent of fibrosis in the mucosa.

11.2.2 State of elastic fibres (Verhoeff's stain). Arrangement of fibres and whether there is an increase or decrease of fibres.

11.2.3 Presence and state of blood vessels (H&E). The patency and thickness of the vessel wall and the increase or diminution of vascularity. Method of study for patent luminae of blood vessels - Under 40x magnification a field in the middle (in the horizontal direction) of the section was selected with the edge of the field touching the basal cells of the epithelium (see Fig. 4.5). All blood vessels with a recognisable wall were then counted and their diameters in cross-section measured with a Zeiss Graticule (10x). The width of the lumen was also recorded. The procedure was repeated in the adjacent field. Eighteen autopsy controls and 18 randomly selected slides of patients with OSF were compared.

11.2.4 Inflammation in the lamina propria. The type of inflammation was

noted and the inflammatory infiltrate was graded into mild, moderate, severe and absent.

11.2.5 Mast cells (Toluidine blue stain)

Under 400x magnification the lamina propria was examined from one end of the section to the other (right to left). The fields did not overlap and the top end of the field only touched the basal cell layer. The same procedure was repeated from left to right in a field deeper in the section (see Fig. 4.6). Only cells which contained recognisable granules were counted.

11.2.6 Melanin deposition was graded into mild, moderate, severe and absent.

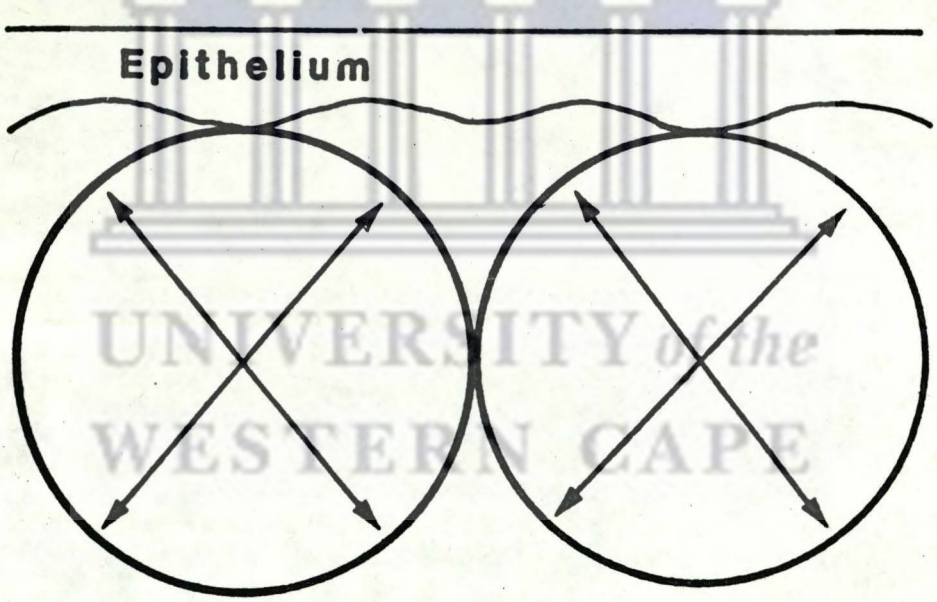


FIGURE 4.5 THIS DIAGRAM DEPICTS THE AREAS OF STUDY FOR BLOOD VESSELS

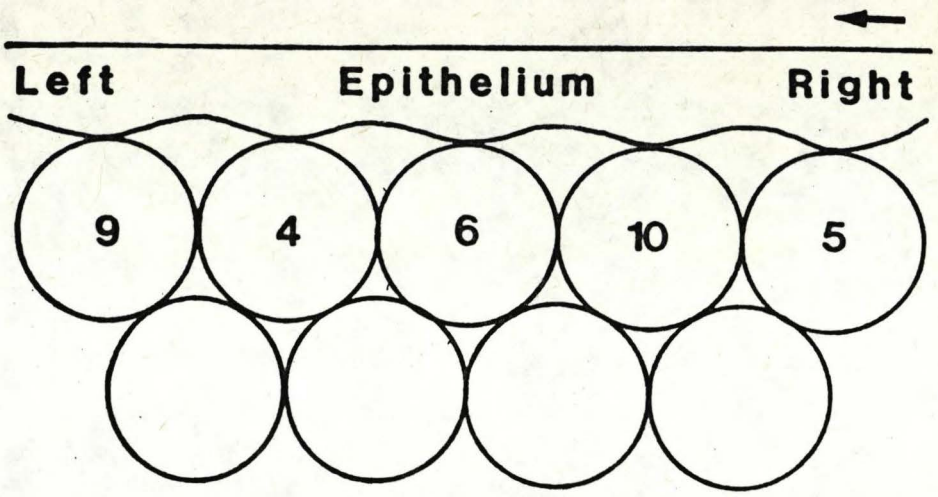


FIGURE 4.6 METHOD OF DETERMINING MAST CELL COUNT. THE NUMBERS IN THE CIRCLES INDICATE THE NUMBER OF MAST CELLS FOUND IN A FIELD

11.3 SUBMUCOSA

The following was examined in the submucosa:

11.3.1 Extension of the fibrosis from the lamina propria into the submucosa.

11.3.2 The muscle fibres - whether there were any conspicuous morphological changes and whether fibres have been displaced by the fibrosis.

11.3.3 The salivary glands. Whether any degenerative changes were present and whether glands have been replaced by fibrosis.

11.3.4 Nerve bundles. The extent of peri-neural fibrosis.

11.3.5 Fibrosis and fatty tissues - whether the fibrosis encircled groups or individual cells.

12 ELECTRON MICROSCOPIC EVALUATION

The features of collagen bundles and individual collagen fibres were recorded next to the basement membrane and deeper into the lamina propria. The diameter and periodicity of collagen fibres were measured.

13 CONTROLS

For the controls, specimens were obtained from 18 autopsy cases. These were 12 Black females and 6 Black males. They were chosen because it is known that Black South Africans do not indulge in the betel habit. Seventy-two specimens were obtained from the inner aspect of the lower lip, canine, first and third molar regions of the cheek, fixed in Bouin's fluid and stained similarly to the betel chewer specimens. The histologic variables which were to be studied in OSF were first recorded in the controls by visual and photographic means.

14 STATISTICAL METHODS

The statistical analysis was carried out by the Institute for Biostatistics of the South African Medical Research Council. Comparisons of discrete variables were done using the chi-square test of independence (Ray, 1982), except for four-fold (2x2) table where Fisher's Exact Test was used. Comparisons of continuous variables were done using the median test (Ray, 1982). Five percent was accepted as a statistical level of significance.

CHAPTER V

R E S U L T S

1 SURVEY

1.1 FINDINGS WITH REGARD TO TOTAL SAMPLE

This survey was carried out over a period of two years starting in February 1981 and completed in March 1983.

1.1.1 The objective of examining 2 058 subjects, with equal sex distribution, was accomplished. There were seven age groups ranging from 10 to 106 years. The mean age for all the age groups ranged from 12,2 to 70,4 years (Table 5.1).

TABLE 5.1
DISTRIBUTION OF SURVEY SUBJECTS ACCORDING TO AGE

AGE GROUP	NUMBER	MEAN AGE (S.D.)
10-14	294	12,2 (0,5)
15-24	294	19,2 (0,8)
25-34	294	29,3 (1,2)
35-44	294	39,0 (1,6)
45-54	294	49,1 (2,0)
55-64	294	58,8 (2,4)
65+	294	70,4 (2,8)

RANGE : 10-106 years

1.1.2 Six hundred and four subjects (29%) of the sample were single. Of the remainder, 1192 persons (58%) were married and 262 (13%) were divorced, separated or widowed.

1.1.3 The occupations in the sample were grouped into four main

categories as shown in Table 5.2. From this it can be seen that housewives comprised 23,8% of the sample, followed by scholars, pupils or students of 21% and 20,6% in the retired group. The 'other' group comprised 34,6%, 20% of which belonged to the other clerical and related worker.

1.1.4 The majority of the subjects were born in the Republic of South Africa (99%) and the balance of 30 (1%) claimed that they were born in India.

1.1.5 The most common home language spoken was Tamil (34%) followed by Telegu (24%) and then Hindi (20%) (Table 5.3). Urdu was spoken by 9,6%, Gujarati 7,1% and English and/or Afrikaans by 4,3%. However, the vast majority of the subjects were able to speak English as a second language.

1.1.6 The majority of the subjects belonged to the Hindu faith (1 493 or 72,5%), followed by Muslims (366 or 17,8%). The rest (199 or 9,7%) were Christians. However, many of the Christians are converts from Hinduism.

1.2 VALIDITY OF THE SAMPLE

As the survey sample was stratified a comparison between survey subjects and the figures of the Durban City Council (1980) (The General Population) was not possible in all respects. However, when those parameters were compared which are not directly influenced by stratification, a reasonable correlation was found.

TABLE 5.2

DISTRIBUTION OF SURVEY SUBJECTS ACCORDING TO OCCUPATION

Code	OCCUPATION		NUMBER	%
75	Housewife		469	22,8
76	Scholar, pupil or student		433	21,0
77	Retired		424	20,6
	Other		712	34,6
10	Life science technician	1		
11	Medical doctor, dentist, veterinarian	3		
12	Nurse, midwife, auxiliary nurse	14		
14	Other medical worker	2		
15	Accountant	3		
17	Teacher	21		
18	Worker in religion	6		
19	Other professional and technical worker	13		
20	Administrative and managerial worker	1		
21	Clerical supervisor	4		
22	Government executive, control official	1		
23	Transport and communication supervisor	5		
24	Other clerical and related worker	141		
25	Manager (wholesale and retail trade)	9		
26	Working proprietor (wholesale and retail trade)	5		
27	Insurance/real estate agent, auctioneer	1		
28	Technical salesman, commercial traveller	13		
29	Other sales worker N.E.C.	56		
30	Manager (catering and accommodation)	1		
32	Other housekeeping service worker	1		
33	Building caretaker, cleaner	1		
35	Hairdresser, barber, beautician	2		
37	Guide, undertaker and other service worker	5		
39	Farmer, nurseryman, market gardener	5		
40	Agricultural and animal husbandry worker	1		
42	Fisherman, hunter and related worker	2		
43	Production supervisor, general foreman	9		
45	Metal processor	1		
46	Wood preparation worker	2		
47	Chemical processor and related worker	8		
48	Spinner, weaver, knitter, dyer	6		
50	Other food and beverage processor	3		
51	Tailor, dressmaker, sewer, upholsterer	40		
52	Shoemaker, leather goods maker	15		
53	Cabinet maker and related worker	24		
54	Blacksmith, toolmaker, machine tool-operator	1		
55	Machine fitter, precision-instrument maker	3		
56	Mechanic (non-electrical)	16		
57	Plumber, pipe fitter	7		
58	Welder, flame cutter	5		
59	Sheet-metal worker	5		
61	Jeweller and precious metal worker	3		
62	Glass former, potter and related worker	2		
63	Rubber/plastic product maker	2		
64	Printer and related worker	20		
65	Painter	4		
66	Production and related worked N.E.C.	28		
67	Bricklayer, carpenter, construction worker	20		
69	Docker, freight handler and related worker	1		
72	Railway brakeman, guard, signalman	1		
73	Driver (road transport)	40		
74	Labourer N.E.C.	43		
78	Not classifiable by occupation	86		
		712		
	TOTAL		2058	100,0

TABLE 5.3

DISTRIBUTION OF SURVEY SUBJECTS ACCORDING TO THEIR HOME LANGUAGE

HOME LANGUAGE	NUMBER	%
Tamil	700	34,0
Telegu	493	24,0
Hindi	416	20,2
Gujarati	147	7,1
Urdu	197	9,6
Other Indian	14	0,7
English and/or Afrikaans	88	4,3
Unspecified	3	0,1
TOTAL	2 058	100,0

Occupation: The distribution of the occupation among survey chewers compared favourably with the municipal figures. There was a correlation between the occupation groups of the clerical and related workers, the percentages being 6,85 and 6,43 respectively. In Table 5.2 the not-economically active group comprised of the housewife, scholar, pupil or student and the retired, making 65,40% of the 2058 subjects sampled. In Table 4.1 the not-economically active group is given as 68,40%.

Marital Status: In the present sample the group "divorced, separated or widowed" (13%) is considerably higher than that for the general statistics (4,64%, see Table 4.2). The reason for this discrepancy can be related to the fact that in the stratified sample there are proportionally more elderly women and men in the sample, and consequently more widowers, widows and divorcees.

Religion: There is a good correlation of the three religious groups between the two sets of data. The sample as well as the general population (see Table 4.3) shows a preponderance of persons of the Hindu faith. There is a slightly higher Christian group in the general population which may be explained by a tendency for conversion from Hinduism to Christianity. This tendency also emerged when referred OSF cases were interviewed. There were 13,50% of non-respondents in the 1980 census. In the survey subjects, there was not a single case of non-respondency and this could be explained because of the personalisation of the interview and the fact that the survey was continued until the pre-required number of persons were interviewed.

Home language: There is a gross discrepancy between the 1980 census data and the findings of the present survey. The general census showed

that 90,45% spoke English as their home language as opposed to only a small percentage in the survey sample (Table 5.10). It is possible that, due to misinterpretation, the general census data recorded all persons who spoke English, even though as a second language, in this category. The erroneous data could arise in a census where the questionnaires were filled in without personal guidance.

1.3 FINDINGS WITH REGARD TO CHEWERS AND CASES OF OSF

1.3.1 OCCURRENCE

Of the 2 058 subjects who were examined in the survey 186 indulged in the chewing habit. Among these 186 chewers there were 71 who showed signs of oral submucous fibrosis and in 115 there were no clinical features of the disease (Table 5.4). From the 71 with signs of oral submucous fibrosis only 32 attended the hospital and of these 8 refused biopsy. Of the remaining 39 who did not attend the hospital, 31 were traced at home and the questionnaire completed with the result that 63 patients from the 71 OSF survey cases have a full history.

There were 115 betel chewers without signs of OSF but only three could be persuaded to attend for a biopsy. A further 96 allowed examination at home. Therefore, a full history is available for 99 of the 115 chewers without features of oral submucous fibrosis but with histological information of only 3 persons. An additional 6 female chewers, without signs of OSF and who were not part of the survey, were referred by colleagues and consented to biopsies being performed. Thus, a total of 9 specimens was available from chewers without OSF.

In addition to the OSF cases obtained from the survey a further 129 patients were referred to the hospital for the condition by

colleagues. Of these 126 were females and 3 males. Therefore the total number of patients examined with OSF was 200 (129 referred cases + 71 from the survey).

TABLE 5.4

OCCURRENCE OF CHEWERS WITHOUT AND WITH OSF

	CHEWERS WITHOUT OSF NUMBER	%	CHEWERS WITH OSF NUMBER	%	TOTAL NUMBER	%
Females	103	89,6	70	98,6	173	93
Males	12	10,4	1	1,4	13	7
TOTAL	115	100,0	71	100,0	186	100
RATIO	9:1		10:1			

Chewers with OSF prevalence rate 3,45%
Total prevalence rate of all chewers 9,04%

1.3.1.1 GEOGRAPHICAL DISTRIBUTION OF SURVEY CHEWERS

In respect of chewers without OSF, the number of subjects from the suburbs corresponded with the geographical distribution of the sample. In respect of chewers with OSF there was no association between the geographical area and the proportion of persons with the disease.

TABLE 5.5

GEOGRAPHICAL DISTRIBUTION OF SURVEY CHEWERS (Number and per cent)

COMMUNITY AND DISTRICT CODES (SEE FIG.4.1)	SUBURBS SAMPLED	PERCENT OF TOTAL SAMPLE*	CHEWERS WITHOUT OSF	CHEWERS WITH OSF	TOTAL CHEWERS SAMPLED
	DURBAN PROPER				
0401	Merewent	(6,80)	6(3,22)	5(2,69)	11(5,91)
0603	Clairwood	(4,08)	5(2,69)	6(3,22)	11(5,91)
1502	Central Business District	(2,04)	5(2,69)	1(0,54)	6(3,23)
1503	Warwick plus A.K.	(0,68)	0	0	0
1608	Red Hill	-	0	0	0
1701	Parlock	(1,36)	1(054)	0	1(0,54)
1702.	1703 Hippo Road, Peter Road	(0,68)	1(0,54)	0	1(0,54)
1740	Sea Cow Lake	(0,04)	3(1,61)	1(0,54)	4(4,15)
1707	Kenville	(2,04)	5(2,59)	3(1,61)	8(4,20)
1709	Avoca	(2,04)	3(1,61)	3(1,61)	6(3,22)
1902	Sydennam	(8,16)	7(3,76)	8(4,30)	15(8,06)
1903	Springfield	(3,40)	4(2,15)	1(0,54)	5(2,59)
1904	Clare Hills	(2,04)	3(1,61)	0	3(1,61)
1905.	1906 Palmiet Recreation	(2,72)	1(0,54)	1(0,54)	2(1,08)
1907	Reservoir Hills	(3,40)	2(1,07)	1(0,54)	3(1,61)
	SUB-TOTAL	(41,48)	46(24,73)	30(16,12)	76(42,85)
	CHATSWORTH PROPER				
0101	Havenside	(3,40)	3(1,61)	0	3(1,61)
0102	Bayview	(5,44)	10(5,38)	2(1,07)	12(5,45)
0103	Westcliff	(6,12)	7(3,76)	4(2,15)	11(5,91)
0104	Mobeni Heights	(2,04)	3(1,61)	3(1,61)	6(3,22)
0105	Croftdene	(4,08)	4(2,15)	4(2,15)	8(4,30)
0106	Arena Park	(2,72)	0	2(1,07)	2(1,07)
0107	Montford	(6,80)	9(4,83)	4(2,15)	13(6,98)
0108	Risecliff	(5,44)	8(4,30)	6(3,22)	14(7,52)
0109	Moorton	(2,72)	3(1,61)	1(0,54)	4(2,15)
0110	Woodhurst	(2,72)	2(1,07)	3(1,61)	5(2,68)
0111	Crossmoor	(4,08)	4(2,15)	3(1,61)	7(2,76)
	SUB-TOTAL	(45,56)	53(28,49)	32(17,20)	85(43,65)
	CHATSWORTH AREA				
0114	Silvergien	(0,04)	4(2,15	0	4(2,15)
0115	Umhlatuzana	(2,04)	1(0,54)	2(1,07)	3(1,61)
0117	Kharwastan	(1,36)	1(0,54)	0	1(0,54)
	SUB-TOTAL	(5,44)	6(3,22)	2(1,07)	8(4,30)
2200	PHOENIX	(7,48)	10(5,38)	7(3,76)	17(9,14)
	TOTAL	(99,96)	115(61,82)	71(38,15)	186(99,94)

* See Fig. 4.5

1.3.2 ANALYSIS OF PERSONAL HISTORY

1.3.2.1 AGE AND SEX

The age and sex distribution showed that females predominated in all the groups; 93% of all chewers, 90% in chewers without OSF and 98% of OSF cases.

The age distribution of chewers with and without the disease differed significantly (Chi-square = 80,657, DF = 10, p 0,0001). In the chewers without OSF the larger proportion fell in the older group while for chewers with OSF the larger proportion fell in the 45-54 age group and for the referred OSF cases the larger proportion fell in the 35-54 age group.

TABLE 5.6

AGE AND SEX DISTRIBUTION OF SURVEY CHEWERS, CHEWERS WITHOUT OSF, CHEWERS WITH OSF AND REFERRED OSF CASES.

	CHEWERS				CHEWERS WITHOUT OSF				CHEWERS WITH OSF				REFERRED OSF CASES			
AGE	TOTAL(%)+	F(%)*	M(%)**		TOTAL(%)	F(%)*	M(%)**		TOTAL(%)	F(%)*	M(%)**		TOTAL	F	M	
10-14	2(0,7)	1(0,7)	1(0,7)		1(0,3)	0	1(0,7)		1(0,3)	1(0,7)	0		1	1	0	
15-24	6(2,0)	6(4,1)	0		2(0,7)	2(1,4)	0		4(1,5)	4(2,7)	0		11	11	0	
25-34	17(5,8)	17(11,6)	0		4(1,5)	4(2,7)	0		13(4,4)	13(8,8)	0		23	22	1	
35-44	32(10,9)	32(21,8)	0		19(6,5)	19(12,9)	0		13(4,4)	13(8,8)	0		44	44	0	
45-54	41(13,9)	37(25)	4(2,7)		21(7,1)	18(12,2)	3(2)		20(6,8)	19(12,9)	1(0,7)		37	35	2	
55-64	37(12,6)	35(23,8)	2(1,4)		28(9,5)	26(17,7)	2(1,4)		9(3,1)	9(6,1)	0		12	12	0	
65+	51(17,3)	45(30,6)	6(4,1)		40(13,6)	34(23,1)	6(4,1)		11(3,7)	11(7,5)	0		1	1	0	
				RATIO				RATIO				RATIO				RATIO
TOTAL	186	173	13	13:1	115	103	12	9:1	71	70	1	70:1	129	126	3	42:1

\+ % of total, 294 per age group

* % of females) 147 per age group

** % of males)

* Chi-square = 52,350, DF = 2, p < 0,0001

1.3.2.2 MARITAL STATUS

When referred OSF cases were compared with the survey OSF cases and the survey chewers, it was found that a significant proportion of the survey OSF and survey chewers were widowed, separated or divorced.

When all three groups were pooled and the subjects divided into three age groups, less than 39 years, 40-54 and 55+ years, it was found that the 55+ age showed the largest proportion of separated, widowed and divorced subjects (Chi-square = 83,318 DF = 4, $p < 0,0001$).

TABLE 5.7
DISTRIBUTION OF SURVEY CHEWERS WITHOUT OSF, WITH OSF AND REFERRED OSF CASES ACCORDING TO MARITAL STATUS

MARITAL STATUS	CHEWERS WITHOUT OSF		CHEWERS WITH OSF		REFERRED OSF CASES	
	NUMBER	%	NUMBER	%	NUMBER	%
Single	6	5	5	7	18	14
Married or living together	64	56	41	58	91	71
Divorced, separated or widowed	45	39	25	35	20	15
Married migrant working/ living apart from family	-	-	-	-	-	-
TOTAL	115	100	71	100	129	100

Chi-square = 22,212, DF 4, $p < 0,0002$

1.3.2.3 OCCUPATION

When the occupations of the three groups were compared it was found that the largest number of chewers without OSF were retired, while the largest number of chewers with OSF and referred cases were housewives. This difference was statistically significant.

TABLE 5.8

DISTRIBUTION OF SURVEY CHEWERS WITHOUT OSF, WITH OSF AND REFERRED OSF CASES ACCORDING TO OCCUPATION

CODE	OCCUPATION	CHEWERS WITHOUT OSF			CHEWERS WITH OSF			REFERRED OSF CASES		
		NUMBER		%	NUMBER		%	NUMBER		%
75	Housewife	48		42	49		69	81		63
76	Scholar, pupil or student	1		1	3		4	5		4
77	Retired	56		48	14		20	4		3
	Other		10	9		5	7		39	30
17	Teacher	-			-			2		
24	Other clerical and related worker	-			-			1		
25	Manager (wholesale and retail trade)	-			1			-		
28	Technical salesman, commercial traveller	1			-			-		
29	Other sales worker N.E.C.	-			-			1		
33	Building caretaker, cleaner	-			-			1		
46	Wood preparation worker	1			-			-		
47	Chemical processor and related worker	1			-			-		
48	Spinner, weaver, knitter, dyer	-			-			1		
51	Tailor, dressmaker, sewer, upholsterer	2			2			9		
52	Shoemaker, leather goods maker	-			-			1		
53	Cabinet maker and related worker	-			-			1		
66	Production and related worker N.E.C.	2			1			1		
74	Labourer N.E.C.	3			-			4		
78	Not classifiable by occupation	-			1			17		
	TOTAL	10	115	100	5	71	100	39	129	100

Chi-square = 83,450, DF = 4, p<0,0001

1.3.2.4 BIRTHPLACE

With regard to birthplace there was no significant difference among the three groups.

TABLE 5.9

DISTRIBUTION OF SURVEY CHEWERS WITHOUT OSF, WITH OSF AND REFERRED OSF CASES ACCORDING TO THEIR BIRTHPLACE

BIRTHPLACE	CHEWERS WITHOUT OSF		CHEWERS WITH OSF		REFERRED OSF CASES	
	NUMBER	%	NUMBER	%	NUMBER	%
Republic of South Africa	110	96	70	99	127	98
India	5	4	1	1	2	2
TOTAL	115	100	71	100	129	100

Chi-square = 1,589, DF = 2, p<0,4518

1.3.2.5 HOME LANGUAGE

There was no significant difference with regard to the home language among the 3 groups.

TABLE 5.10
DISTRIBUTION OF SURVEY CHEWERS WITHOUT OSF, WITH OSF AND REFERRED OSF CASES ACCORDING TO THEIR HOME LANGUAGE

HOME LANGUAGE	CHEWERS WITHOUT OSF		CHEWERS WITH OSF		REFERRED OSF CASES	
	NUMBER	%	NUMBER	%	NUMBER	%
Tamil	40	35	31	44	51	40
Telegu	26	22	8	11	20	15
Hindi	26	22	17	24	28	22
Gujarati	9	8	3	4	4	3
Urdu	10	9	9	13	17	13
Other Indian	2	2	0	0	1	1
English and/or Afrikaans	2	2	3	4	7	5
Unspecified	0	0	0	0	1	1
TOTAL	115	100	71	100	129	100

Chi-square = 13,786, DF = 14, p <0,4658

1.3.2.6 RELIGION

There was no significant difference among the three groups with regard to religion.

TABLE 5.11
DISTRIBUTION OF SURVEY CHEWERS WITHOUT OSF, WITH OSF AND REFERRED OSF CASES ACCORDING TO THEIR RELIGION

RELIGION	CHEWERS WITHOUT OSF		CHEWERS WITH OSF		REFERRED OSF CASES	
	NUMBER	%	NUMBER	%	NUMBER	%
Hindu	90	78	50	70	87	67
Muslim	17	15	14	20	23	18
Christian	8	7	7	10	18	14
Other	0	0	0	0	1	1
TOTAL	115	100	71	100	129	100

Chi-square = 6,022, DF 6, p<0,4207

1.3.3 ANALYSIS OF THE BETEL HABIT

The betel habit is practiced in many forms. The betel nut alone may be chewed or it may be a constituent of the betel package. Any one variety of the betel nut is used. Lime is usually smeared onto the undersurface of the betel leaf, in which the different constituents are packed. Lime may also be used alone by being placed in the lower buccal sulcus or in conjunction with the betel nut.

1.3.3.1 PRACTICE OF BETEL CHEWING

There was a significant difference in the practice of betel chewing among the three groups. This difference was owing to the five cases of referred OSF, who did not chew betel nut.

TABLE 5.12
PRACTICE OF BETEL CHEWING AMONG SURVEY CHEWERS WITHOUT OSF, WITH OSF AND REFERRED OSF CASES

	CHEWERS WITHOUT OSF		CHEWERS WITH OSF		REFERRED OSF CASES	
	NUMBER	%	NUMBER	%	NUMBER	%
Chewed	115	100	71	100	124	96
Have not chewed	0	0	0	0	5	4
TOTAL	115	100	71	100	129	100

Chi-square = 7,321, DF = 2, $p<0,05$

1.3.3.2 ONLY BETEL NUT CHEWING

The proportion of subjects who chewed the nut only was substantially larger in the referred OSF cases than amongst the group who chewed without OSF and those chewers of the survey with OSF. There was a significant difference among the 3 groups with regard to the practice of chewing only the nut.

TABLE 5.13
ONLY BETEL NUT CHEWING AMONG SURVEY CHEWERS WITHOUT OSF, WITH OSF AND REFERRED OSF CASES

	CHEWERS WITHOUT OSF		CHEWERS WITH OSF		REFERRED OSF CASES	
	NUMBER	%	NUMBER	%	NUMBER	%
Nut only	31	31,3	37	58,7	100	80,6
Other	68	68,7	26	41,3	24	19,4
TOTAL	99	100,0	63	100,0	124	100,0

Chi-square = 55,267 DF = 2 $p < 0,0005$

1.3.3.3 AMOUNT OF BETEL NUTS CHEWED

The majority of subjects chewed five or less betel nuts per day. There were very few who chewed more than 15 nuts per day in the three groups. When all three groups were pooled and the subjects divided into three age groups, under 39 years, 40-54 years and 55+ years it was found that there was no statistical significance with regard to the number of betel nuts chewed per day (Chi-square = 1,763, DF = 2, P $<$0,4141).

TABLE 5.14
NUMBER OF BETEL NUTS CHEWED BY SURVEY CHEWERS WITHOUT OSF, WITH OSF AND REFERRED OSF CASES

NUMBER OF BETEL NUTS CHEWED/DAY	CHEWERS WITHOUT OSF	CHEWERS WITH OSF	REFERRED OSF CASES
0-5	64	31	64
6-15	26	24	46
16-25	3	4	7
30+	6	4	7
T O T A L	99	63	124

1.3.3.4 METHOD OF CHEWING AND THE TYPE OF BETEL NUT USED

The vast majority of the people in all three groups chewed and swallowed the betel nut. In about 10% of the referred OSF cases the nut was chewed and held in buccal sulcus. This difference, however, was statistically significant (Chi-square = 13,009, DF = 4, P< 0,0112). The proportion of the bitter betel nut chewers among the referred cases was considerably greater, whereas in the other two groups the majority preferred the black nut. This difference was significant. (Chi-square = 30,789, DF = 4, p <0,0001).

TABLE 5.15
METHOD OF CHEWING AND TYPE OF BETEL NUT USED BY SURVEY CHEWERS WITHOUT OSF, WITH OSF AND REFERRED OSF CASES

	CHEWERS WITHOUT OSF	CHEWERS WITH OSF	REFERRED OSF CASES
M E T H O D			
Chewed & swallowed	97	61	110
Not chewed but held in buccal sulcus only	2	0	2
Chewed & held in buccal sulcus	0	2	12
TOTAL	99	63	124
T Y P E			
White	12	7	10
Black	60	39	40
Bitter	27	17	74
TOTAL	99	63	124

1.3.3.5 DURATION OF BETEL NUT HABIT

The mean as well as the median duration of betel nut chewing differed in the three groups. The duration was considerably less in the referred OSF cases. However, because the data did not follow a normal

distribution, the median duration was compared and the differences among the 3 groups was found to be statistically significant.

TABLE 5.16
DURATION OF BETEL NUT HABIT AMONG SURVEY CHEWERS WITHOUT OSF, WITH OSF AND REFERRED OSF CASES.

YEARS	CHEWERS WITHOUT OSF	CHEWERS WITH OSF	REFERRED OSF CASES
0-10	29	33	86
11-20	13	12	29
21-30	24	7	5
31-40	15	7	3
41-50	11	2	0
51-60	6	2	1
61-70	0	0	0
71-75	1	0	0
TOTAL	99	63	124
MEAN DURATION	25,99	15,88	9,32
MEDIAN DURATION*	25,00	10,00	6,00

* Chi-square = 37,701, DF = 2, p $<$ 0,0001

1.3.3.6 PAAN (BETEL PACKAGE) CHEWING

The proportion of people using the betel package was higher in the chewers without OSF than in the other two groups. This tendency of people chewing the betel package was significantly different in the three groups. Owing to the small number of cases (5) of nut and lime users it was not possible to make any meaningful deductions.

TABLE 5.17
PAAN (BETEL PACKAGE) CHEWING AMONG SURVEY CHEWERS WITHOUT OSF, WITH OSF AND REFERRED OSF CASES.

	CHEWERS WITHOUT OSF	CHEWERS WITH OSF	REFERRED OSF CASES
Yes	67	26	20
No	31	37	100
Nut + lime	1	0	4
Total	99	63	124

Chi-square = 60,018, DF = 2, $p < 0,001$

1.3.3.7 DURATION OF PAAN (BETEL PACKAGE) CHEWING

The mean as well as the median duration differed in the three groups. However, as the mean duration did not follow a normal distribution the median duration was compared. This median age was found to be significantly different; the longest duration occurring in chewers without OSF. When all three groups were pooled and the subjects divided into three age groups, under 39 years, 40-54 years and 55+ years, it was found that a larger proportion of older people chewed for a longer period (Chi-square = 21,289, DF = 2, $p < 0,0001$).

TABLE 5.18
DURATION OF PAAN (BETEL PACKAGE) CHEWING AMONG SURVEY CHEWERS WITHOUT OSF, WITH OSF AND REFERRED OSF CASES.

YEARS	CHEWERS WITHOUT OSF	CHEWERS WITH OSF	REFERRED OSF CASES
0-10	12	9	9
11-20	9	6	4
21-30	19	5	3
31-40	11	3	3
41-50	11	2	1
51-60	5	2	0
61-70	0	0	0
71-75	1	0	0
Nut + lime	1	0	4
TOTAL	69	26	24
MEAN DURATION	29,7	21,7	15,4
MEDIAN DURATION*	30,0	19,0	13,0

* Chi-square = 9,409, DF = 2, $p < 0,0091$

1.3.3.8 LIME USAGE

There was a larger proportion of non-lime users among referred OSF cases, while the lime users were more common among the chewers without OSF. This difference was significant.

TABLE 5.19
LIME USAGE AMONG SURVEY CHEWERS WITHOUT OSF, WITH OSF AND REFERRED OSF CASES

	CHEWERS WITHOUT OSF	CHEWERS WITH OSF	REFERRED OSF CASES
Lime users	63	24	22
Non-lime users	36	39	102
TOTAL	99	63	124

Chi-square = 49,163, DF = 2, p <0,0005

TABLE 5.20
ANALYSIS OF HABITS (VARIATIONS) AMONG SURVEY CHEWERS WITHOUT OSF (a), WITH OSF (b) AND REFERRED OSF CASES (c)

DURATION (YEARS)		0-5	6-10	11-15	16-20	21-25	25+	TOTAL
Betel nut only	a	9	7	2	2	2	9	31
	b	22	4	2	3	1	5	37
	c	54	20	10	11	2	3	100
Nut + Leaf	a	0	0	0	2	1	1	4
	b	2	0	0	0	1	0	3
	c	0	0	0	0	0	1	1
Nut + Leaf + Lime	a	5	3	2	6	6	18	40
	b	2	1	2	1	1	4	11
	c	4	2	1	1	1	1	10
Nut + Leaf + Smoking	a	1	0	0	0	0	0	1
	b	0	0	0	0	0	0	0
	c	0	0	0	0	0	0	0
Nut + Leaf + Catechu	a	0	0	0	0	0	0	0
	b	0	0	0	0	0	0	0
	c	1	0	0	0	0	0	1
Nut + Leaf + Lime + Catechu	a	0	0	0	0	1	0	1
	b	0	1	0	0	0	2	3
	c	0	0	0	0	0	0	0
Nut + Leaf + Lime + Catechu + Snuff	a	0	0	0	0	0	0	0
	b	0	0	0	0	0	0	0
	c	0	0	0	0	0	1	1
Nut + Leaf + Lime + Catechu + Tobacco	a	1	0	0	0	0	0	1
	b	0	0	0	0	0	0	0
	c	0	0	0	0	0	1	1
Nut + Leaf + Lime + Tobacco	a	0	0	0	0	0	1	1
	b	0	0	0	0	0	0	0
	c	0	0	0	0	0	0	0
Nut + Leaf + Lime + Snuff	a	1	1	1	1	1	10	15
	b	1	0	2	2	0	4	9
	c	0	1	1	0	0	1	3
Leaf + Nut + Lime + Tobacco + Snuff	a	0	0	0	0	0	1	1
	b	0	0	0	0	0	0	0
	c	0	0	0	0	0	0	0
Nut + Lime	a	0	0	0	0	0	1	1
	b	0	0	0	0	0	0	0
	c	1	1	1	0	1	0	4
Nut + Snuff	a	0	0	0	0	0	3	3
	b	0	0	0	0	0	0	0
	c	0	0	1	0	0	2	3
*Nut + Smoking	a	0	0	0	0	0	0	0
	b	0	0	1	0	0	1	2
	c	0	1	0	0	0	0	1
*Nut + Smoking + Alcohol	a	0	0	0	0	0	0	0
	b	0	0	0	0	0	0	0
	c	0	1	0	0	0	0	1
No betel habit	a	0	0	0	0	0	0	0
	b	0	0	0	0	0	0	0
	c	0	0	0	0	0	0	5

*Included in betel nut only habit

1.3.3.9 ANALYSIS OF HABITS (VARIATIONS)

The chewing of only the betel nut was the most popular of all the habits, particularly among the referred OSF cases. This was followed by the nut, leaf and lime package with or without snuff which was the most popular habit among survey chewers without OSF, especially in the older age groups. Five people in the referred OSF group alleged to have no betel habit. On the whole, the use of tobacco, cigarettes and alcohol was negligible.

1.3.4 ANALYSIS OF FOOD SPICING

1.3.4.1 FOOD SPICING

The proportion of people using spicy foods was the largest among the referred OSF cases but the difference was not significant. When the OSF referrals were compared with survey OSF there was no signicant difference (Fisher's Exact Test $p<0,5497$).

TABLE 5.21
FOOD SPICING AMONG SURVEY CHEWERS WITHOUT OSF, WITH OSF AND REFERRED OSF CASES.

FOOD SPICING	CHEWERS WITHOUT OSF	CHEWERS WITH OSF	REFERRED OSF CASES
Unspiced	5	1	1
Spiced	94	62	128
TOTAL	99	63	129

Chi-square = 4,590, DF = 2, $p < 0,1007$

1.3.4.2 AMOUNT AND TYPE OF CHILLIES

There was a higher proportion of people using mildly chillied food than highly chillied food in all three groups. The proportion of people using highly chillied food in the three groups was similar. There was a higher proportion of referred OSF cases using no chillies than chewers with OSF (Chi-square = 6,479, DF = 2, $P < 0,0388$). There was no difference in the usage of chillies between the survey OSF and

survey chewers (Chi-square = 0,912, DF = 2, p <0,6338). There was no significant difference in the type of chillies used by the three groups (Chi-square = 5,045, DF = 4, p <0,2827).

TABLE 5.22
AMOUNT AND TYPE OF CHILLIES USED BY SURVEY CHEWERS WITHOUT OSF, WITH OSF AND REFERRED OSF CASES

	CHEWERS WITHOUT OSF	CHEWERS WITH OSF	REFERRED OSF CASES
A M O U N T			
No chillies	1	0	10
Mildly chillied	62	43	70
Highly chillied	36	20	49
TOTAL	99	63	129
T Y P E			
Powdered chillies	46	25	59
Green chillies	5	4	12
Both	47	34	48
NUMBER OF PATIENTS	98	63	119
No chillies	1	0	10
TOTAL NUMBER OF PATIENTS	99	63	129

1.3.4.3 USE AND TYPE OF PICKLES

In the three groups a higher proportion of people used no pickles. Again, in all the three groups the proportion of people using chilli pickles with vinegar was substantially higher than the proportion using pickles without vinegar. When the survey chewers were compared with the survey OSF cases the proportion of people using pickles was not significantly different between the two groups (Chi-square =

3,148, DF = 2, P < 0,3694). Large chillies are commonly used by all three groups. Two-thirds of chewers with OSF and chewers without OSF use pickles, while about half of the referred OSF cases use pickles.

TABLE 5.23
USE AND TYPE OF PICKLES USED BY SURVEY CHEWERS WITHOUT OSF, WITH OSF AND REFERRED OSF CASES

	CHEWERS WITHOUT OSF	CHEWERS WITH OSF	REFERRED OSF CASES
U S E			
No pickles	68	42	69
Chilli pickles - without vinegar	0	2	4
Chilli pickles - with vinegar	31	19	56
TOTAL NUMBER OF PATIENTS	99	63	129
T Y P E			
Tiny chillies	1	0	3
Large chillies	30	19	53
Peppers	0	2	4
NUMBER OF PATIENTS	31	21	60
No pickles	68	42	69
TOTAL NUMBER OF PATIENTS	99	63	129

1.3.5 SYMPTOMS AND SIGNS AS REPORTED BY SUBJECTS.

1.3.5.1 PAIN, INTERMITTENT BURNING SENSATION AND INTERMITTENT BURNING SENSATION WITH THE USE OF BETEL NUT.

There was a significant difference in the proportion of patients with a history of pain among the three groups. The number of people with a history of pain in the referred group was substantially larger and

these differences were significant. (Chi-square = 96,403, DF = 2, p < 0,0001).

The proportion of people with a history of intermittent burning sensation was significantly larger in the referred OSF cases (Chi-square = 161,685, DF = 2, p <0,0001). The proportion of people younger than 39 years with a history of intermittent burning sensation was significantly larger (Chi-square = 49,922, DF = 2, p < 0,0001).

A higher proportion of people in the referred OSF cases gave a history of intermittent burning sensation with the use of betel nut. This difference was significant (Chi-square = 16,399, DF = 2, p < 0,0003).

TABLE 5.24
THE PRESENCE OF PAIN, HISTORY OF INTERMITTENT BURNING SENSATION AND INTERMITTENT BURNING SENSATION WITH THE USE OF BETEL NUT AMONG SURVEY BY CHEWERS WITHOUT OSF, WITH OSF AND REFERRED OSF CASES.

	CHEWERS WITHOUT OSF	CHEWERS WITH OSF	REFERRED OSF CASES
		PRESENCE OF PAIN	
Yes	0	24	83
No	99	39	46
TOTAL	99	63	129
		HISTORY OF INTERMITTENT BURNING SENSATION	
Yes	0	25	116
No	99	38	13
TOTAL	99	63	129
		HISTORY OF INTERMITTENT BURNING SENSATION WITH THE USE OF BETEL NUT	
Yes	0	1	14
No	99	62	110
TOTAL	99	63	124

1.3.5.2 OTHER SYMPTOMS

The highest proportion of people who complained of dryness of the mouth was among referred OSF patients. None of the chewers without OSF complained of dryness of the mouth. This difference in the proportion of people complaining of dryness of the mouth was significantly different among the three groups. The number of people who complained of vesicles and ulcers was larger among the referred OSF cases. Numbness, referred pain - earache and dysphagia were only found in the referred OSF cases.

TABLE 5.25
SYMPTOMS OTHER THAN PAIN AND INTERMITTENT BURNING SENSATION AMONG SURVEY CHEWERS WITHOUT OSF, WITH OSF AND REFERRED OSF CASES

	CHEWERS WITHOUT OSF		CHEWERS WITH OSF		REFERRED OSF CASES	
	YES	NO	YES	NO	YES	NO
Dryness of mouth[+]	0	0	9	54	50	79
Numbness	0	0	0	63	2	127
Referred pain - earache	0	0	0	63	8	121
Dysphagia	0	0	0	63	10	119
Vesicles	0	0	4	59	18	111
Ulcers	0	0	5	58	16	113

[+] Chi-square = 12,575, DF = 2, $p<0,0004$

1.3.6 SIGNS OBSERVED DURING EXAMINATION

The following signs were observed during the course of the examination of the patients. Ulcers were actually seen, as distinct from a history of ulceration. Some of the signs were measured.

1.3.6.1 The mouth opening (Fig. 5.2) varied from zero to 45mm. Forty-four patients fell in the 16-20mm range and another 44 in the 41-45mm range. About 50% of cases could not open their mouths beyond 20mm.

There was a higher proportion of people with limitation of mouth opening in the referred OSF group and none in the chewers without OSF. There was a significant difference in the three groups (Chi-square = 207,643, DF = 2, $p < 0,0001$).

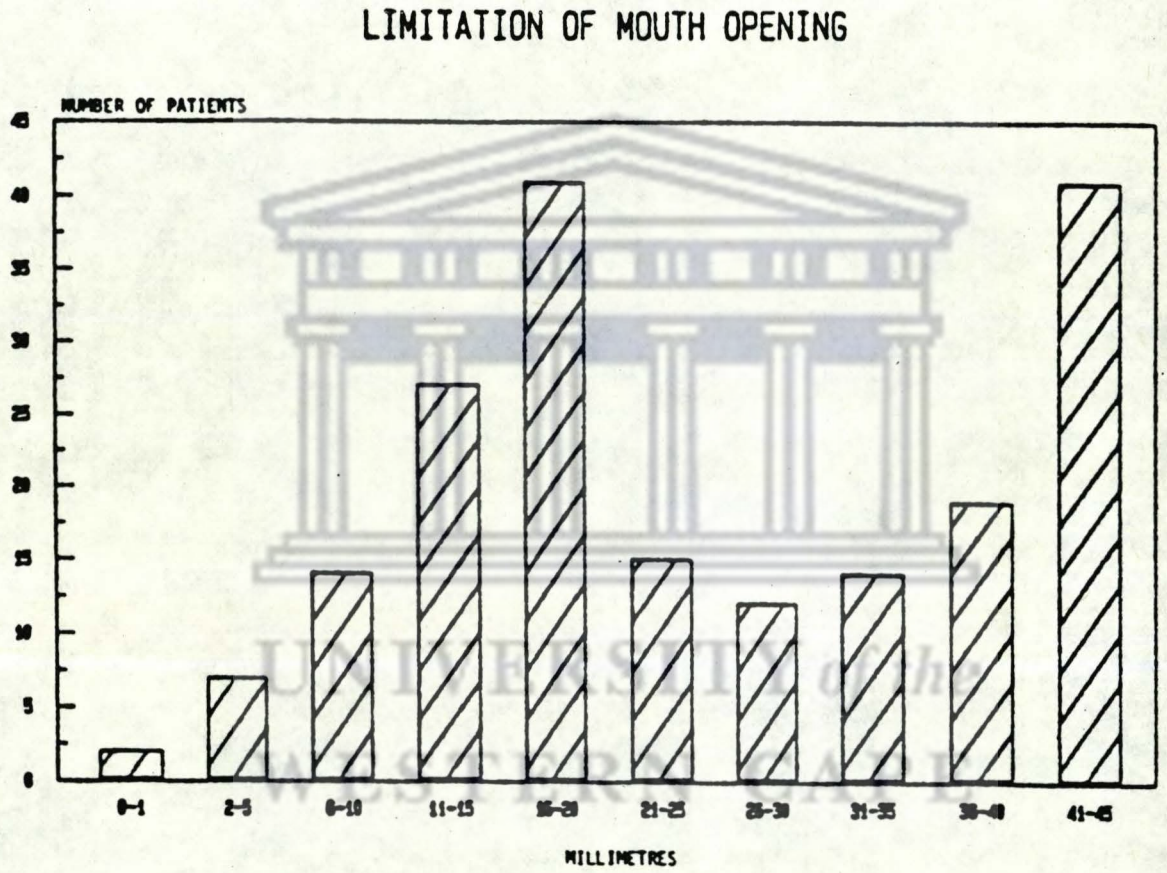


FIGURE 5.1 THIS HISTOGRAM SHOWS THE EXTENT OF MOUTH OPENING IN 192 PATIENTS WITH OSF

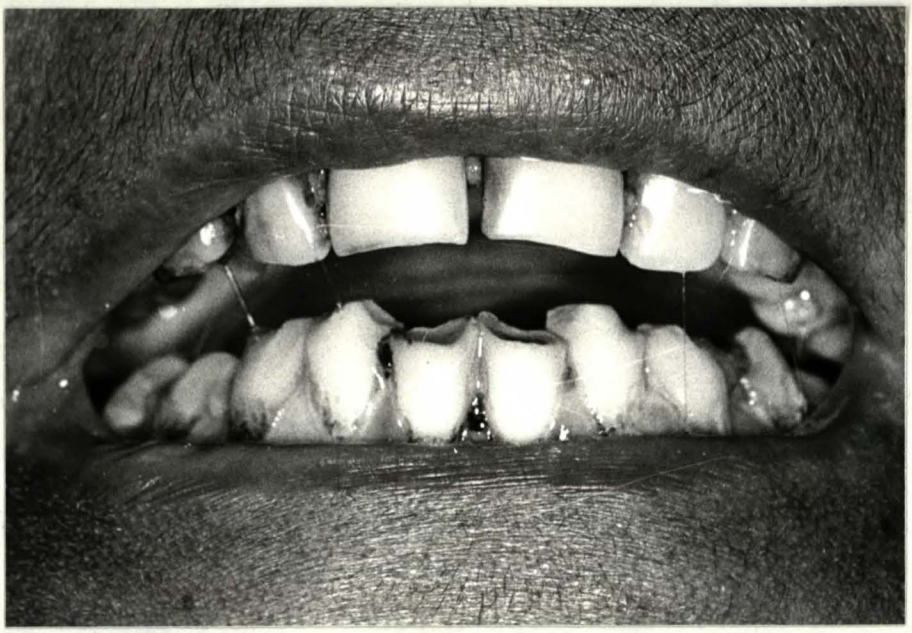


FIGURE 5.2 AN EXAMPLE OF SEVERE LIMITATION OF MOUTH OPENING IN A PATIENT WITH OSF. IN THIS CASE THE MOUTH OPENING WAS LIMITED TO 3mm.

1.3.6.2 LIMITED PROTRUSION OF TONGUE

The limited protrusion of the tongue (Fig. 5.4) was measured in 82 patients and the protrusion varied from 1mm to 45mm beyond the lower incisor teeth or edentulous ridge. Seventy percent of the cases were unable to protrude their tongue beyond 20mm.

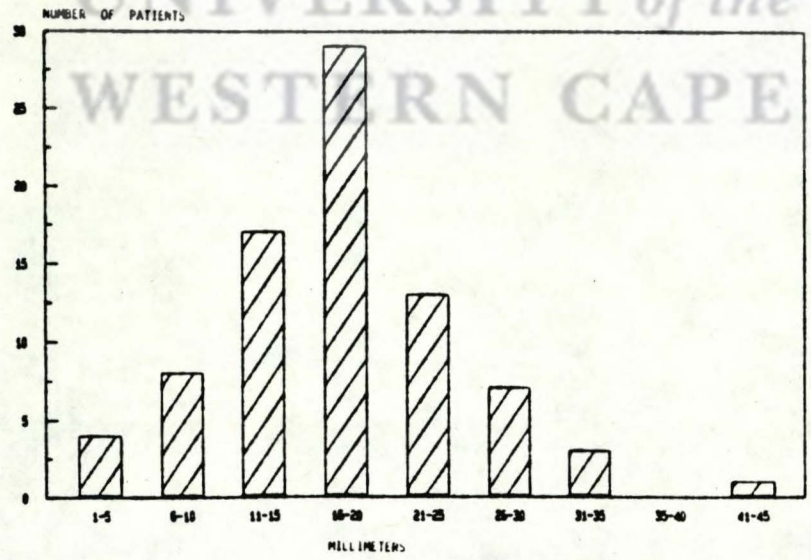


FIGURE 5.3 THIS HISTOGRAM SHOWS THE EXTENT OF LIMITED PROTRUSION OF THE TONGUE IN OSF

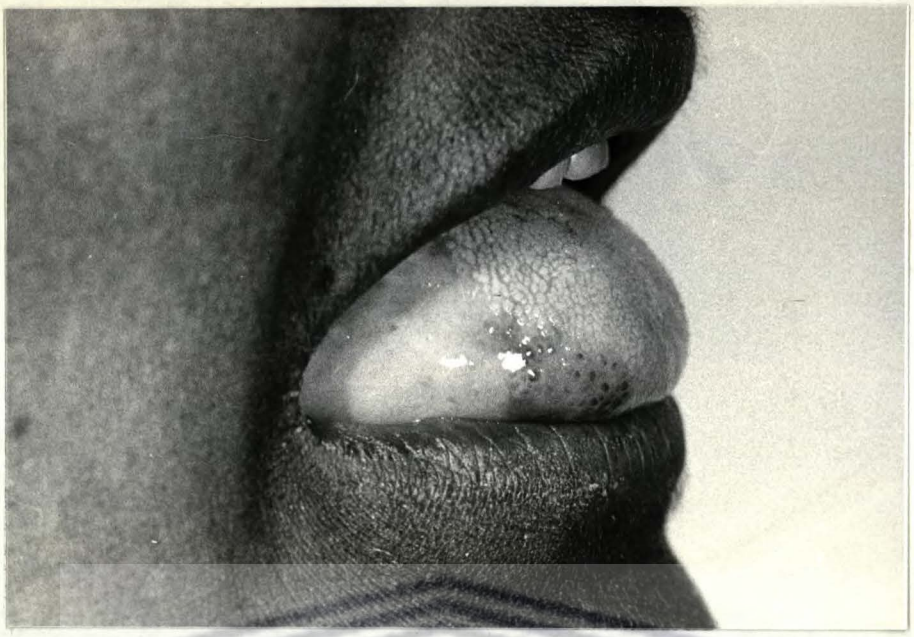


FIGURE 5.4 LIMITATION OF TONGUE PROTRUSION IN A PATIENT WITH ORAL SUBMUCOUS FIBROSIS. IN THIS CASE THE TONGUE COULD BARELY REACH BEYOND THE LOWER TEETH. THERE IS ALSO SMOOTHENING OF THE TONGUE.

1.3.6.3 PRESENCE AND DISTRIBUTION OF BLANCHING WITH/WITHOUT FIBROUS BANDS

1.3.6.3.1 Presence

Blanching occurred in all cases with OSF. Blanching occurred over the whole of the lining mucosa as well as on the surface of the tongue. Blanching with palpable fibrous bands was seen in an overwhelming majority of referred OSF cases (Figs. 5.5a,b,c,d; 5.7a,b.). In the survey chewers with OSF about 50% of the chewers had blanching with no palpable fibrous bands.

TABLE 5.26
THE PRESENCE OF BLANCHING WITH OR WITHOUT PALPABLE FIBROUS BANDS AMONG SURVEY CHEWERS WITHOUT OSF, WITH OSF AND REFERRED OSF CASES.

	CHEWERS WITHOUT OSF		CHEWERS WITH OSF		REFERRED OSF CASES	
	WITH FIBROUS BANDS	NO FIBROUS BANDS	WITH FIBROUS BANDS	NO FIBROUS BANDS	WITH FIBROUS BANDS	NO FIBROUS BANDS
Blanching	0	0	33	30	122	7
No blanching	0	115	0	0	0	0
TOTAL	115		63		129	

1.3.6.3.2 Distribution

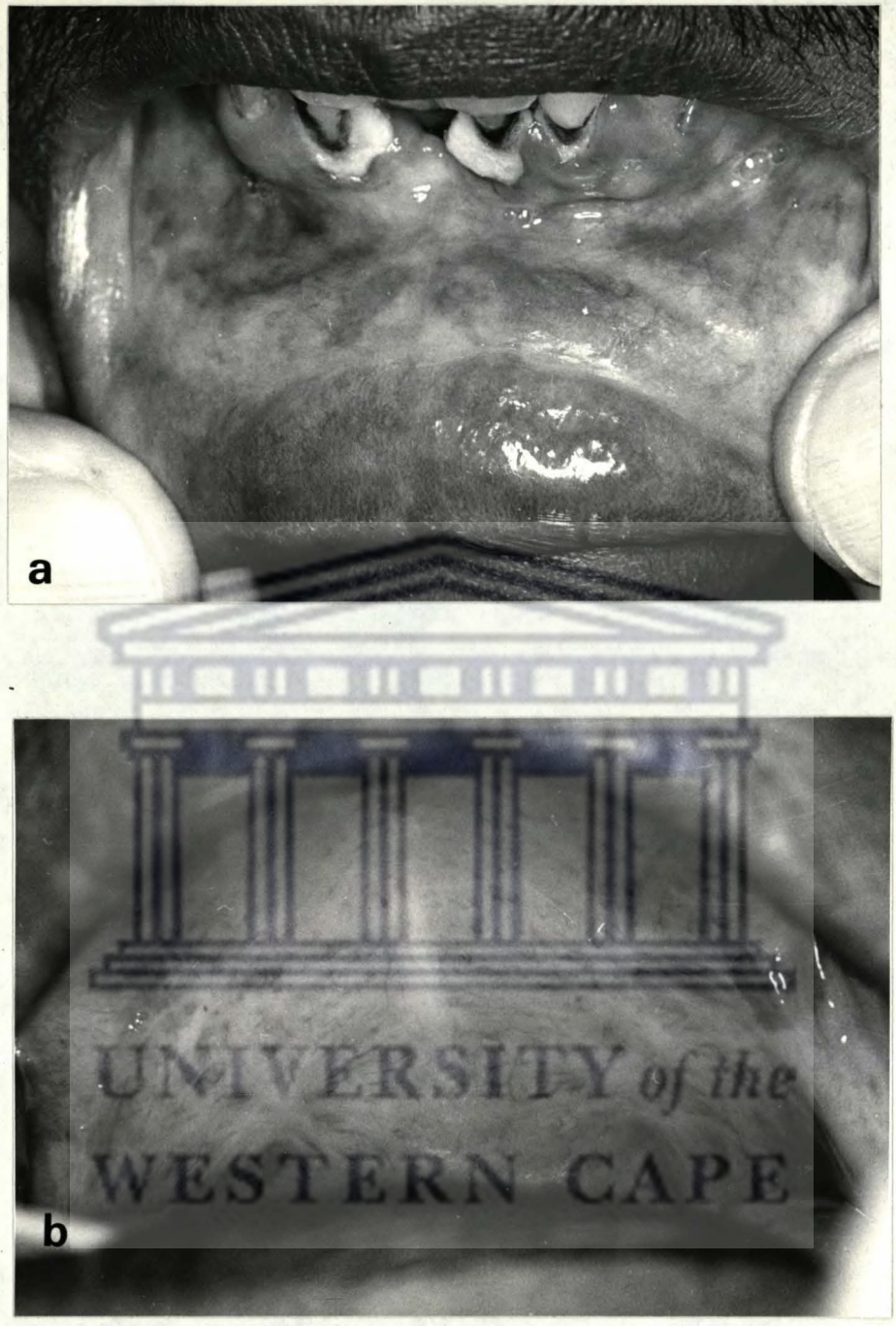
Blanching involved all intra-oral surfaces, except that of the dorsal surface of the tongue. In both groups the blanching was identically distributed. The blanching was similar whether fibrous bands were present or not.

Blanching with palpable fibrous bands was mostly distributed in the buccal (Fig. 5.5c) and labial mucosa (Fig. 5.7a), soft palate and the uvula (Fig. 5.5d), and less in the floor of the mouth. The floor of the mouth was significantly more involved in referred OSF cases than the chewers with OSF (Fisher's Exact Test $p < 0{,}0001$).

TABLE 5.27
DISTRIBUTION OF BLANCHING WITH OR WITHOUT PALPABLE FIBROUS BANDS AMONG SURVEY CHEWERS WITH OSF AND REFERRED OSF CASES.

	CHEWERS WITH OSF		REFERRED OSF CASES	
LOCATION	WITH FIBROUS BANDS	NO FIBROUS BANDS	WITH FIBROUS BANDS	NO FIBROUS BANDS
Buccal mucosa	33	30	122	7
Labial mucosa	20	30	118	7
Soft palate	29	30	119	7
Uvula	29	30	119	6
Tongue*	0	0	0	0
Floor of mouth	19	23	111	7
Total number of patients	63		129	

*Although fibrosis was not palpable in the tongue, 82 patients showed limitation of protrusion. Invariably the ventral surface of the tongue was also involved.



FIGURES 5.5 ORAL SUBMUCOUS FIBROSIS WITH BLANCHING

a LOWER LIP
b PALATE. NOTE THE NETWORK-LIKE APPEARANCE OF THE FIBROUS BANDS

FIGURES 5.5 c LEFT BUCCAL MUCOSA AND RETRO-MOLAR AREA. THE MUCOSA EXHIBITS A DRY MARBLE WHITE APPEARANCE. NOTE ALSO THE PRESENCE OF FIBROUS BANDS (ARROWED).

d SOFT PALATE AND UVULA. THE SOFT PALATE HAS BEEN GROSSLY DIMINISHED. THE UVULA IS MARKEDLY SHORTENED WITH EVERSION OF THE TIP (ARROW).

1.3.6.4 REDUCED RIMA ORIS

The range of the reduced rima oris varied from 26 to 140mms, with over half (53%) of the subjects with <45mms.

Reduced rima oris is associated with circular-like bands running in the cheeks and lips (Fig. 5.7a). In very severe cases furrowing of the lips occurs (Fig. 5.7b).

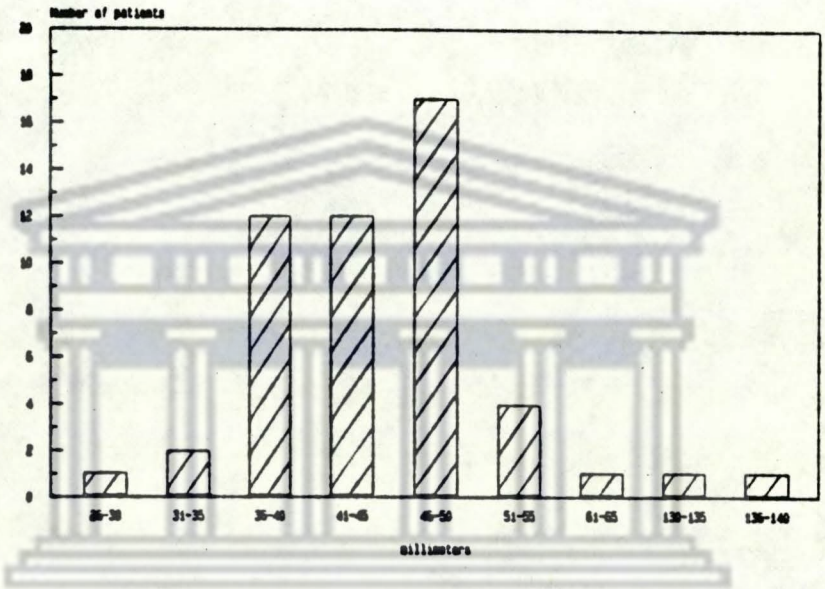


FIGURE 5.6 THIS HISTOGRAM SHOWS THE EXTENT OF REDUCED RIMA ORIS IN 51 REFERRED OSF CASES

1.3.6.5 CONTRACTED ISTHMUS FAUCIUM AND INABILITY TO WHISTLE

There was a greater proportion of contracted isthmus faucium in referred OSF cases than in chewers with OSF (Fisher's Exact Test $p < 0,001$). None occurred in the survey chewers without OSF. The highest proportion of people unable to whistle occurred in the referred OSF cases. There was a significant difference in the proportion of subjects unable to whistle among the three groups (Chi-square = 124,673, DF = 2, $p < 0,0001$).

TABLE 5.28
CONTRACTED ISTHMUS FAUCIUM AND INABILITY TO WHISTLE IN SURVEY CHEWERS WITHOUT OSF, WITH OSF AND REFERRED OSF CASES

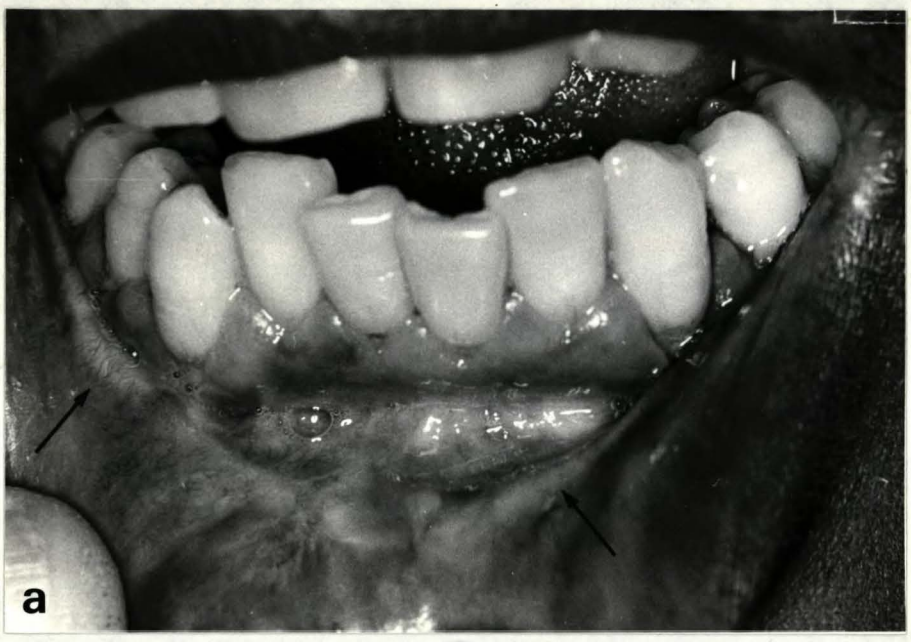
	CHEWERS WITHOUT OSF	CHEWERS WITH OSF	REFERRED OSF CASES
Contracted isthmus faucium	0	11	115
Inability to whistle	0	17	93
TOTAL NUMBER OF PATIENTS	99	63	129

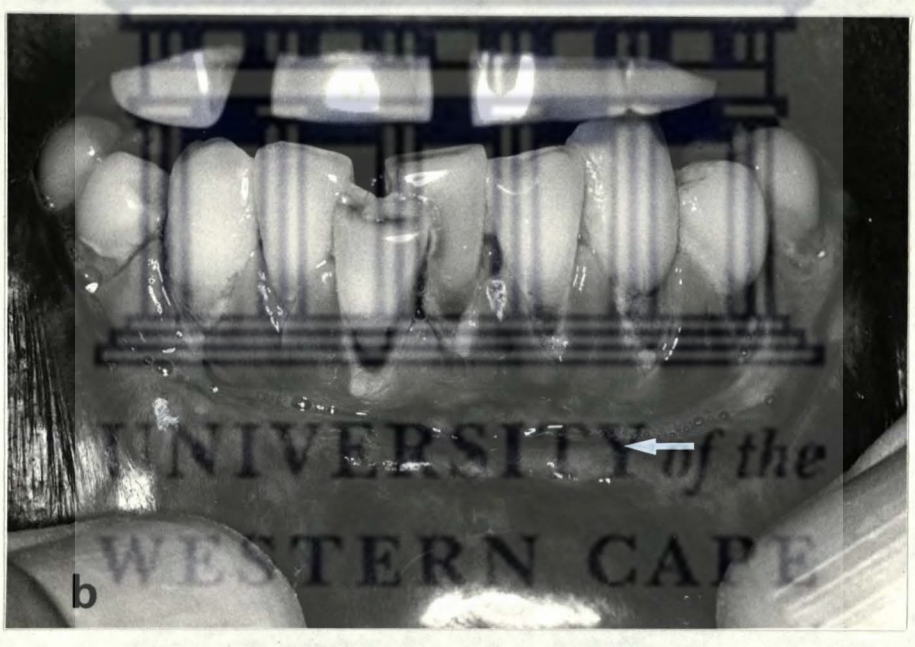
1.3.6.6 INTRA-ORAL PIGMENTATION

Pigmentation occurred in patches which were widespread intra-orally or it was localised (Fig. 5.8b) or specific to certain areas. In the buccal mucosa it was distributed mostly bilaterally (Fig. 5.8a). On the tongue it occurred second most commonly. The floor of the mouth was least involved.

TABLE 5.29
INTRA-ORAL PIGMENT DISTRIBUTION IN SURVEY CHEWERS WITHOUT OSF, WITH OSF AND REFERRED OSF CASES

	CHEWERS WITHOUT OSF	CHEWERS WITH OSF	REFERRED OSF CASES
Buccal mucosa	1	7	23
Palate and uvula	0	0	6
Tongue	1	2	8
Floor of mouth	0	0	1

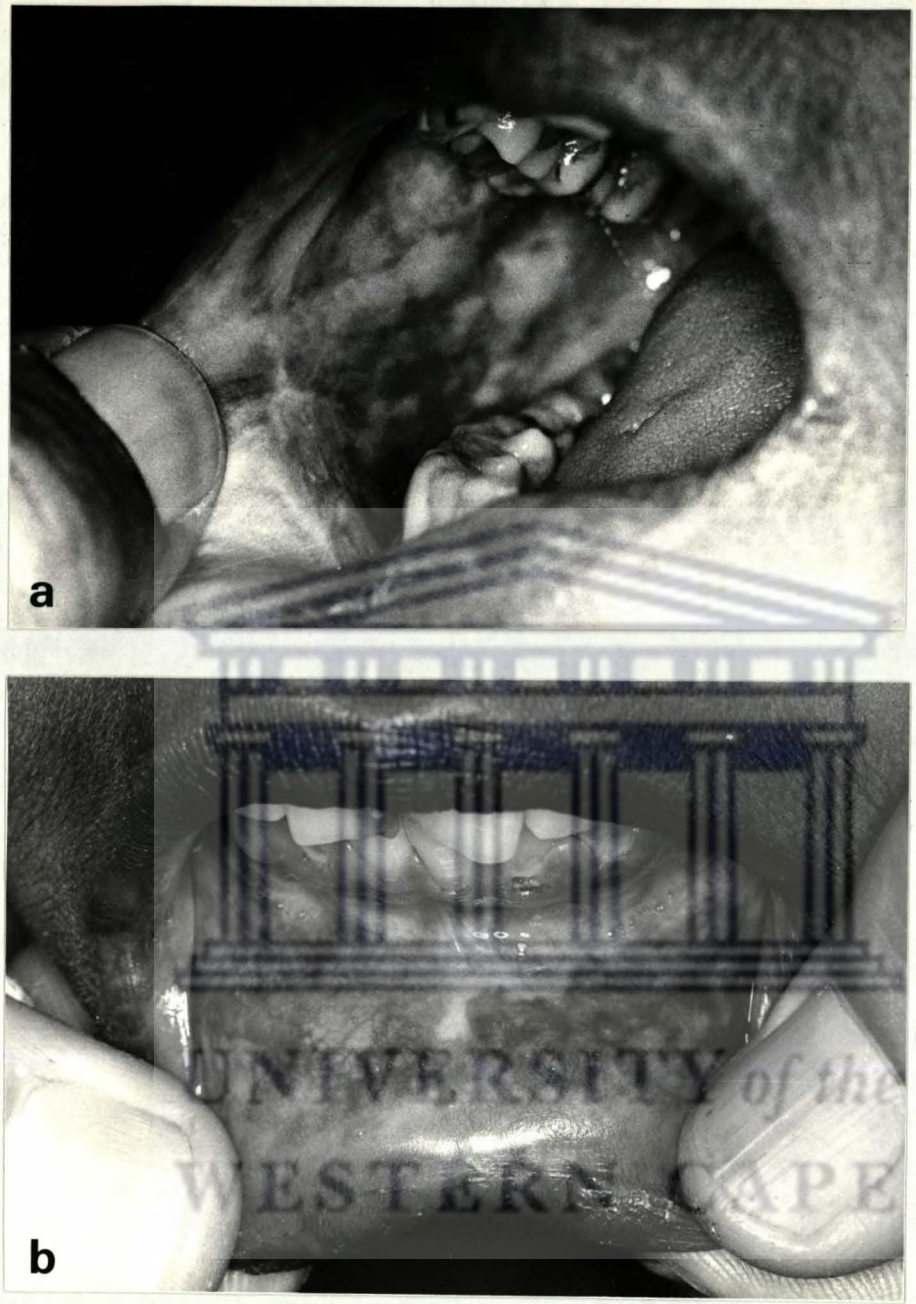




FIGURES 5.7 OSF INVOLVING THE LOWER LIP WITH REDUCED RIMA ORIS

a THE CIRCULAR BAND ACROSS THE LIP (ARROWS) RESULTS IN THE REDUCTION OF THE RIMA ORIS. THERE IS ALSO MARKED LIMITATION OF MOUTH OPENING.

b MARKEDLY REDUCED RIMA ORIS AND SEVERE TRISMUS. THERE IS FURROWING OF THE LIP PRODUCED BY THE FIBROUS BANDS. THE FURROWS RUN BETWEEN BANDS (ARROWED)



FIGURES 5.8 ORAL SUBMUCOUS FIBROSIS WITH PIGMENTATION
a THE MUCOSA OF THE RIGHT CHEEK. THE NON-PIGMENTED AREAS OF THE MOUTH ARE BLANCHED.
b LOWER LIP WITH SCATTERED AREAS OF PIGMENTATION.

1.3.6.7 DIMPLING

Dimpling (Fig. 5.9) was found in 60 patients with OSF. The majority of the people with dimpling chewed the nut only (Table 5.30) and not the betel package. Blanching with palpable fibrous bands was present in all cases of dimpling. In over 50% of patients there was reduced rima oris and in 88% there was limitation of tongue protrusion. In 13% there was angular cheilitis and dimpling. The vast majority of patients with dimpling fell in the 20-50 year age group. Two cases with no chewing habit also had dimpling.

FIGURE 5.9 DIMPLING OF THE FACE (ARROWED) IN ORAL SUBMUCOUS FIBROSIS

TABLE 5.30

DIMPLING IN RELATION TO FREQUENCY AND DURATION OF HABITS, AGE, MOUTH OPENING, BLANCHING, PALPABLE FIBROUS BANDS, REDUCED RIMA ORIS, LIMITED PROTRUSION OF TONGUE AND ANGULAR CHEILITIS

HABIT	FREQUENCY (PER DAY)	DURATION (YEARS)	AGE (YEARS)	MOUTH OPENING (mm)	BLANCHING	PALPABLE FIBROUS BANDS	REDUCED RIMA ORIS (mm)	LIMITED PROTRUSION OF TONGUE (mm)	ANGULAR CHEILITIS
Nut only	4	3	37	31	✓	✓	-	-	-
Nut only	2	2	37	37	✓	✓	-	NM	-
Nut only	10	2	34	12	✓	✓	48	NM	-
Nut only	20	42	55	22	✓	✓	49	13	-
Nut only	5	9	33	3	✓	✓	36	NM	-
Nut only	1	1	42	10	✓	✓	26	NM	-
Nut only	10	3	52	11	✓	✓	52	NM	-
Nut only	25	16	38	16	✓	✓	-	-	-
Nut only	10	3	49	15	✓	✓	-	-	-
Nut only	4	8	36	12	✓	✓	50	NM	✓
Nut only	6	2	28	15	✓	✓	42	NM	-
Nut only	3	3	55	14	✓	✓	50	10	✓
Nut only	4	4	42	10	✓	✓	34	NM	-
Nut only	10	1	56	1	✓	✓	132	30	-
Nut only	10	4	22	20	✓	✓	-	NM	-
Nut only	6	4	43	26	✓	✓	-	25	-
Nut only	20	2	37	17	✓	✓	-	NM	-
Nut only	2	1	46	28	✓	✓	-	NM	-
Nut only	5	6	27	35	✓	✓	-	25	-
Nut only	1	5	36	12	✓	✓	-	12	-
Nut only	6	5	40	18	✓	✓	38	10	-
Nut only	6	5	19	15	✓	✓	-	NM	-
Nut only	2	3	39	3	✓	✓	50	2	-
Nut only	1	1	43	18	✓	✓	40	NM	-
Nut only	6	10	38	16	✓	✓	-	15	-
Nut only	3	18	42	15	✓	✓	-	25	-
Nut only	9	7	27	17	✓	✓	50	NM	-
Nut only	6	10	30	10	✓	✓	-	15	-
Nut only	1	20	36	16	✓	✓	45	20	-
Nut only	40	1	34	13	✓	✓	38	NM	-
Nut only	10	3	46	6	✓	✓	140	15	-
Nut only	12	6	41	16	✓	✓	48	NM	-
Nut only	10	7	26	26	✓	✓	-	NM	-
Nut only	1	16	50	16	✓	✓	-	-	-
Nut only	30	29	45	20	✓	✓	50	NM	-
Nut only	1	5	38	18	✓	✓	-	NM	-
Nut only	4	1	26	15	✓	✓	52	NM	-
Nut only	15	17	4	10	✓	✓	50	NM	-
Nut only	8	1	19	19	✓	✓	48	NM	-
Nut only	2	1	47	20	✓	✓	44	15	-
Nut only	10	9	26	6	✓	✓	45	2	-
Nut only	2	3	34	6	✓	✓	46	16	-
Nut only	10	20	40	12	✓	✓	48	22	✓
Nut only	15	2	35	18	✓	✓	55	18	-
Nut only	10	11	52	9	✓	✓	45	10	✓
Nut only	10	8	56	23	✓	✓	-	11	-
Nut only	7	20	42	5	✓	✓	50	6	-
Nut + smoking	30	29	45	19	✓	✓	-	30	-
Nut + snuff	5	2	40	13	✓	✓	36	20	-
Nut + snuff	4	10	42	29	✓	✓	-	20	-
Nut + snuff	70	56	71	13	✓	✓	-	18	-
Nut + leaf	1	28	53	33	✓	✓		17	-
Nut + leaf + lime	1	60	80	35	✓	✓	-	19	-
Nut + leaf + lime	5	20	47	18	✓	✓	-	-	✓
Nut + leaf + lime	5	20	58	20	✓	✓	-	-	-
Nut + leaf + lime	3	1	45	28	✓	✓	-	-	-
Nut + leaf + lime + catechu + snuff	5	20	49	12	✓	✓	47	NM	✓
Nut + lime	50	21	50	17	✓	✓	45	18	-
No habits	-	-	36	15	✓	✓	40	8	-
No habits	-	-	49	26	✓	✓	-	15	-
			TOTAL NUMBER OF PATIENTS	60					

✓ = Present
NM = Not Measured

1.3.6.8 OTHER MUCOSAL LESIONS FOUND

Changes in the texture of the mucosa due to lime were found in some subjects in all three groups. Lichen planus was diagnosed clinically and seen only in patients with OSF. Erythroplakia (Fig. 5.10) was observed in three referred OSF cases. There was greater frequency of lesions in the referred OSF group than chewers without OSF.

Snuff lesions were found in all three groups. The referred OSF group had the greatest number of smooth tongues (Fig. 5.4). Crenated tongue was observed in patients with OSF.

TABLE 5.31
OTHER MUCOSAL LESIONS FOUND WITH BETEL CHEWING IN SURVEY CHEWERS WITHOUT OSF, WITH OSF AND REFERRED OSF CASES

	CHEWERS WITHOUT OSF	CHEWERS WITH OSF	REFERRED OSF CASES
Lime lesion	1	1	1
Snuff + lime lesion	0	1	0
Lichen planus	0	1	5
Generalised stomatitis	0	0	2
Erythroplakia	0	0	3
Ulcers	0	0	2
Snuff lesion	2	2	2
Smooth tongue	2	1	12
Crenated tongue	0	2	2

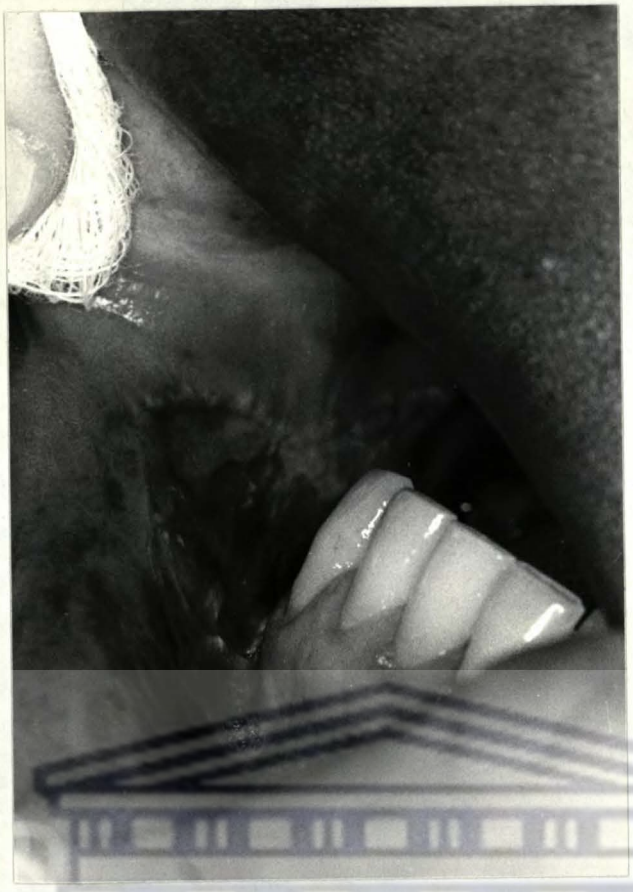


FIGURE 5.10 ERYTHROPLAKIA OF THE RIGHT CHEEK IN A PATIENT WITH ORAL SUBMUCOUS FIBROSIS. THIS PATIENT CHEWED THE NUT ONLY, ONE DAILY FOR 16 YEARS.

1.3.7 MEDICAL HISTORY OF SURVEY CHEWERS WITHOUT OSF, WITH OSF AND REFERRED OSF CASES

The proportion of people who lost weight was significantly different among the three groups (Chi-square = 29,003, DF = 2, $p < 0,0001$). In particular, the proportion of people who lost weight in the referred OSF group was significantly larger than the proportion of people who lost weight in the chewers with OSF group (Fisher's Exact Test $p < 0,0015$). The proportion of menopausal women was significantly different among the three groups (Chi-square = 9,649, DF = 2, $p < 0,01$). The proportion of people suffering from hypertension among the three groups was significantly different (Chi-square = 29,062, DF = 2, $p < 0,001$).

TABLE 5.32

MEDICAL HISTORY OF SURVEY CHEWERS WITHOUT OSF, WITH OSF AND REFERRED OSF CASES

	CHEWERS WITHOUT OSF	CHEWERS WITH OSF	REFERRED OSF CASES
Allergies	0	0	2
Asthma	3	2	3
Steroid treatment	0	1	3
Diabetes Mellitus	19	8	10
Rheumatoid arthritis	0	0	1
Anaemia	1	2	8
Gastro-intestinal disorder	1	3	8
Loss of weight	2	4	32
Abnormal menstrual history	0	2	7
Menopausal	63	32	39
OTHER			
Hypertension	25	8	0
Hypertension + Hemiplegia	2	0	0
Hypertension + Angina	1	0	1
Hypertension + Diabetes Mellitus	0	0	1
Cor-pulmonale + Rheumatic Heart Disease	1	0	0
Eczema	0	0	1
Thyroidectomy	0	0	2
Goitre	0	0	1
Thyrotoxicosis	0	0	1
Hysterectomy	0	0	3
Blindness	0	2	1
Tongue tie	1	0	0

2 BLOOD INVESTIGATIONS IN PATIENTS WITH OSF AND CHEWERS WITHOUT OSF

Patients with OSF include referred cases as well as OSF cases found during the survey.

2.1 HAEMATOLOGICAL

2.1.1 Haemoglobin Levels

Forty five percent of patients with OSF and 50% of chewers without OSF were anaemic with haemoglobin levels of less than 12 g/dl.

TABLE 5.33
HAEMOGLOBIN LEVELS OF PATIENTS WITH OSF
AND CHEWERS WITHOUT OSF

	OSF		CHEWERS	
HAEMOGLOBIN VALUE g/dl	NUMBER	%	NUMBER	%
2 - 7,9	13	9	0	0
8 - 9,9	23	15	2	25
10 - 11,9	31	20	2	25
12 (Normal)	85	56	4	50
Total number of patients	152	100	8	100

2.1.2 Morphological Classification of Anaemia

The erythrocyte indices were microcytic hypochromic in 42% of patients with OSF and 62,5% of chewers without OSF.

TABLE 5.34
MORPHOLOGICAL CLASSIFICATION OF ANAEMIA IN PATIENTS WITH OSF AND
CHEWERS WITHOUT OSF

	OSF		CHEWERS	
	NUMBER	%	NUMBER	%
Normocytic normochromic (Normal)	68	45	3	37,5
Normocytic hypochromic	18	12	0	0
Microcytic hypochromic	64	42	5	62,5
Macrocytic normochromic	2	1	0	0
Total number of patients	152	100	8	100

2.1.3 Eosinophilia

Eosinophilia (>400/cu.mm.) was observed in 13% of patients with OSF and in one chewer without OSF

TABLE 5.35
EOSINOPHIL COUNTS IN PATIENTS WITH OSF AND CHEWERS WITHOUT OSF

	OSF		CHEWERS	
10^9/L	NUMBER	%	NUMBER	%
0,4 (Normal)	133	87	7	87,5
>0,4	19	13	1	12,5
Range	0,42-1,60		0,69	
Total number of patients	152	100	8	100,0

2.1.4 STUDIES OF IRON STATUS

Serum ferritin (10 ng/ml) (Table 5.36) was found in 30% of patients with OSF and 75% of chewers without OSF. The low levels of serum iron (Table 5.37) and transferrin saturation (Table 5.38) confirmed iron deficiency in 40% of the patients with OSF and in 75% of chewers without OSF.

2.1.4.1 Serum Ferritin

TABLE 5.36
SERUM FERRITIN LEVELS IN PATIENTS WITH OSF AND CHEWERS WITHOUT OSF

	OSF		CHEWERS	
ng/ml	NUMBER	%	NUMBER	%
10 (Normal)	101	70	2	25
<10 (Iron deficient)	44	30	6	75
Total number of patients	145	100	8	100

TABLE 5.37
SERUM IRON LEVELS IN PATIENTS WITH OSF AND CHEWERS WITHOUT OSF

	OSF		CHEWERS	
umol/l	NUMBER	%	NUMBER	%
< 9	56	40	5	62,5
9 - 32 (Normal)	82	59	3	37,5
> 32	2	1	0	0
Total number of patients	140	100	8	100

TABLE 5.38
TRANSFERRIN SATURATION IN PATIENTS WITH OSF AND CHEWERS WITHOUT OSF

$$\text{Transferrin Saturation} = \frac{\text{SERUM IRON}}{\text{TOTAL IRON BINDING CAPACITY}} \times 100$$

	OSF		CHEWERS	
PERCENTAGE SATURATION	NUMBER	%	NUMBER	%
< 12 (Iron deficient)	56	40	6	75
> 12 - 25 (Decreased iron saturation)	55	39	1	12,5
26 - 33 (Normal)	22	16	0	0
> 33	7	5	1	12,5
Total number of patients	140	100	8	100,0

2.1.5 Serum Folate

Folate deficiency was found in two of the 71 patients with OSF and in none of the chewers without OSF.

TABLE 5.39
SERUM FOLATE LEVELS OF PATIENTS WITH OSF AND CHEWERS WITHOUT OSF

		OSF		CHEWERS	
	ng/ml	NUMBER	%	NUMBER	%
Normal	2,5 - 15,5	61	86	4	100
Borderline deficiency	2,0 - 2,4	8	11	0	0
Definite deficiency	0,5 - 1,9	2	3	0	0
Total number of patients		71	100	4	100

2.1.6 Serum Vitamin B12 Levels of Patients with OSF and Chewers without OSF

Of the 71 patients with OSF tested none had any biochemical evidence of Vitamin B12 deficiency. The range of the results were from 221 pg/ml to 1355 pg/ml. None of the four chewers had biochemical evidence of Vitamin B12 deficiency and their range of results were from 312 pg/ml to 605 pg/ml.

2.1.7 Erythrocyte Sedimentation Rate

The erythrocyte sedimentation rate was increased (>10 mm/hr) in 86% of patients with OSF and 83% of chewers without OSF.

TABLE 5.40
ERYTHROCYTE SEDIMENTATION RATE OF PATIENTS WITH OSF AND CHEWERS WITHOUT OSF

	OSF		CHEWERS	
mm/hr	NUMBER	%	NUMBER	%
<10 (Normal)	15	14	1	17
>10	86	86	5	83
Total number of patients	101	100	6	100

2.2 IMMUNOLOGICAL INVESTIGATIONS

2.2.1 Antinuclear Factor

The antinuclear factor was weakly positive in two female patients with OSF and was negative in all the chewers without OSF.

TABLE 5.41
ANTINUCLEAR FACTOR IN PATIENTS WITH OSF AND CHEWERS WITHOUT OSF

	OSF		CHEWERS	
	M	F	M	F
Negative	2	103	0	9
Weakly positive	0	2	0	0
Sub-total	2	105	0	9
Total number of patients	107		9	

2.2.2 Smooth Muscle Antibodies

None of the subjects exhibited antibodies to smooth muscle in the serum.

TABLE 5.42
SMOOTH MUSCLE ANTIBODIES IN PATIENTS WITH OSF AND CHEWERS WITHOUT OSF

	OSF		CHEWERS	
	M	F	M	F
Negative	2	105	0	9
Positive	0	0	0	0
Total number of patients	107		9	

2.2.3 Parietal Cell Antibodies

Nineteen of the 105 patients with OSF and one chewer without OSF had positive parietal cell antibodies.

TABLE 5.43
PARIETAL CELL ANTIBODIES IN PATIENTS WITH OSF AND CHEWERS WITHOUT OSF

	OSF		CHEWERS	
	M	F	M	F
Negative	2	86	0	8
Positive	0	19	0	1
Sub-total	2	105	0	9
Total number of patients	107		9	

2.2.4 Age distribution of patients with positive parietal cell antibodies

They were all females and fell within the age group 25 to 64 years.

TABLE 5.44
AGE DISTRIBUTION OF SUBJECTS WITH OSF AND CHEWERS WITH PARIETAL CELL ANTIBODIES

AGE (YEARS)	OSF	CHEWERS
10-14	0	0
15-24	0	0
25-34	3	1
35-44	9	0
45-54	6	0
55-64	1	0
65+	0	0

2.2.5 Mitochondrial Antibodies

The number of patients tested for mitochondrial antibodies were 107 with OSF and six chewers without OSF. All were negative.

2.2.6 Rheumatoid Factor

Three patients with OSF had a significant titre (>1/80).

TABLE 5.45
RHEUMATOID FACTOR IN PATIENTS WITH OSF AND CHEWERS WITHOUT OSF

	OSF		CHEWERS	
	M	F	M	F
Negative	99	89	6	100
Non-significant positive titre (up to 1/40)	9	8	0	0
Significant titre (>1/80)	3	2	0	0
Total number of patients	111	100	6	100

2.2.7 Serum Protein Electrophoresis

The protein electrophoresis estimation in patients with OSF revealed that 68% had mildly elevated gamma globulin levels and fractionation of the serum globulins showed that 33% had elevated beta globulins. Of the chewers without OSF three had elevated gamma globulins and one elevated beta globulin.

TABLE 5.46
SERUM GLOBULIN FRACTIONATION IN PATIENTS WITH OSF AND CHEWERS WITHOUT OSF

	NORMAL RANGE g/l	SUBJECTS' RANGE g/l	MEAN g/l	ELEVATED LEVELS NUMBER	ELEVATED LEVELS %
ALL SUBJECTS WITH OSF (99)					
Alpha 1	1,7 - 3,3	1,2 - 3,9	2,2	2	2
Alpha 2	4,2 - 8,7	1,8 - 10,3	6,4	6	6
Beta	5,2 - 10,5	4,6 - 16,2	9,9	32	33
Gamma	7,1 - 14,5	8,7 - 29,6	16,0	67	68
CHEWERS WITHOUT OSF (6)					
Alpha 1	1,7 - 3,3	1,6 - 3,6	2,75	1	17
Alpha 2	4,2 - 8,7	5,3 - 8,7	7,0	0	0
Beta	5,2 - 10,5	9,2 - 11,4	9,9	1	17
Gamma	7,1 - 14,5	9,8 - 19,6	15,6	3	50

2.2.8 Serum Immunoglobins

The serum IgG, IgA and IgM levels were increased by 31%, 28% and 38% respectively in subjects with OSF. One chewer without OSF had increased IgG levels.

TABLE 5.47
SERUM IMMUNOGLOBULINS IN PATIENTS WITH OSF AND CHEWERS WITHOUT OSF

	ALL SUBJECTS WITH OSF (97)				
	NORMAL LAB. RANGE mg/dl	DECREASED	NORMAL	INCREASED	RANGE mg/dl
IgG	800 - 1800	2 (2%)	65 (65%)	30 (31%)	783 - 6333
IgA	90 - 450	4 (4%)	66 (69%)	27 (28%)	-1 - 1083
IgM	60 - 250	5 (5%)	55 (57%)	37 (38%)	-1 - 684,7
	CHEWERS WITHOUT OSF (2)				
IgG	800 - 1800	0	1	1	1414 - 1870
IgA	90 - 450	0	2	0	257 - 330
IgM	60 - 250	0	2	0	200 - 247

2.3 BIOCHEMICAL AND SEROLOGICAL

2.3.1 Serum Albumin and Globulin

The serum albumin was low in only two patients with OSF with levels less than 35 g/dl and the chewers without OSF had normal levels. The serum globulin was low in 16% of patients with OSF with levels less than 31 g/dl and in three chewers without OSF.

TABLE 5.48
SERUM ALBUMIN AND GLOBULIN LEVELS IN PATIENTS WITH OSF AND CHEWERS WITHOUT OSF

g/l	ALBUMIN				GLOBULIN			
	OSF		CHEWERS		OSF		CHEWERS	
	NUMBER	%	NUMBER	%	NUMBER	%	NUMBER	%
< 20	0	0	0	0	0	0	0	0
20 - 25	1	1	0	0	4	4	0	0
26 - 30	0	0	0	0	12	12	3	50
31 - 35	1	1	0	0	45	45	2	33
36 - 40	14	14	0	0	29	29	1	17
41 - 45	65	64	4	67	7	7	0	0
46 - 52	20	20	2	33	4	4	0	0
Total number of patients	101	100	6	100	101	100	6	100

2.3.2 Serum Bilirubin

Of the 101 patients with OSF eight (8%) had mildly elevated serum levels of bilirubin, the upper limit of normal being 17 umol/l. All except one patient had levels of less than 27 umol/l. This patient, a 42 year old female, had a bilirubin level of 88 umol/l with other biochemical evidence of liver disease viz. serum albumin of 27 g/l, serum globulin 47 g/l and a raised alkaline phosphatase (121 umol/l). This patient was a non-alcoholic and refused any further investigations. Of the six patients, who chewed but had no evidence of OSF only one had a raised serum bilirubin level of 52 umol/l but otherwise with normal liver function tests.

2.3.3 Serum Alkaline Phosphatase

The number of patients tested for serum alkaline phosphatase were 101 with OSF and six chewers without OSF. Serum alkaline phosphatase was

mildly elevated (i.e. > 100 umol/l) in 32 (32%) patients with OSF and in three (50%) chewers without OSF. The raised serum alkaline phosphatase levels ranged from 101-263 umol/l, with a median value of 121 umol/l.

2.3.4 Serum Zinc

Thirty patients with OSF were tested for serum zinc levels. None of the patients had biochemical evidence of zinc deficiency. The normal range is 11-19,6 mmol/l but the patients examined had levels ranging from 14,3-24,5 mmol/l. On the other hand one chewer without OSF was tested with no evidence of zinc deficiency.

2.3.5 Serological Tests for Syphilis

The Wassermann Reaction was performed in 98 patients and was weakly positive in four individuals. However, the specific Fluorescent Treponema Antibody Test was negative in all four patients, denoting a false positive Wassermann Reaction.

3 MORPHOLOGICAL INVESTIGATIONS

Biopsy specimens were taken from:

1 129 Referred cases with OSF. A total of 143 specimens were taken from the lips and cheeks. Some patients donated several specimens.

2 24 Cases of OSF which were derived from the survey population. Of the 32 survey patients with OSF which were referred to the hospital only 24 allowed biopsies to be performed. 26 specimens were taken.

3 Nine chewers without signs of OSF. These consisted of three survey patients and six referrals by colleagues. Nine specimens were examined.

Thus, specimens from 153 cases of clinically diagnosed OSF and nine chewers without clinical OSF were examined.

3.1 HISTOLOGICAL FEATURES OBSERVED IN TISSUES FROM CHEWERS WITH OSF AND CHEWERS WITHOUT CLINICAL OSF.

3.1.1 EPITHELIUM

From the 153 sections of chewers with OSF, 149 were examined, as one section was poor and three did not have epithelium. The changes observed in the epithelium were atrophic epithelium in 104 (70%) (Fig. 5.11a) and hyperplastic/acanthotic epithelium in 32 (21%) (Fig. 5.11b). There was normal epithelium in 13 (9%). In the nine biopsy specimens of chewers without clinical OSF there was hyperplastic/acanthotic epithelium in eight (89%) (Figs. 5.11c & 5.15j). In one section the epithelium was normal. Atrophic epithelium was not observed.

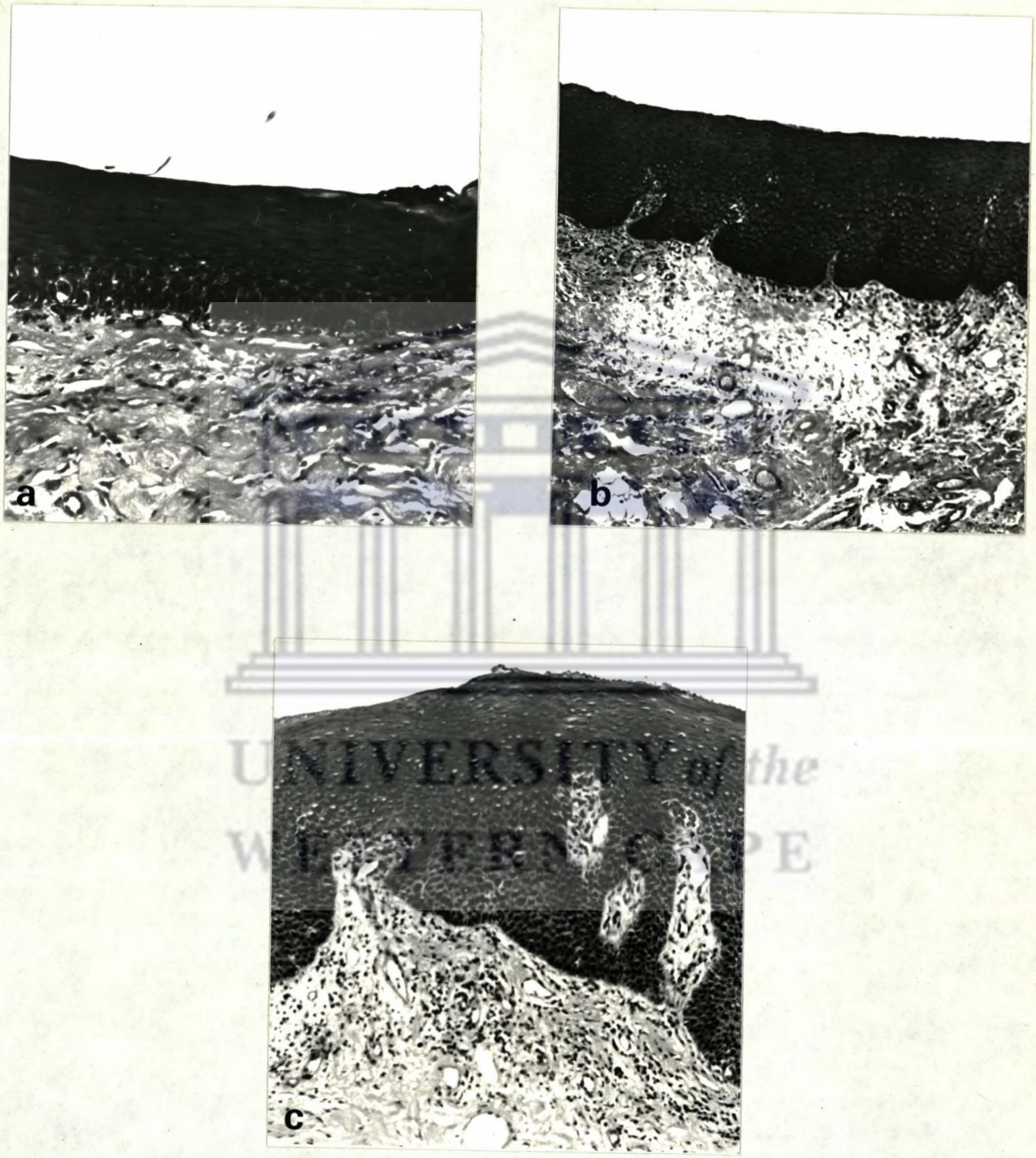
3.1.1.1 Keratinisation

The epithelium was unkeratinised in 91 (61%) cases of chewers with OSF. It was parakeratinised (Fig. 5.12a) in 49 (33%) and orthokeratinised (Fig. 12b) in nine (6%). The only variation observed in chewers without clinical OSF was parakeratosis in three (33%).

3.1.1.2 Cellular oedema

In the sections from chewers with OSF 85 (61%) showed changes in the spinous layer in the form of intra-cellular oedema producing a vacuolation of the cytoplasm exhibiting a signet-ring appearance (Fig. 5. 13b). Inter-cellular oedema was seen in 34 (24%) biopsies (Fig. 5.13a). Both intra (Fig. 5.13c) and inter-cellular oedema was observed in 21 (15%) biopsies. In the sections from chewers without clinical OSF

three had signet-rings, six had intra-cellular oedema, four inter-cellular oedema and three both intra-and inter-cellular oedema.

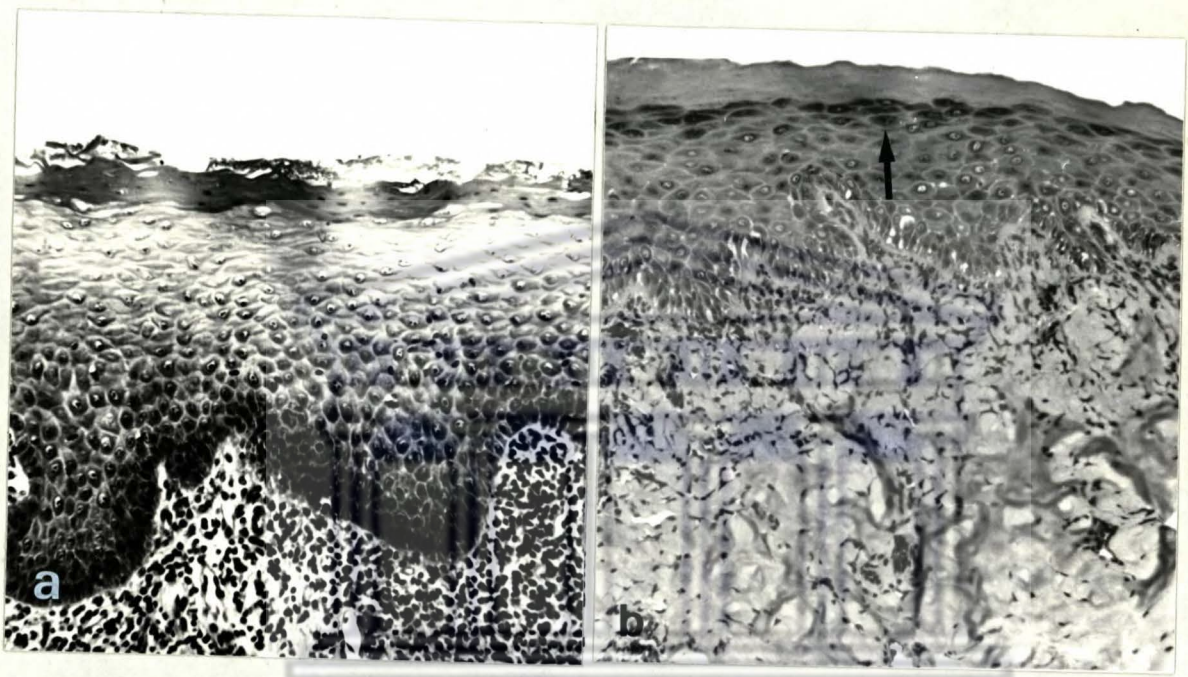


FIGURES 5.11 THESE PHOTOCGRAPHS DEPICT THE STATE OF THE EPITHELIUM OF THE CHEEK MUCOSA IN CHEWERS

a ATROPHIC EPITHELIUM IN A CHEWER WITH OSF (50x)

b ACANTHOTIC EPITHELIUM IN OSF (30x)

c HYPERPLASTIC EPITHELIUM IN A CHEWER WITHOUT CLINICAL OSF (32x) (H & E)

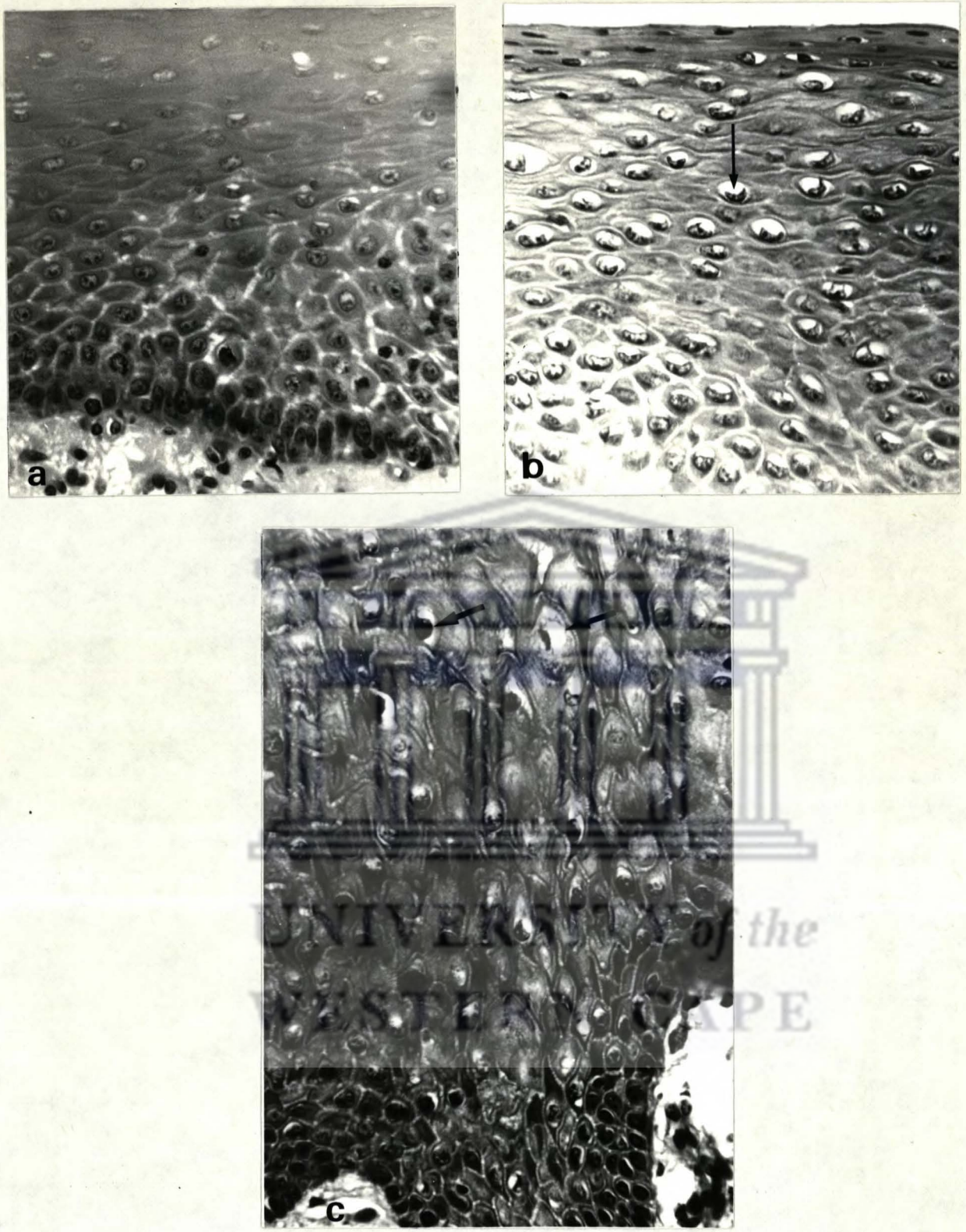


FIGURES 5.12 THESE ILLUSTRATIONS DEMONSTRATE KERATINISATION IN CHEWERS WITH OSF

a A LAYER OF PARAKERATIN

b ABNORMAL HYPERORTHOKERATOSIS. NOTE THE GRANULAR LAYER (ARROWED)

(CHEEK EPITHELIUM H & E 50x)



FIGURES 5.13 THESE PHOTOGRAPHS SHOW CHANGES IN THE STRATUM SPINOSUM OF CHEWERS WITH OSF

a SPONGIOSIS. NOTE THE LOOSENING OF CELLS FROM EACH OTHER

b 'SIGNET-RING' CELLS (ARROWED)

c SWELLING OF CELLS AND VACUOLISATION AROUND THE NUCLEUS (ARROWED)

(H & E 126x)

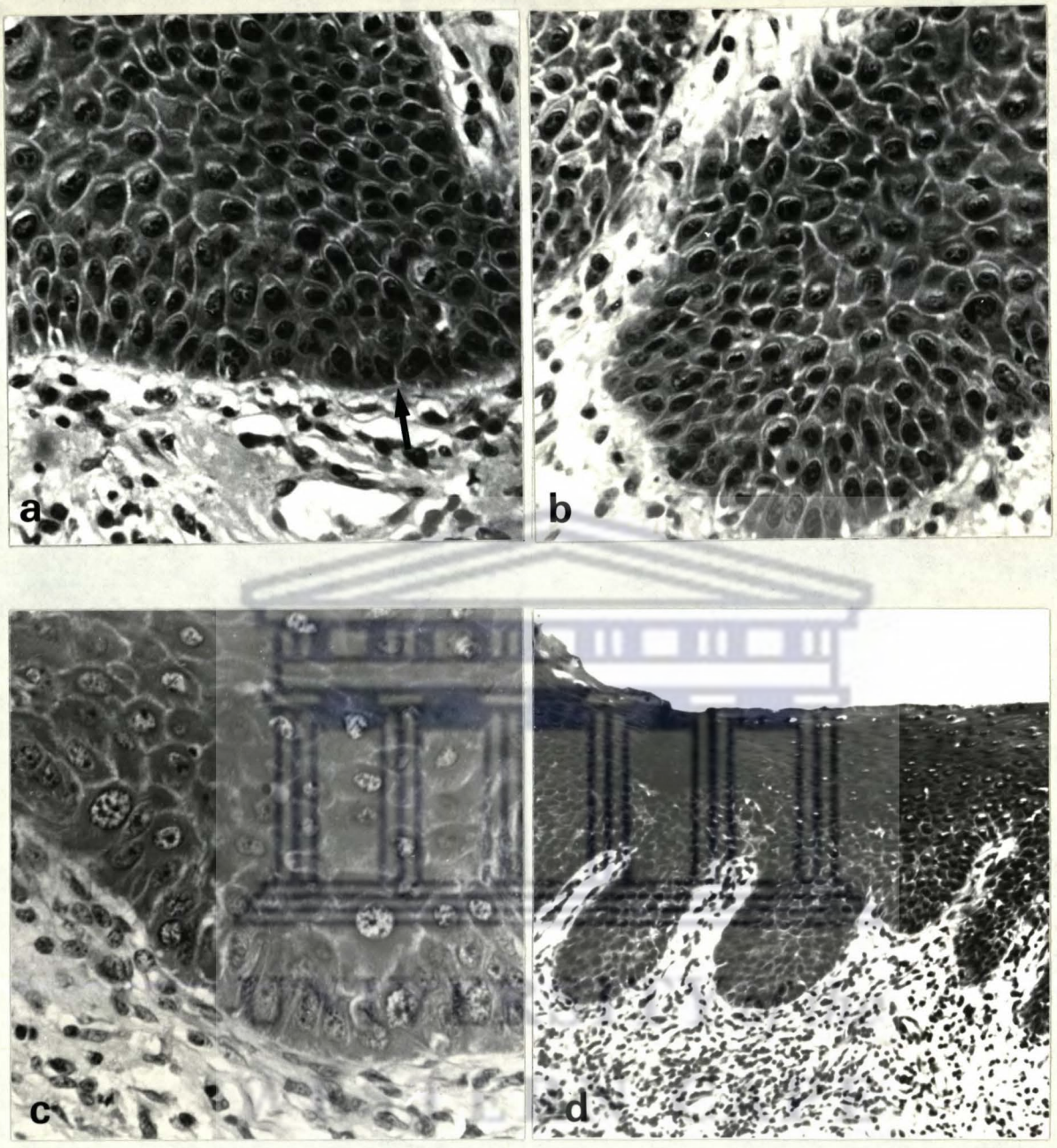
3.1.1.3 Atypia

In the chewers with OSF 149 fields were examined with a mean of 1,1 (SD 1,3) mitotic figures per field. In the chewers without OSF nine fields were examined with a mean of 2,4 (SD 1,8) mitotic figures per field. There was a significant difference in the means of the mitotic index between chewers without OSF and chewers with OSF (t value = -2,129, DF=156, $P < 0,05$), indicating the hyperplastic nature of the epithelium in chewers without clinical OSF.

TABLE 5.49
THE FEATURES OF ATYPIA OBSERVED IN CHEWERS WITH OSF AND IN CHEWERS WITHOUT CLINICAL OSF.

	CHEWERS WITH OSF		CHEWERS WITHOUT CLINICAL OSF	
	NUMBER	%	NUMBER	%
Loss of polarity of basal cells (Fig. 5.14a)	49	33	2	22
The presence of more than one layer of cells having a basaloid appearance (Fig. 5.14b)	34	23	2	22
An increased nuclear-cytoplasmic ratio (Fig. 5.14c)	11	7	0	0
Drop-shaped rete pegs (Fig. 5.14d)	6	4	1	11
Irregular epithelial stratification (Fig. 5.14 e)	6	4	0	0
Increased number of mitotic figures (Fig. 5.14 f)	*35	23	*3	33
The presence of mitotic figures in the superficial half of the epithelium (Fig. 5.14g)	3	2	0	0
Cellular pleomorphism (Fig. 5.14h)	9	6	1	11
Nuclear hyperchromatism (Fig. 5.14i)	10	7	1	11
Enlarged and multiple nucleoli (Fig. 5.14j)	11	7	2	22
Reduction of cellular cohesion (Fig. 5.14j)	34	23	0	0
Keratinisation of single cells or cell groups in the prickle layer (Fig. 5.14k)	2	1	0	0
TOTAL NUMBER OF BIOPSIES OF CASES EXAMINED	149		9	

*More than two mitotic figures per field (400x)



FIGURES 5.14 THESE ILLUSTRATIONS EXHIBIT THE FEATURES OF ATYPIA IN CHEWERS WITH OSF

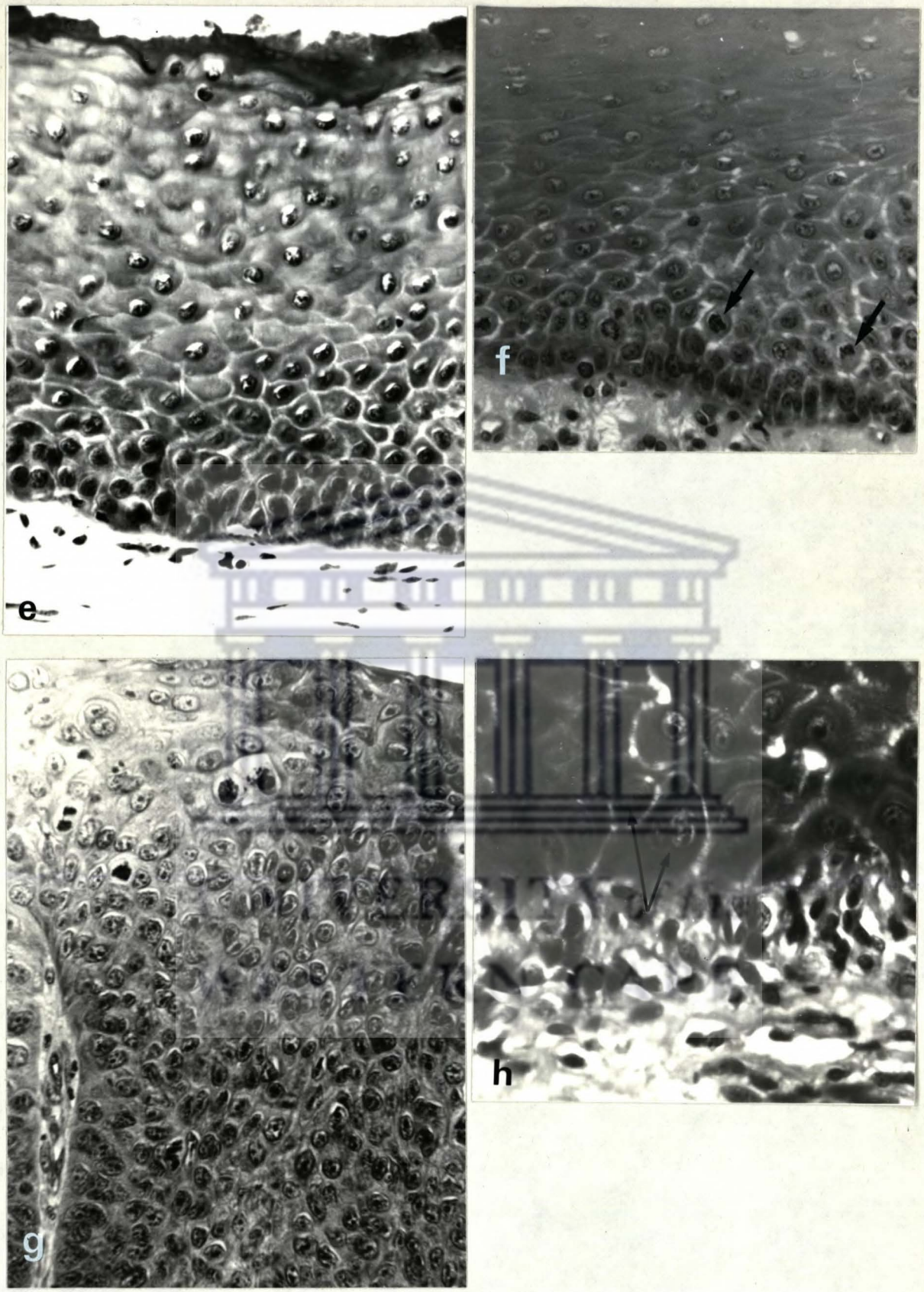
a LOSS OF POLARITY OF THE BASAL CELLS (INDICATED) (126x)

b THE BASALOID APPEARANCE OF CELLS OF A RETE PEG (126x)

c THE DISTURBED NUCLEAR-CYTOPLASMIC RATIOS OF THE BASAL CELLS (200x)

d DROP-SHAPED RETE PEGS (50x)

(H & E)



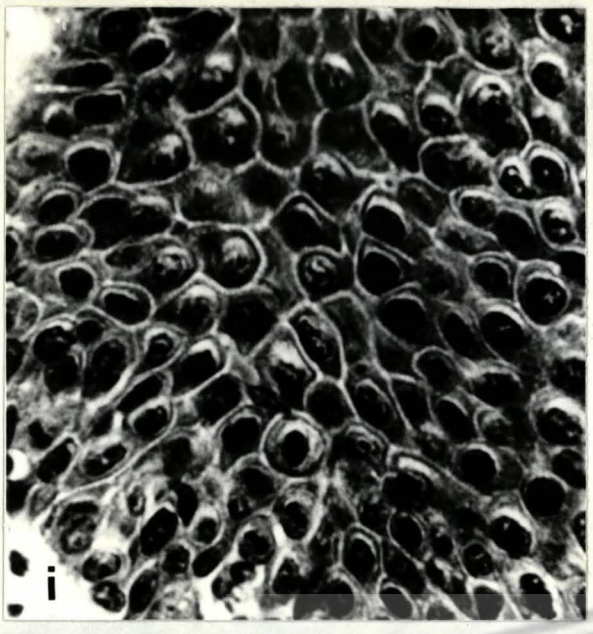
FIGURES 5.14

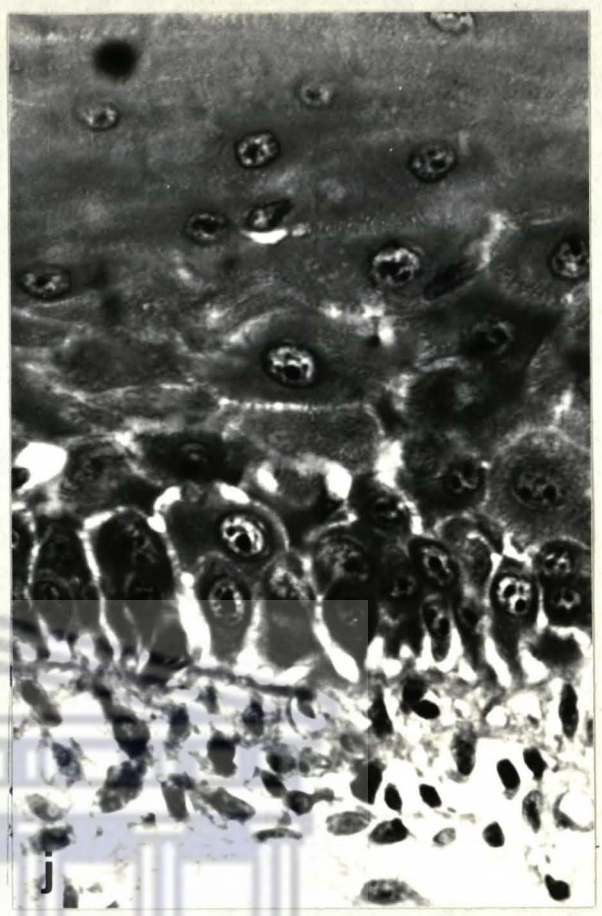
e IRREGULAR STRATIFICATION. NOTE THE ROUNDED CELLS IN THE SUPERFIFICAL LAYER OF THE EPITHELIUM (126x)

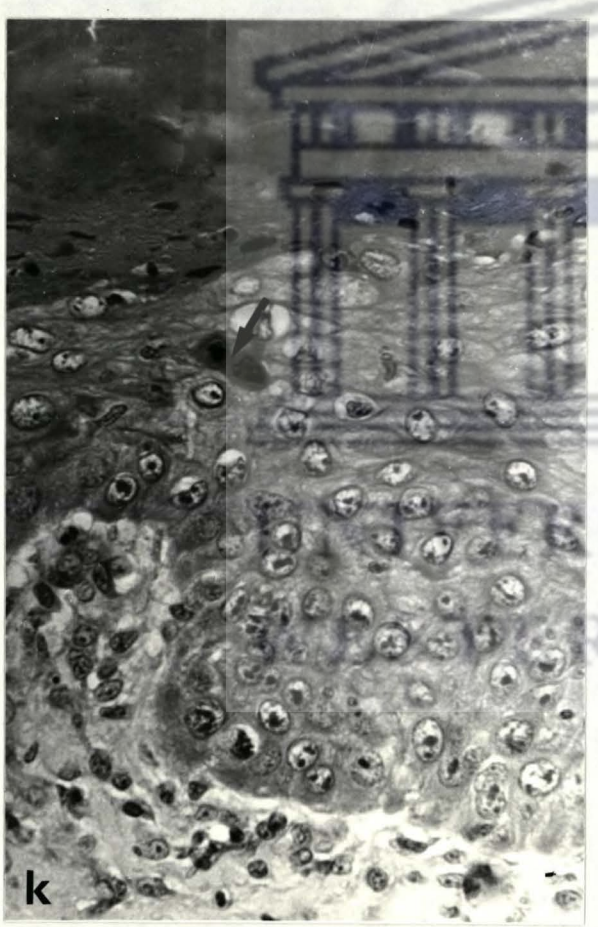
f MITOTIC FIGURES IN ATROPHIC EPITHELIUM (INDICATED) (126x)

g MITOTIC FIGURES IN THE SUPERFICIAL HALF OF THE EPITHELIUM (126x)

h CELLULAR PLEOMORPHISM. NOTE THE DIFFERENT SIZES OF THE CELLS (200x)







FIGURES 5.14

i NUCLEAR HYPERCHROMATISM (200x)
j ENLARGED AND MULTIPLE NUCLEOLI AS WELL AS A REDUCTION OF CELLULAR COHESION (200x)
k INDIVIDUAL CELL KERATINISATION OF TWO CELLS (ARROWED) (126x)

(H & E)

3.1.2 LAMINA PROPRIA

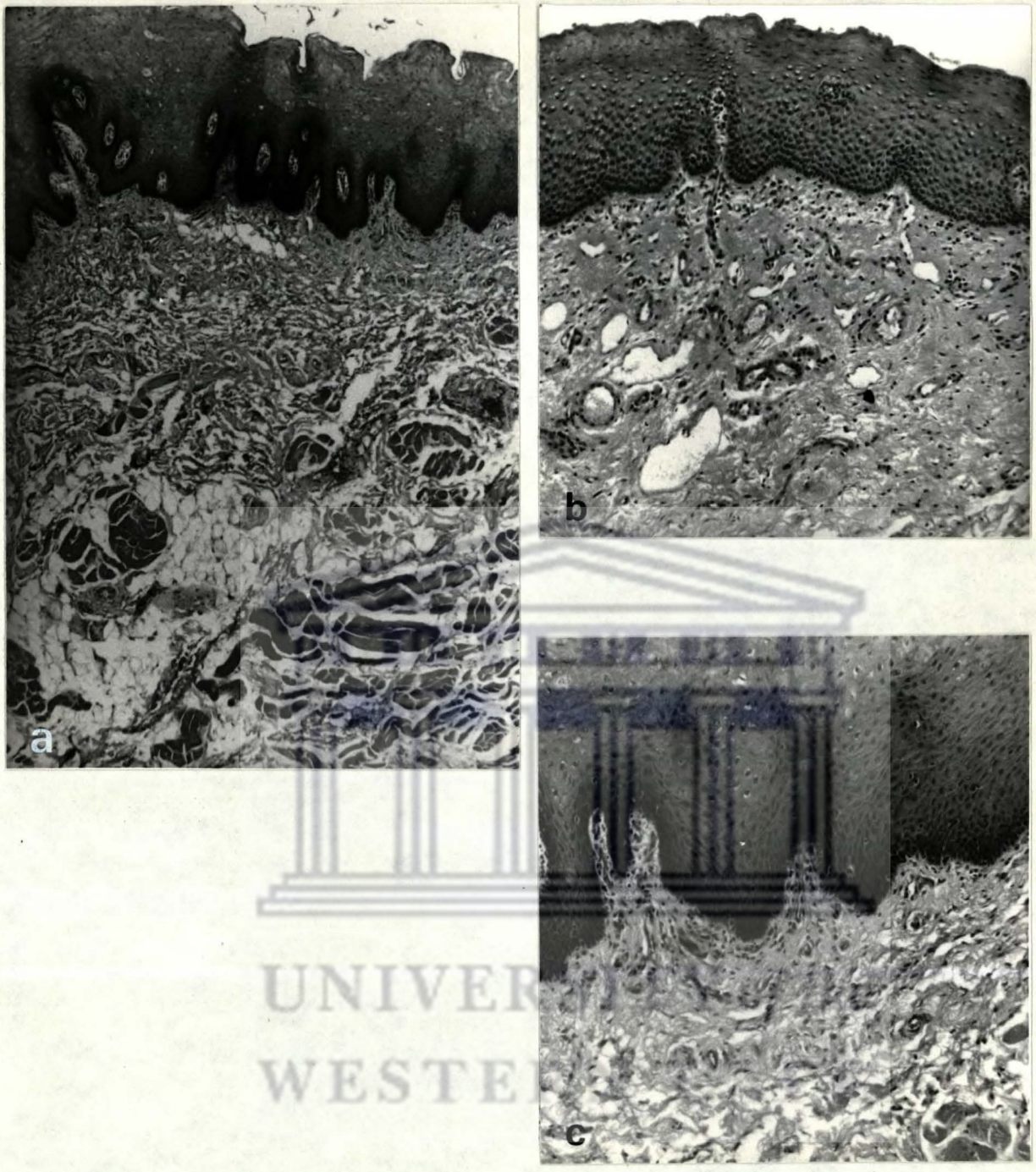
3.1.2.1 COLLAGEN

The collagen in chewers with OSF varied from very dense (Fig. 5.15f) to loosely woven structures (Figs. 5.15b & c). In some instances the collagen was losely woven next to the epithelium while the rest of the lamina propria was dense (Figs. 5.15h & i). In other instances it was loosely woven in the deeper part of the lamina propria while the superficial part was dense (Fig. 5.15d).

Of the above, 12 showed an amorphous layer next to the epithelium (Fig. 5.15f). The collagen in the lamina propria in chewers without clinical OSF varied from very dense to loosely woven. In four sections it was moderately dense (Figs. 5.15j & k).

TABLE 5.50
DISTRIBUTION OF COLLAGEN IN CHEWERS WITH OSF AND CHEWERS WITHOUT OSF

	CHEWERS WITH OSF		CHEWERS WITHOUT CLINICAL OSF	
Dense in lamina propria		99		1
1 lamina propria only	24		1	
2 lamina propria and submucosa	75		0	
Moderately dense in lamina propria		40		5
1 lamina propria only	30		4	
2 lamina propria and submucosa	10		1	
Loosely woven in lamina propria		13		2
Normal		0		1
TOTAL		152		9



FIGURES 5.15 THESE PHOTOGRAPHS ILLUSTRATE THE DISTRIBUTION OF COLLAGEN IN A CONTROL AND CHEWERS WITH OR WITHOUT CLINICAL OSF

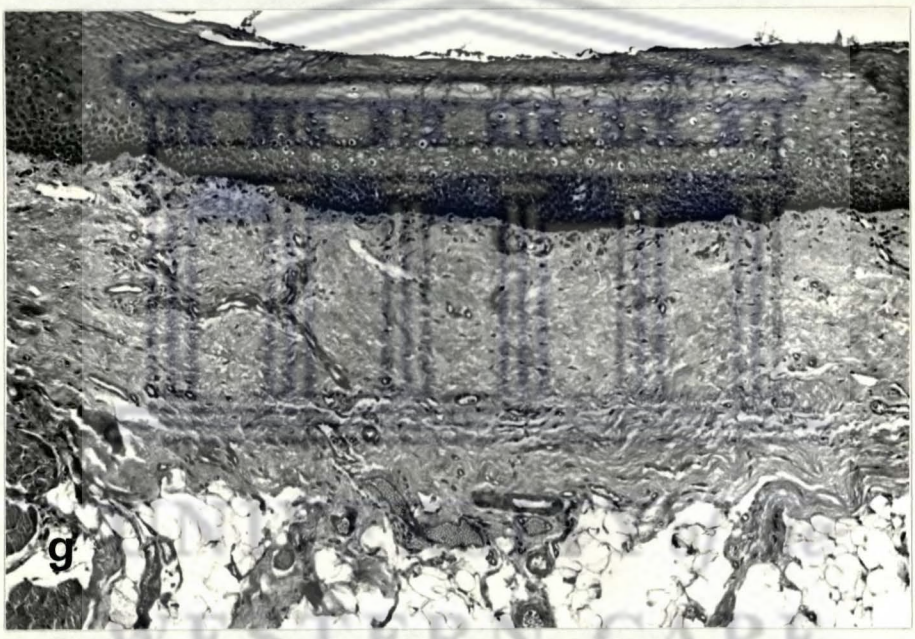
a A CONTROL SPECIMEN SHOWING THE LOOSE ARRANGEMENT OF COLLAGEN IN THE LAMINA PROPRIA (13x)

b & c EXAMPLES OF CHEWERS WITH OSF WHERE THE COLLAGEN IN THE LAMINA PROPRIA WAS LOOSELY ARRANGED. THE INDIVIDUAL FIBRES CAN BE SEEN AND THE COLLAGEN IS NOT PRESENT AS A DISTINCT BAND IN THE LAMINA PROPRIA (32x)

(H & E)

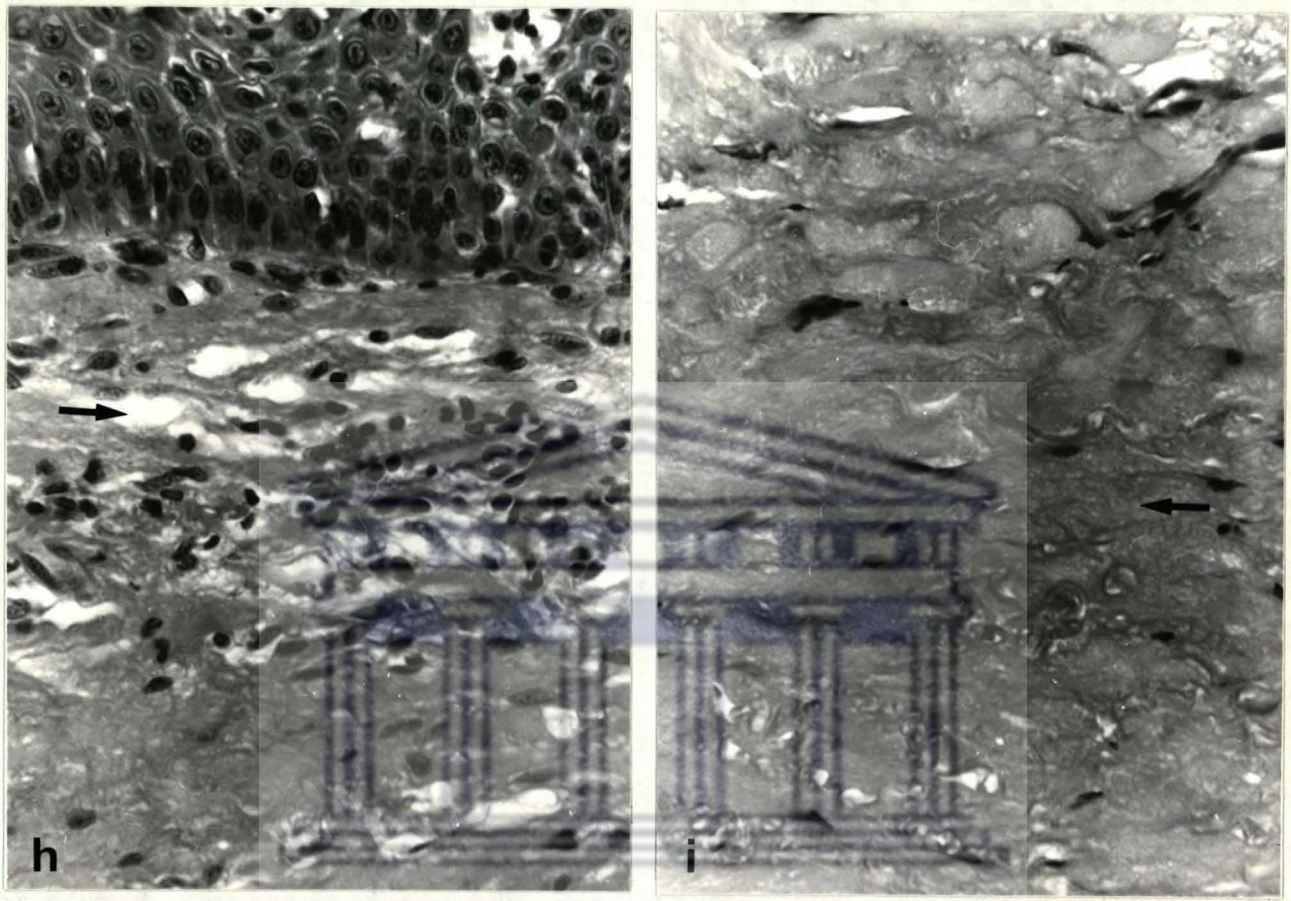
FIGURES 5.15 d MODERATELY DENSE COLLAGEN IN THE LAMINA PROPRIA IN A CHEWER WITH OSF. NOTE THAT THE COLLAGEN IS DENSE NEXT TO THE EPITHELIUM BUT MORE LOOSELY ARRANGED DEEPER IN THE LAMINA PROPRIA (ARROWS) (H & E 32x)

e DENSE FIBROSIS EXTENDING FROM THE LAMINA PROPRIA INTO THE SUBMUCOSA IN OSF (ARROWED) (VAN GIESON 20x)



FIGURES 5.15 f JUXTA-EPITHELIAL "HYALINISATION" OF COLLAGEN IN OSF. THE HYALINE-LIKE BAND IS INDICATED (H & E 50x)

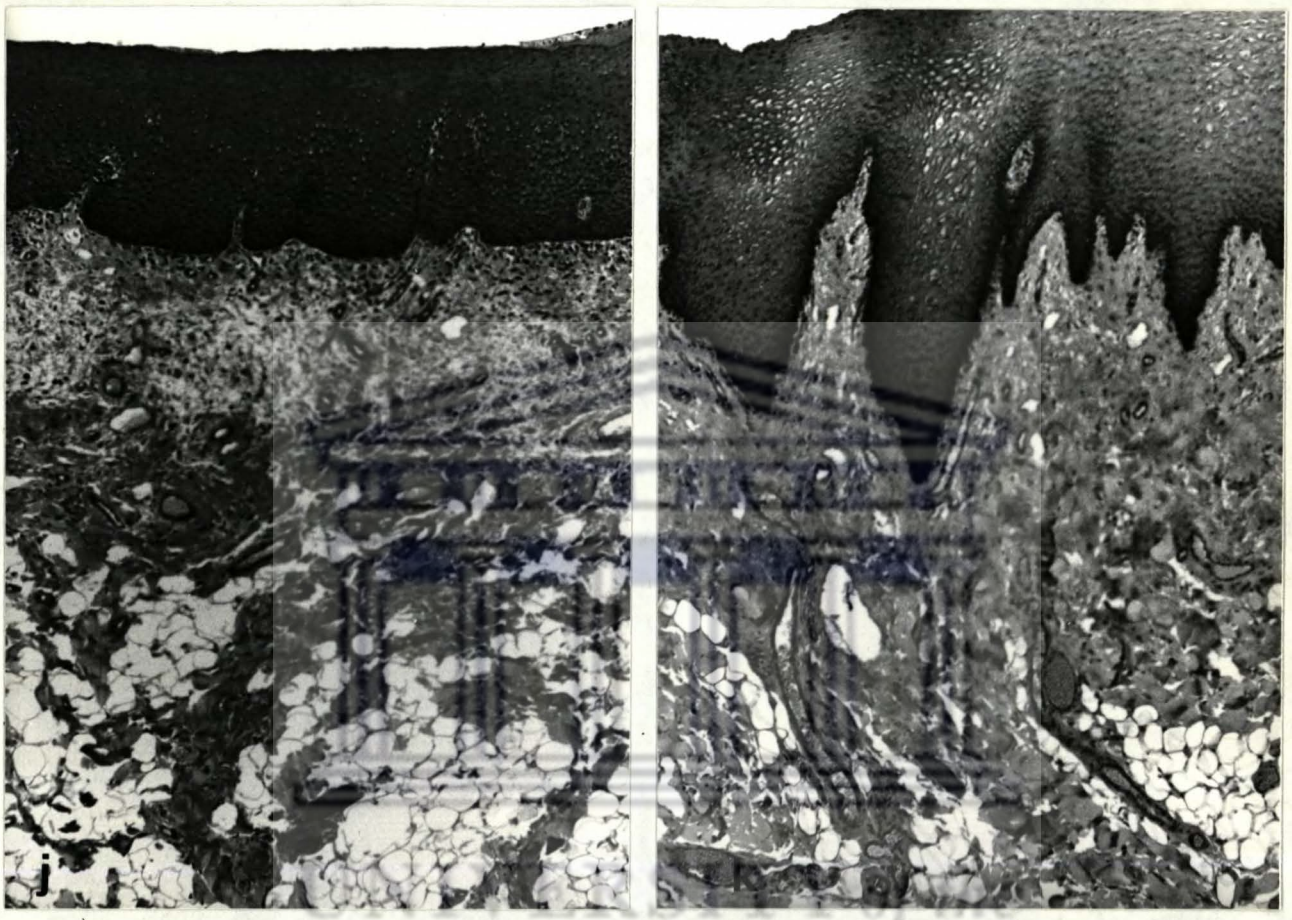
g DENSE COLLAGEN BAND CONFINED TO THE LAMINA PROPRIA IN OSF (H & E 20x)



FIGURES 5.15 h AN EXAMPLE OF OSF WHERE THE COLLAGEN WAS LOOSELY WOVEN CLOSE TO THE EPITHELIUM (FIG. 5.15h) (ARROW)

i BUT DENSE IN THE DEEPER PART OF THE LAMINA PROPRIA (FIG. 5.15i) (ARROWED)

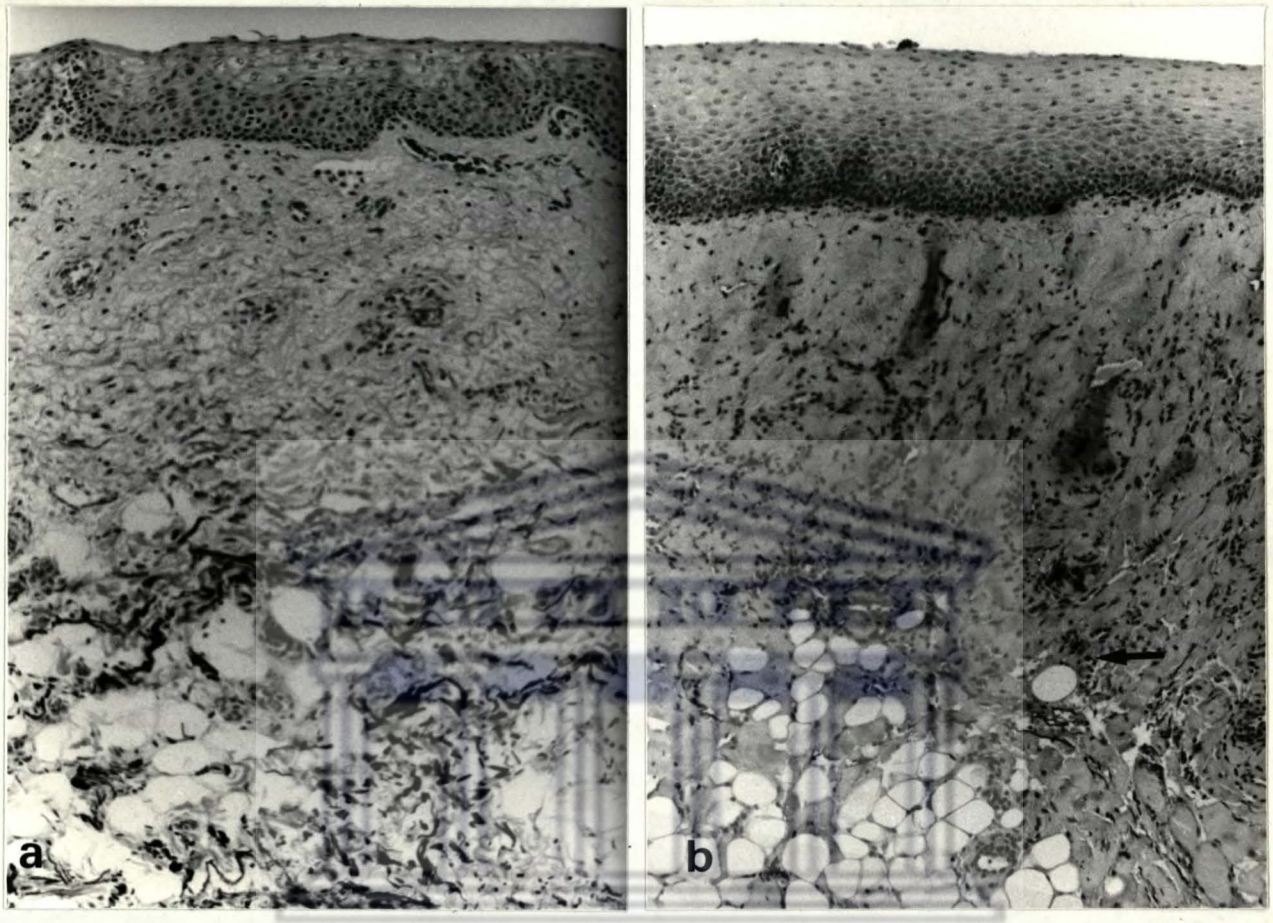
(H & E 126x)



FIGURES 5.15 j THE CHANGES IN A CHEWER WITHOUT CLINICAL OSF. NOTE THE ACANTHOSIS OF THE EPITHELIUM AND FIBROSIS IN THE DEEPER PART OF THE LAMINA PROPRIA WITH BANDS EXTENDING BETWEEN FAT CELLS

k MODERATE DENSITY OF COLLAGEN IN A CHEWER WITHOUT CLINICAL OSF

(H & E 20x)

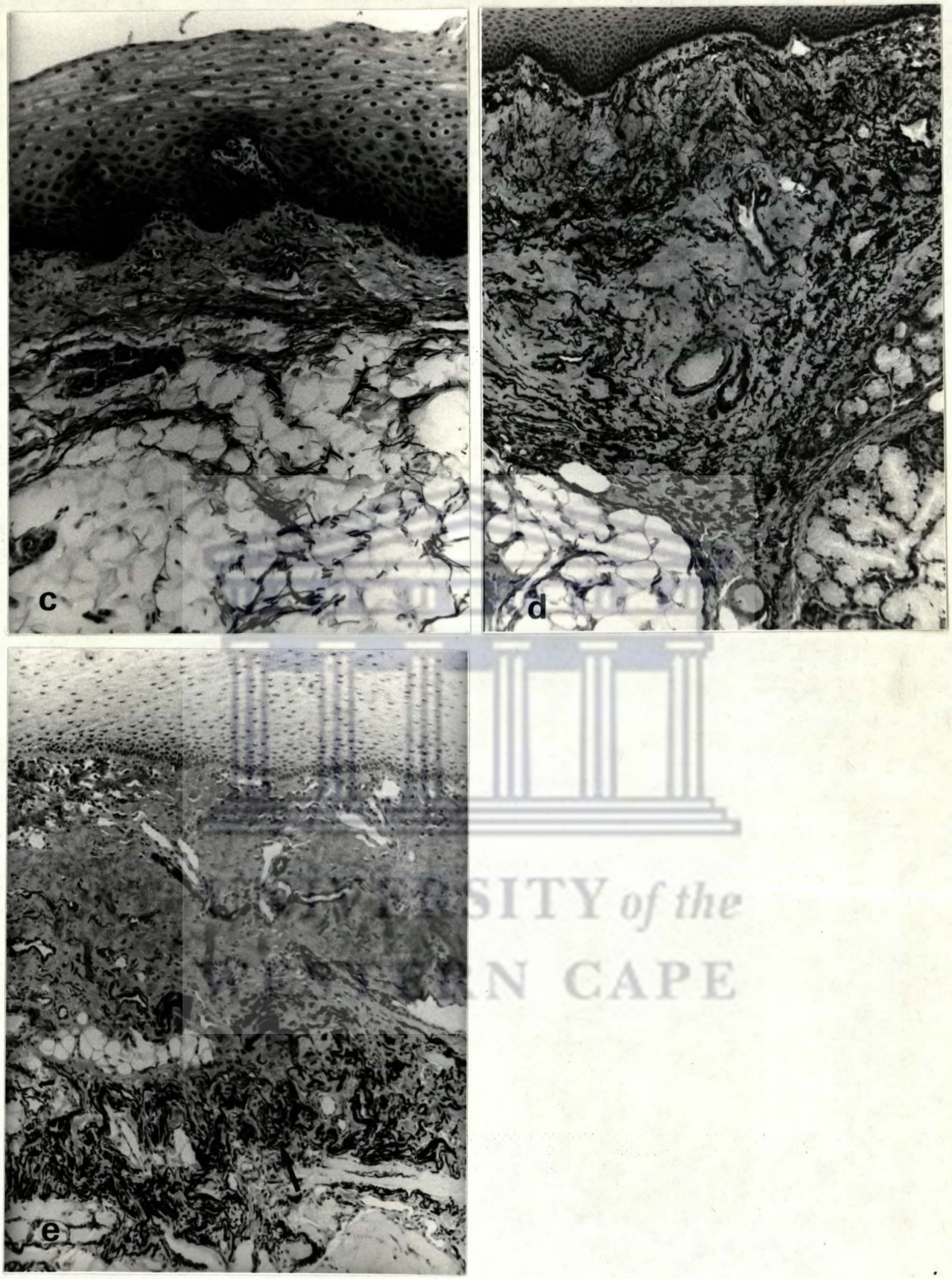


FIGURES 5.16 THESE ILLUSTRATIONS SHOW ELASTIC FIBRES IN CHEWERS WITH OSF AND IN CONTROLS

a ELASTIC FIBRES ARE PRESENT IN THE SUBMUCOSA BUT NOT IN THE LAMINA PROPRIA IN OSF (FIG. 5.16a)

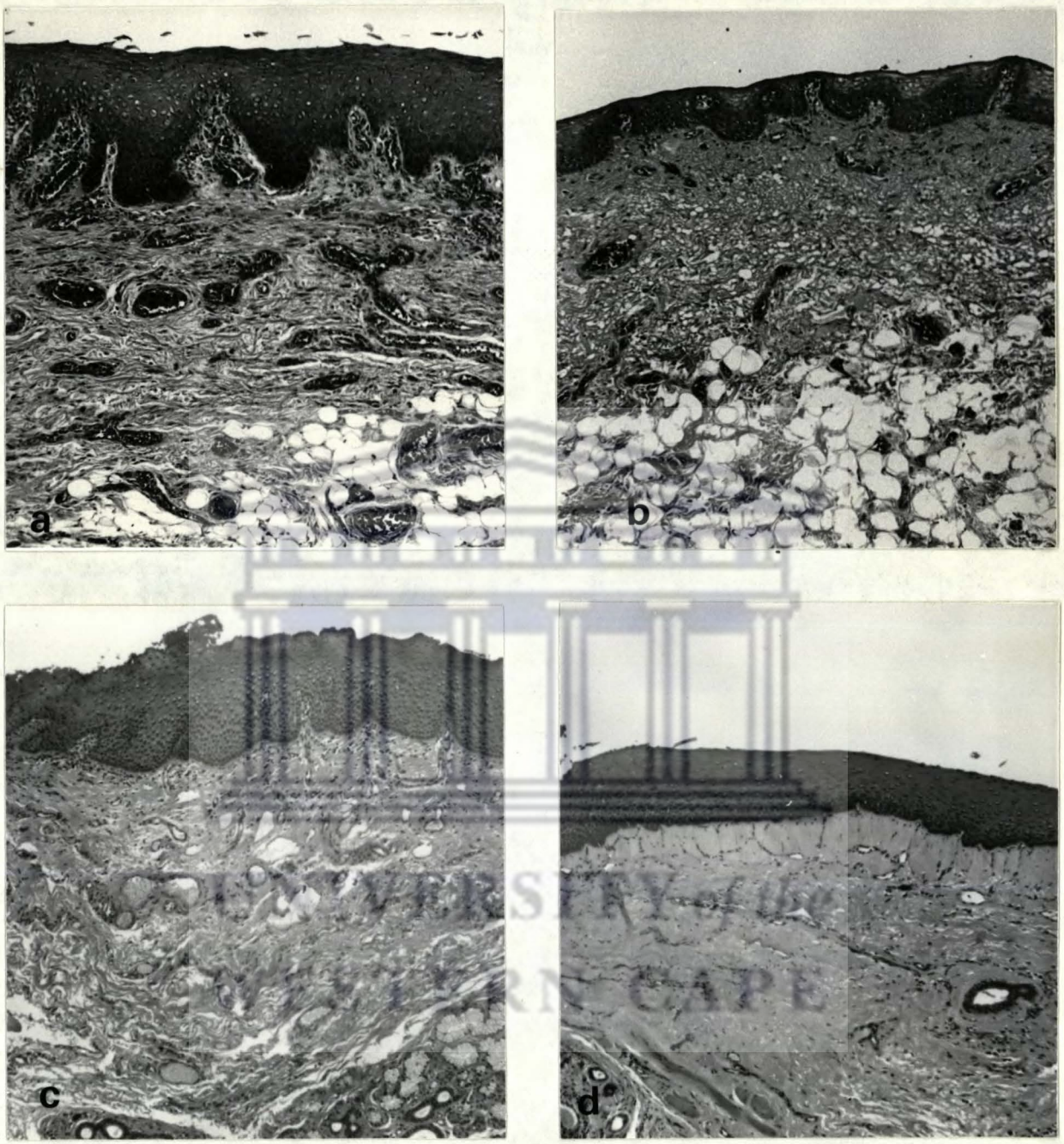
b IN THE CONTROL (FIG. 5.16b) ELASTIC FIBRES CAN BE SEEN AS DARK SPOTS (ARROWED) IN THE SUB-MUCOSA

(VERHOEFF'S STAIN 32x)



FIGURES 5.16 c THE PRESENCE OF ELASTIC FIBRES IN THE LAMINA PROPRIA IN A CONTROL (FIG. 5.16c) AND THE
d FIBRES IN OSF (FIG. 5.16d) APPEAR TO BE THICKER AND MORE ABUNDANT
e ELASTIC FIBRES APPEAR TO BE MORE DISCREET AND PROMINENT (ARROW) IN THE SUBMUCOSA IN A CHEWER WITH OSF

(VERHOEFF'S STAIN 32x)



FIGURES 5.17 THESE PHOTOGRAPHS EXHIBIT THE VASCULARITY IN CONTROLS AND IN CHEWERS WITH OSF

a & b THE VASCULARITY IN THE LAMINA PROPRIA OF CONTROLS

c A FAIR DEGREE OF AVASCULARITY IN THE LAMINA PROPRIA IN OSF

d A FAIR DEGREE OF AVASCULARITY IN DENSE COLLAGEN IN OSF

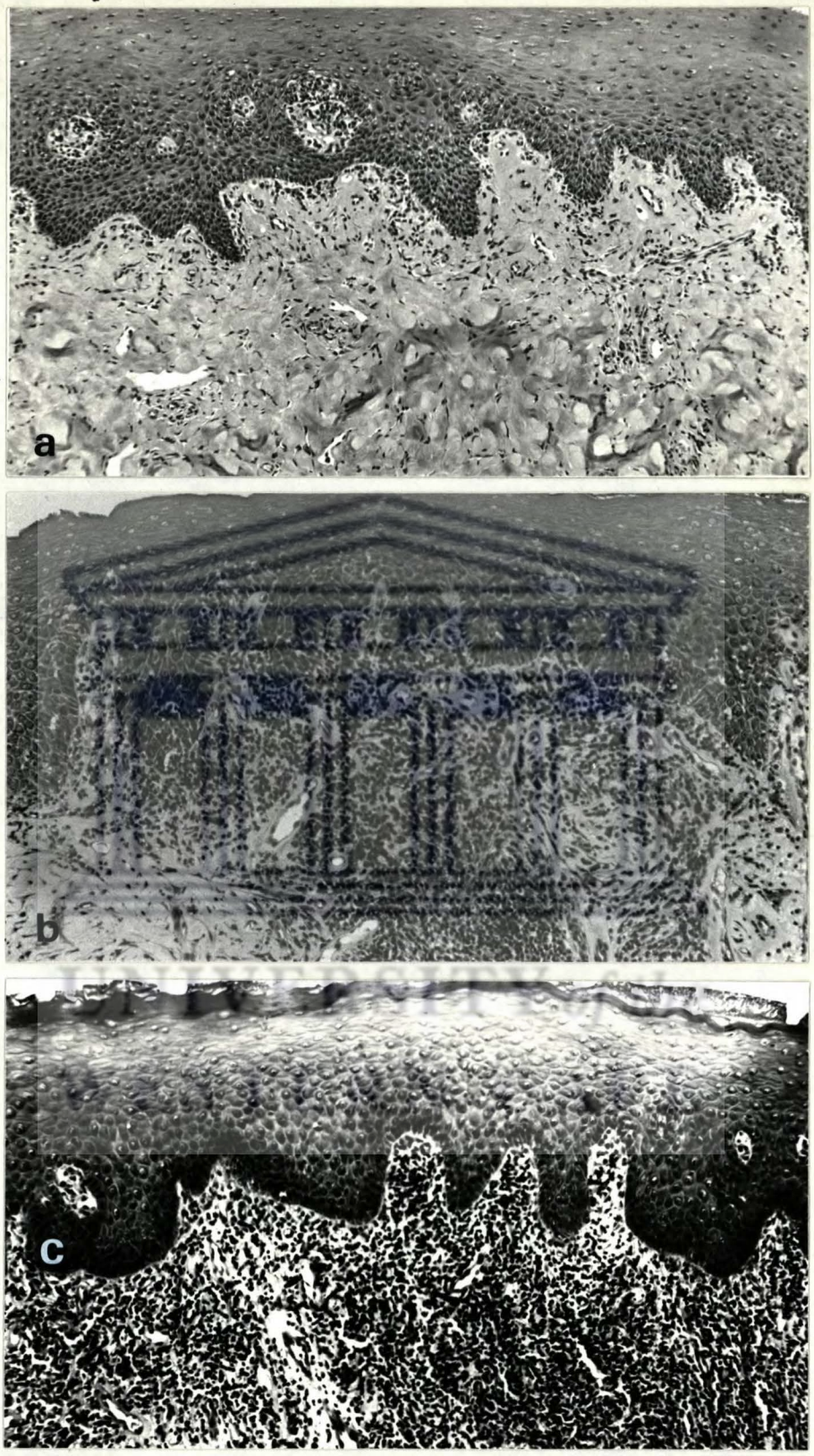
(H & E 20x)

3.1.2.2 ELASTIC FIBRES

Five cases with oral submucous fibrosis (all referrals) and five control specimens were examined. Staining by Verhoeff's method demonstrated well-defined elastic fibres in all cases. No obvious difference in the staining reaction, the distribution and the number of elastic fibres between the examples of OSF and the control specimens (Figs. 5.16a, b, c, & d) was recorded. However, the elastic fibres in OSF did appear to be more prominent and in thicker bundles (Figs. 5.16d & e). The elastic fibres were seen in some examples to be distributed throughout the lamina propria and submucosa (Fig. 5.16d). In some examples they were only present in the submucosa (Figs. 5.16a & e), while in a few elastic fibres were not obvious. In the nine examples of chewers without clinical OSF no obvious differences with regard to elastic fibres were noted when compared with the control specimens.

3.1.2.3 BLOOD VESSELS

Eighteen randomly selected sections of OSF (Figs. 5.17c & d) were compared with 18 control sections (Figs. 5.17a & b). As described in the section on methods and materials, all blood vessels with a recognisable wall were counted. In sections of OSF 116 vessels were counted and measured whereas 185 vessels were likewise examined for the controls. A mean of 3,22 (SD 1,91) vessels per field were measured in OSF cases and 5,13 (SD 2,29) vessels in the controls. The mean thickness of the walls of the vessels was 12,87um (SD 10, 15um) in OSF and for the controls 14,61um (SD 11,51um). The mean diameter of lumen of vessels in OSF was 10,39 um (SD 5,27um) and for the controls 7,02um (SD 3,51um). When the number of vessels was compared it was found to be significant (t value = -8,506, DF = 289, $p < 0,001$). There was a significant difference in the thickness of the vessel walls in both



FIGURES 5.18 THESE ILLUSTRATIONS SHOW EXAMPLES OF INFLAMMATORY INFILTRATE IN THE LAMINA PROPRIA IN OSF

a MILD INFLAMMATORY INFILTRATE

b MODERATE INFLAMMATORY INFILTRATE. NOTE THAT IT CAN BE FOCAL WITH SURROUNDING AREAS ONLY MILDLY INFLAMED

c SEVERE INFLAMMATION. THE INFILTRATE IS DENSE AND BAND-LIKE.

(H & E 32x)

control and OSF groups (t value = 6,64096, DF = 34, $p < 0,001$). Two groups, i.e. control and OSF are not significantly different with respect to mean vessel diameter (t value = -1,3413, DF = 34, $p > 0,1$).

3.1.2.4 CELLULAR INFILTRATION IN THE LAMINA PROPRIA

In 108 (71%) of the 152 examples of chewers with OSF no cellular infiltration in the lamina propria was observed. The cellular infiltration was mild (Fig. 5.18a) in 23 (15%), moderate (Fig. 5.18b) in 15 (10%) and severe (Fig. 5.18c) in 6 (4%). When present it was chronic inflammatory infiltrate but in some instances polymorphs were also present. In the nine chewers without clinical OSF, 77% had mild to moderate chronic inflammatory infiltration.

3.1.2.5 MAST CELLS (Fig. 5.19)

From the control tissues, 10 biopsy specimens which had been taken from the buccal mucosa as a control and 151 biopsy specimens from OSF cases were studied. The number of mast cells varied from one to six per field in the control. In the total cases of OSF the number varied from zero to 16 per field. In 103 of these sections the average mast cells per field were two and less (Table 5.51) which shows some difference from the control sections, where the majority of specimens showed at least three mast cells per field. In the eight cases of chewers without clinical OSF the number of mast cells varied from one to 21 per field.

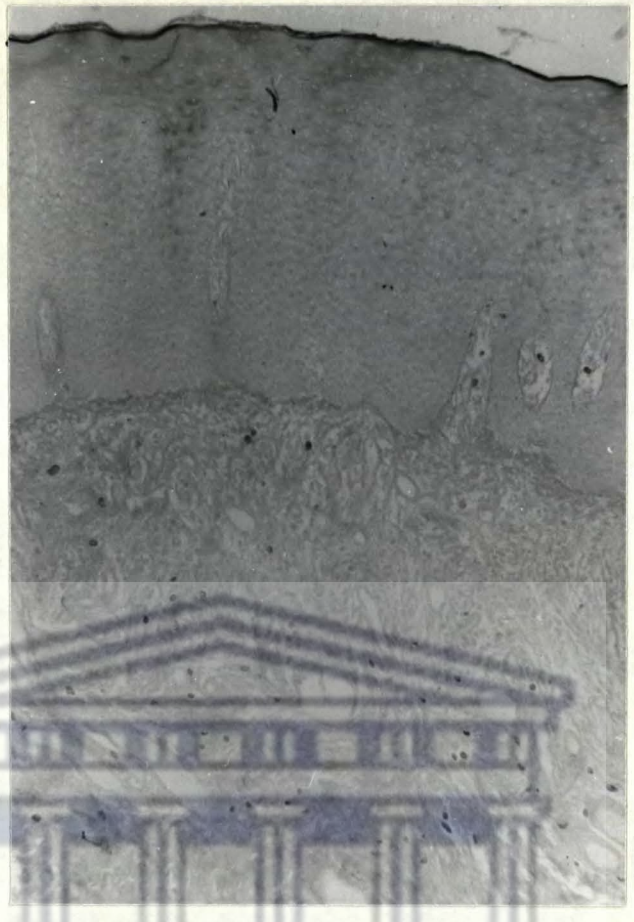


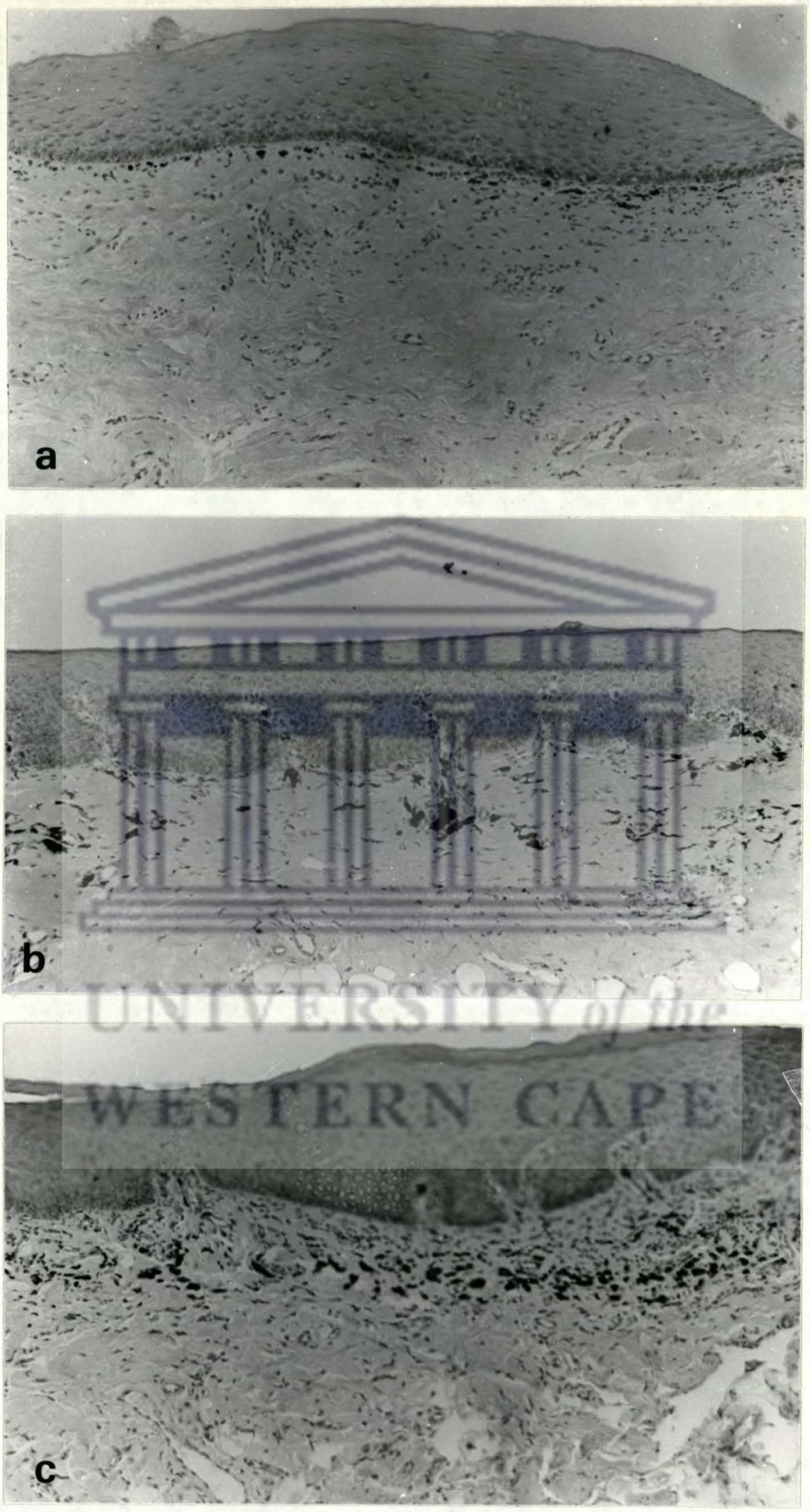
FIGURE 5.19 FOR THIS PHOTOGRAPH CSABA'S MAST CELL STAIN (CULLING, p.419) WAS USED TO DEMONSTRATE CELLS IN A CASE OF OSF (32x)

TABLE 5.51

MAST CELL COUNT PER FIELD (400x) IN CHEWERS WITH OSF AND IN CHEWERS WITHOUT CLINICAL OSF

NUMBER OF MAST CELLS PER FIELD	NUMBER OF CASES OF CONTROLS	NUMBER OF CASES OF OSF	NUMBER OF CHEWERS WITHOUT OSF
0	0	36	0
1	0	27	1
1	1	19	1
2	1	21	1
3	4	17	1
4	1	8	0
5	1	2	0
6	2	2	1
7	0	4	0
8	0	3	1
9	0	3	0
10	0	3	0
11	0	1	0
12	0	1	0
13	0	2	0
15	0	1	0
16	0	1	1
21	0	0	1
TOTAL	10	151	8

In one section of a chewer with OSF the chronic infiltrate was too dense to study the mast cells.



FIGURES 5.20 THESE PHOTOGRAPHS DEMONSTRATE MELANIN DEPOSITION IN OSF
a MILD MELANIN DEPOSITION
b MODERATE MELANIN DEPOSITION
c SEVERE MELANIN DEPOSITION

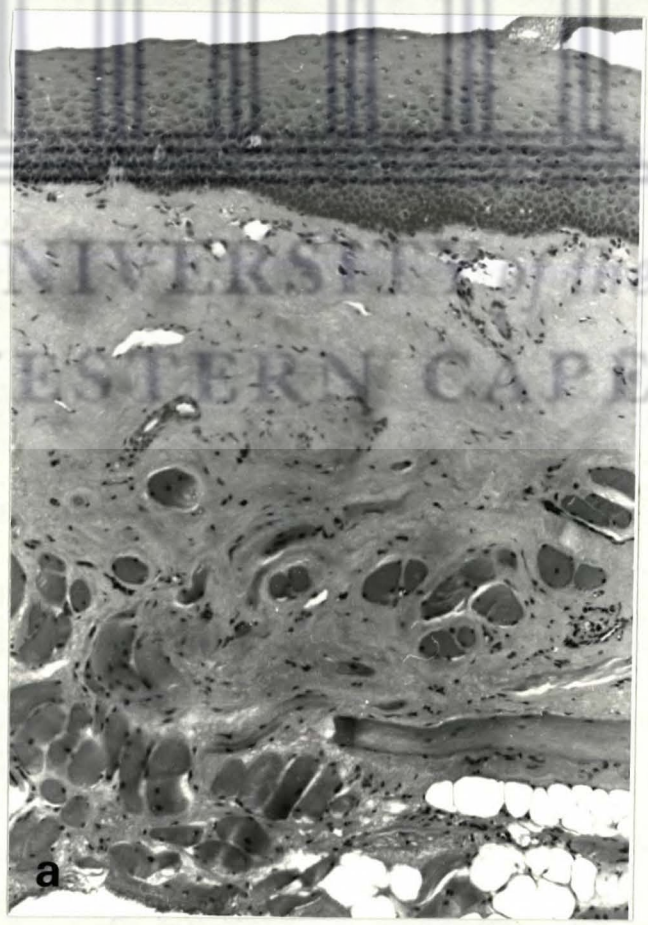
(SCHMORL'S METHOD 32x)

3.1.2.6 THE PRESENCE OF MELANIN IN THE LAMINA PROPRIA OR UNDERNEATH THE EPITHELIUM

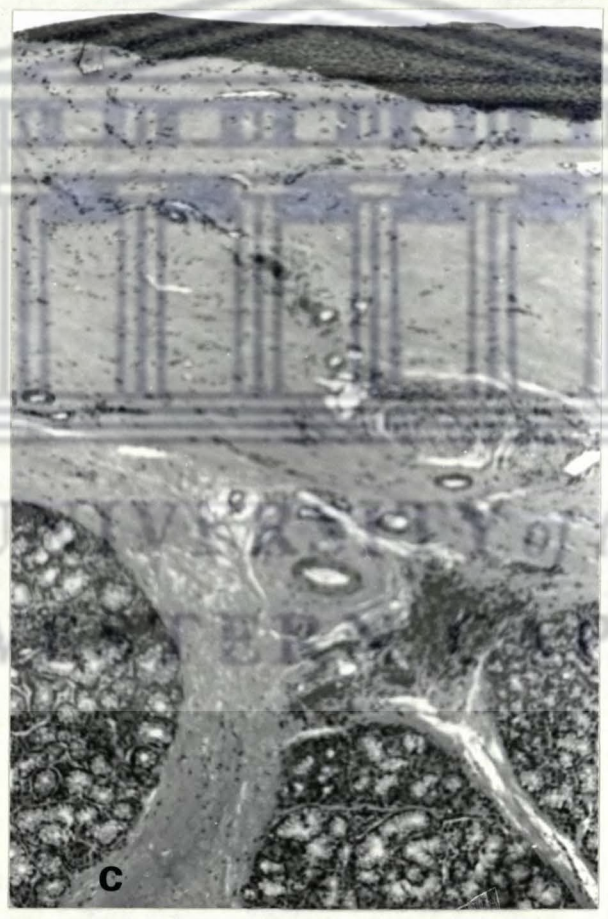
Melanin deposition, in 152 sections of chewers with OSF, was observed to be mild (Fig. 5.20a) in 48 (32%), moderate (Fig. 5.20b) in 26 (17%) and severe (Fig. 5.20c) in 11 (7%), and was absent in 67 (44%). In the nine chewers without clinical OSF melanin deposition was absent in six and there was one each in the mild, moderate and severe categories.

3.1.3 SUBMUCOSA

In 85 sections of OSF cases the fibrosis extended from the lamina propria into the submucosa (Fig. 5.15e). The fibrosis encircles muscle fibres (Fig. 5.21a), salivary glands (Fig. 5.21c), blood vessels (Fig. 5.21c), nerve bundles (Fig. 5.21d) and fatty tissue (Fig. 5.21e). In one of the seven sections of chewers without clinical OSF the collagen was moderately dense in the lamina propria and submucosa.

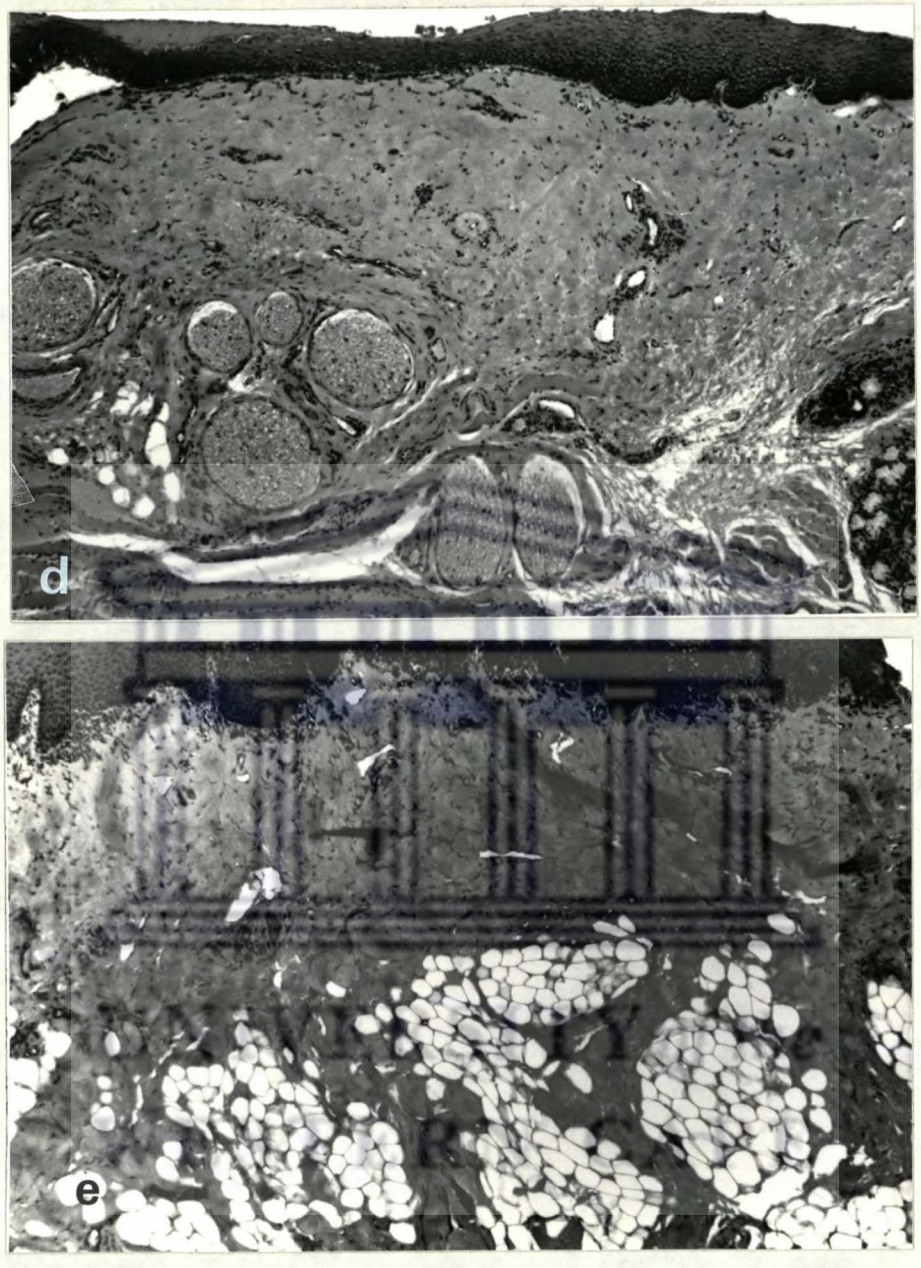


FIGURES 5.21 THESE PHOTOGRAPHS EXHIBIT THE SUBMUCOSA IN CHEWERS WITH OSF AND IN A CONTROL
a PERI-MUSCULAR FIBROSIS IN AN EXAMPLE OF OSF (H & E 32x)



FIGURES 5.21 b CONTROL. SALIVARY GLAND LYING LOOSE IN THE SUBMUCOSA (H & E 13x)

c PERI-GLANDULAR FIBROSIS IN OSF. PERI-VASCULAR FIBROSIS IS ALSO PRESENT (H & E 20x)



FIGURES 5.21 d PERI-NEURAL FIBROSIS IN A CASE OF OSF
e THE FIBROSIS EXTENDING INTO FATTY TISSUES SURROUNDING INDIVIDUAL AND GROUPS OF FAT CELLS IN OSF

(H & E 20x)

3.2 ELECTRON MICROSCOPY

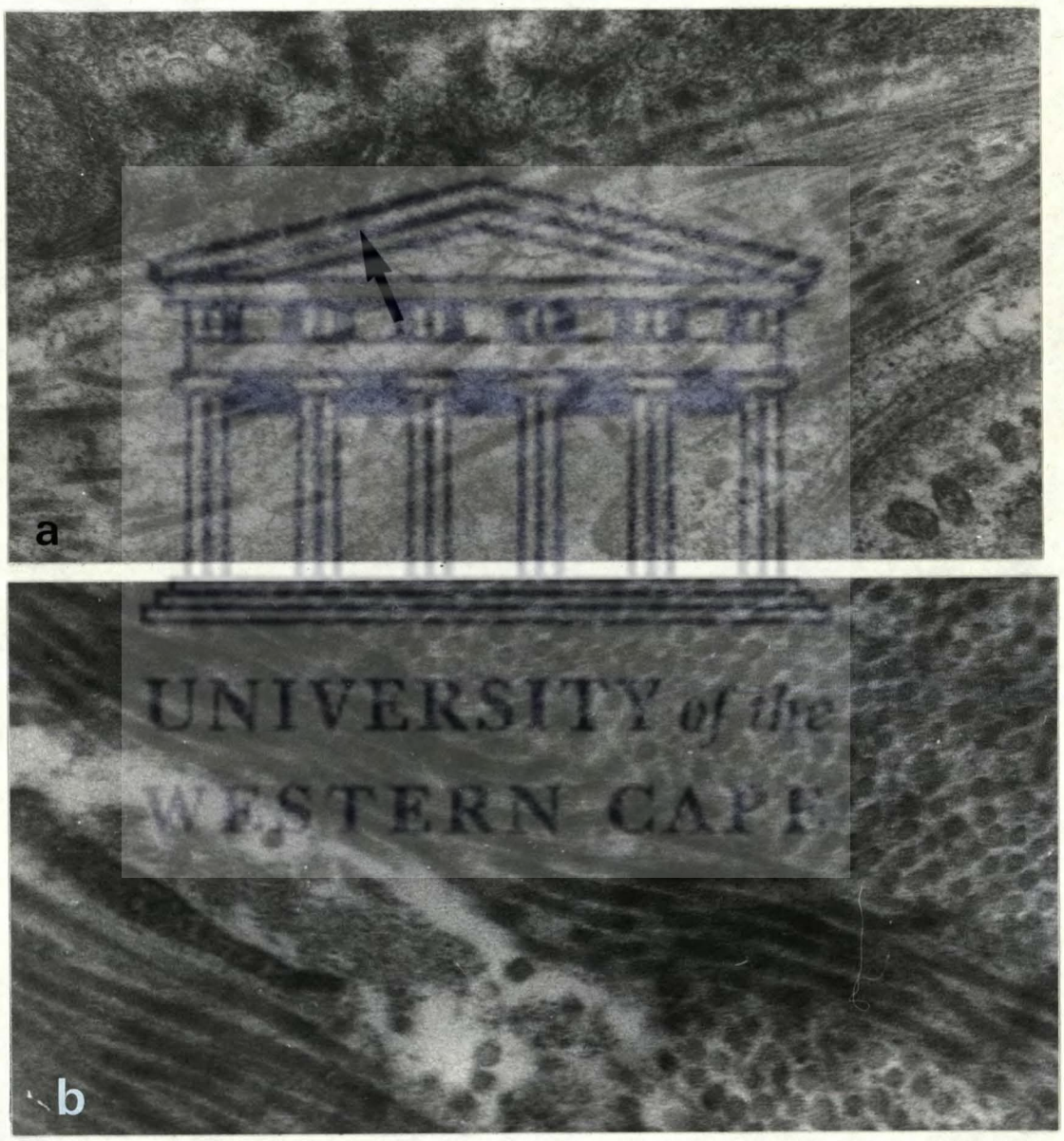
Electron microscopy was carried out on five specimens of OSF obtained from this study and on seven controls of normal mucosa provided by the Department of Oral Pathology, University of Stellenbosch. Longitudinal and transverse sections of collagen fibrils next to the basement membrane (Fig. 5.22a) and deeper in the lamina propria (Fig. 5.22b) were photographed at standardised magnification and measured on contact prints. The periodicity of fibrils in both localities in all specimens was normal (55-60 nm).

In all instances average diameters of fibrils next to the basement membrane (overall mean = 44 nm) were significantly smaller than fibrils deeper in the lamina propria (overall mean = 55,2 nm) ($p < 0,01$). There was no difference between fibrils of OSF and healthy mucosa from either localities. Although collagen bundles were denser in OSF there were no signs indicating that the collagen fibrils were immature.

3.3 A CASE HISTORY OF ONE OF THE REFERRED OSF PATIENTS

A 33 year old female presented a two year history of ulceration of her right buccal mucosa with a dentulous mouth opening of 3mm. She had lost much weight. She had chewed five black betel nuts per day for the past nine years. She had no other chewing habits. She did not smoke or consume alcohol. There was a history of progressive limitation of the mouth opening with intermittent burning sensation on eating spicy foods over the past seven years. There was no significant findings in her medical history. An examination was carried out under general anaesthesia and biopsy specimens taken. A large ulcer was found in the buccal mucosa at the level of the occlusal plane commencing from behind the right commissure and extending to the retromolar area. Fibrous bands were palpable in her left cheek and lips. There was a contracted isthmus faucium and the uvula was a mere bud. Biopsy specimens from the right cheek showed a moderately, well differentiated, invasive squamous carcinoma and from the left cheek showed atrophic epithelium and a dense fibrosis of the lamina propria extending around muscle bundles of the submucosa. The patient died nine months after the first examination and the cause of her death was severe emaciation and a squamous carcinoma which had destroyed her right cheek exposing the mandibular and maxillary teeth and extending into the depths of the sulci. At post-mortem specimens for histology were taken from the soft palate, floor of mouth, tongue and the whole thickness of the cheek from skin to mucosa. The post-mortem findings revealed that in addition to her having OSF and an associated well-differentiated invasive squamous carcinoma of her right cheek she had a concomitant poorly differentiated squamous carcinoma of the soft palate. In the floor of the mouth there was

an increase in collagen. In the tongue there was a dense collagen deposit with peri-bundular fibrosis of the muscle resulting in their stricturing. In biopsies of the cheek extending from the skin to mucous membrane the collagen was dense involving muscle and fatty tissue. There was no evidence of hyalinisation. Elastic fibres were abundant.



FIGURES 5.22 ELECTRON MICROGRAPHS SHOWING COLLAGEN IN OSF
a COLLAGEN CLOSE TO THE BASEMENT MEMBRANE (ARROW)
b COLLAGEN DEEP IN THE LAMINA PROPRIA

(15 000x)

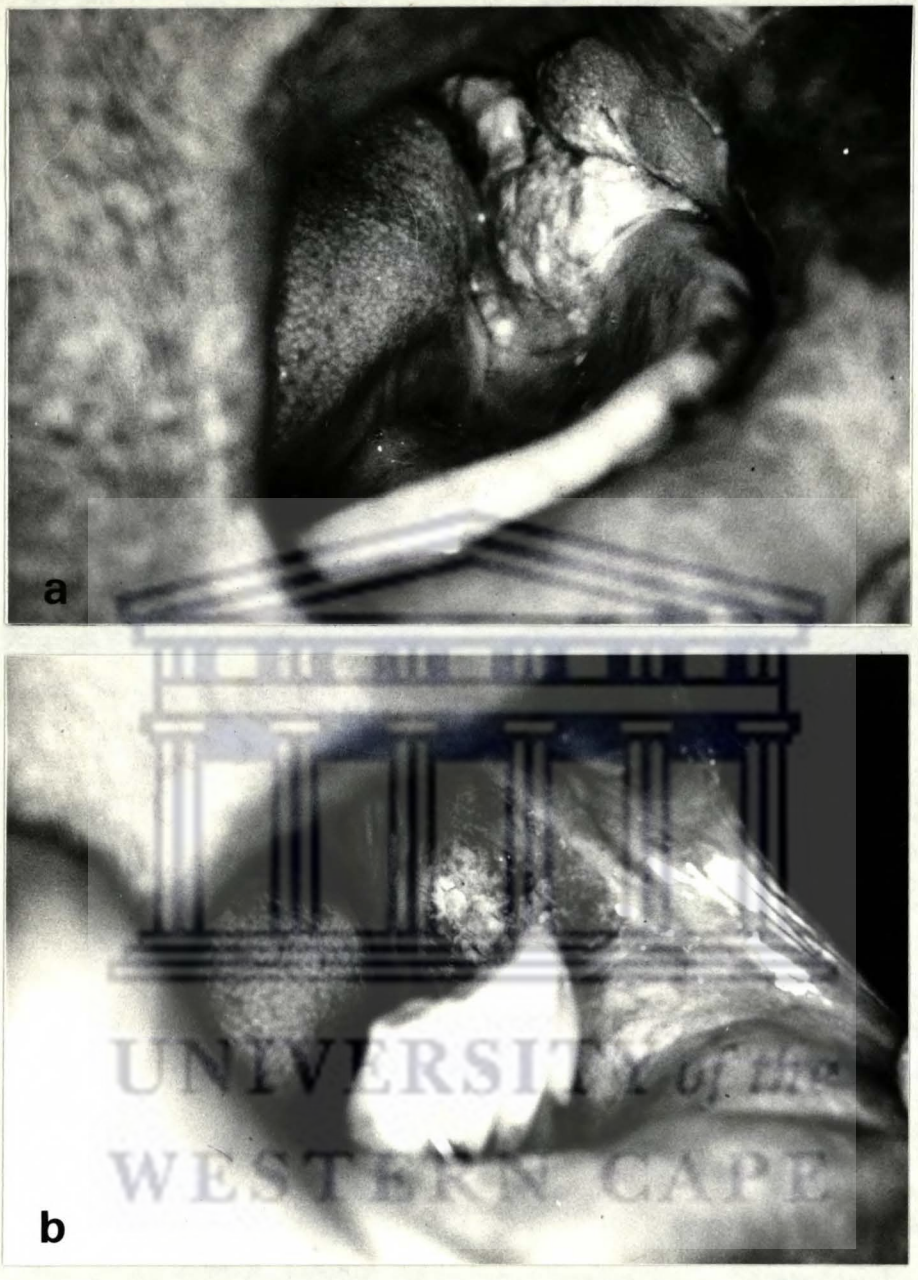
3.4 ORAL CANCER IN CHEWERS WITH OSF

Concomitant cancer in chewers with OSF was found in 10 patients, all females (Figs. 5.23a & b). The youngest was 33 years and the oldest 71 years. Seven were under 50 years of age. Nine chewed the nut only. Eight of the patients were referred cases with cancer at time of examination and two developed cancer during period of observation (Table 5.52). No cases of cancer were found during the survey.

TABLE 5.52
ORAL CANCER IN CHEWERS WITH OSF

	AGE	SEX	HABITS
Well differentiated infiltrating squamous carcinoma of right cheek + At post-mortem poorly differentiated squamous carcinoma of soft palate (see case report)	33	F	Nut only
Well differentiated infiltrating squamous carcinoma of left cheek*	49	F	Nut only
Well differentiated infiltrating squamous carcinoma of left cheek	58	F	Nut + lime + leaf + catechu + tobacco
Cancer in-situ. Well differentiated squamous carcinoma of left cheek*	56	F	Nut only
Invasive squamous carcinoma of right cheek	35	F	Nut only
Well differentiated infiltrating squamous carcinoma of left cheek	45	F	Nut only
Well differentiated infiltrating squamous carcinoma of right cheek	71	F	Nut only
Well differentiated, keratinising infiltrating squamous carcinoma of right cheek	46	F	Nut only
Well differentiated, invasive squamous carcinoma of soft palate	38	F	Nut only
Squamous carcinoma of oesophagus	40	F	Nut only

* Developed cancer during the observation period.



FIGURES 5.23 a & b SQUAMOUS CARCINOMA OF THE LEFT CHEEK IN PATIENTS WITH ORAL SUBMUCOUS FIBROSIS.

4 OTHER FINDINGS

4.1 NON-CHEWERS WITH OSF

Five referred subjects, four females and one male with features of OSF were encountered, but who claimed never to have practiced the habit of betel chewing. All patients had fibrous bands, blanching, limitation of mouth opening (Fig. 5.2 and Table 5.53) and a history of intermittent burning sensation in the mouth with spicy foods. Two patients had limited tongue protrusion and one had a reduced rima oris. Two patients had a history of ulcers and one had erythroplakia involving both the cheeks.

FIGURE 5.24 AN EXAMPLE OF ORAL SUBMUCOUS FIBROSIS IN A PATIENT WITH NO CHEWING HABITS. THERE WAS LIMITATION OF THE MOUTH OPENING (15mm) AND DIMPLING OF THE CHEEKS

TABLE 5.53

NON-CHEWERS WITH OSF

HABIT	AGE	SEX	MOUTH OPENING (mm)	LIMITATION OF TONGUE PRO-TRUSION (mm)	REDUCED RIMA ORIS (mm)	DIMPLING	BLANCING	FIBROUS BANDS	INTERMITTENT BURNING	SIGNS
Snuff only	37	F	25	-	-	No	Yes	Yes	Yes	
No habits	29	F	32	-	-	No	Yes	Yes	Yes	Ulcers on the cheeks
No habits	36	F	15	8	40	Yes	Yes	Yes	Yes	-
No habits	52	M	39	35	-	No	Yes	Yes	Yes	Erythroplakia Cheeks
No habits	49	F	26	15	-	Yes	Yes	Yes	Yes	Pigmented Cheeks

4.2 OCCURRENCE OF CHEWERS WITH OSF WITHIN FAMLIES

In five families (Table 5.54) all referrals, several female members of the family practiced the betel habit. A set of female twins, 19 years old, chewed the nut only. Two other sisters (Fig. 5.25) were also nut only chewers. In the three examples of mother and daughter combinations, the daughters chewed the nut only, with one daughter developing cancer at a very early age.

TABLE 5.54

OCCURRENCE OF CHEWERS WITH OSF WITHIN FAMILIES

FAMILY	RELATIONSHIP	AGE	SEX	HABITS
1	Twins	19	F	Nut only
2	Mother	64	F	Nut + leaf + lime
	Daughter (had squamous carcinoma of cheek)	33	F	Nut only
3	Mother	46	F	Nut + leaf + lime
	Daughter	20	F	Nut only
4	Sister	30	F	Nut only
	Sister	27	F	Nut only
5	Sister	39	F	Nut only
	Sister	42	F	Nut + leaf + lime
	Daughter	22	F	Nut only

FIGURE 5.25 TWO SISTERS WITH ORAL SUBMUCOUS FIBROSIS

4.3 CAPE COLOURED CHEWERS WITH OSF

Three coloured people (Table 5.55), all females, were encountered who practiced the habit, all of them exhibiting OSF. Two of them were married to Indians and the other developed the habit from fellow Indian employees at a factory. Two chewed the nut only.

TABLE 5.55

CAPE COLOURED CHEWERS WITH OSF

	AGE	SEX	HABITS
Referral patient	41	F	Nut only. Alcohol + cigarette
Survey patient	58	F	Nut + leaf + lime + catechu + snuff + alcohol
Survey patient	46	F	Nut only

4.4 A FOLLOW-UP OF CASES WHO STOPPED WITH THE HABIT

The referred cases of OSF have been under observation for six years. During this period all (129) patients stopped chewing betel nut. Although the oral mucosa of these cases assumed a healthy appearance clinically there was no improvement in the clinical manifestations which resulted from the fibrosis.

CHAPTER VI

D I S C U S S I O N

5.1 SURVEY SAMPLE

The survey carried out in this investigation was stratified according to age and gender which allows for calculation of age and sex related prevalences in the population. As this was done according to the strict criteria for such types of surveys there is every reason to believe that the findings reflect relatively accurately the true position in the Durban population.

The Indian population of Durban constitutes 46% of the total Indian population of South Africa which is overwhelmingly urban. According to Meer (1969) the age, religious, language and social distribution (which includes customs) are similar for all South African Indians. Therefore it can be argued that the findings in the Durban population can apply to the rest of the population.

Two thousand and fifty eight subjects were examined of which 186 were betel chewers. Of these 71 (38%) showed signs of oral submucous fibrosis while none of the non-chewers had any signs of the disease.

If the findings of the survey were extrapolated to the population as a whole, it is calculated that there will be approximately 38 699 (5%) chewers, 37 470 (9%) females and 1 723 (0,4%) males. Those with the disease will be 18 884 (2,3%), 18 310 (4,4%) females and 197 (0,04%) males. If one takes the 10 cases of oral cancer among the 200 cases

of oral submucous fibrosis (129 referred + 71 from survey) as a possible occurrence rate of 5%, then it can be predicated that there is a chance that 944 oral cancer cases (916 F and 10 M) may develop in the population due to this habit. (See appendix Va, b, c, d.)

The crude prevalence rates of this study differ markedly from other studies undertaken in South Africa. Schonland and Bradshaw (1969a) found in their study that 30,7% of females and 5,5% of males of all ages were chewers. As the above survey was not a random survey, it is difficult to compare the findings. Should one accept that the results of the above mentioned authors could reflect the situation at that stage, it means a drastic reduction of the practice of the habit during the last 10 years. Some reduction is possible as there is a growing awareness among South African Indians of the inherent danger of betel chewing.

On the other hand, the prevalence rates recorded in this study in Durban is six times that found by Docrat and Shear in 1969 and seven times that found by Shear et al. in 1967 in the Johannesburg/Pretoria area. Again it is possible that the discrepancy is due to the methodology of the respective surveys. Van Wyk et al. (1977) showed a prevalence rate of 1,25% in Cape Town. As the latter sample was small and from an area where there are only 13 000 South African Indians, the determination of a true prevalence rate becomes a problem.

From India there is no definite statistical information available regarding the overall prevalence of OSF. Pindborg et al (1965b) after examination of 10 000 patients in Lucknow (India) for frequency of oral white lesions report that the prevalence of oral submucous fibrosis in

the urbanised population of Lucknow was found to be 0,51%. Also Pindborg et al (1965b) while recording the prevalence of oral leukoplakia and related conditions among 10 000 Bombayites, mention that the prevalence of this disease in the city of Bombay, was found to be similar to that of Lucknow. The above studies were carried out on a selective sample comprising dental out-patients. Other epidemiological surveys in urban and rural areas in India by various authors (see Table 3.4) recorded a percentage prevalence which varied from 0% in Singhbhum district in Bihar to 1,22% in Trivandrum, the overall prevalence percentage being 0,31%.

In this South African study the crude prevalence rate for OSF was 2 229 per 100 000 (2,3%), much higher than in India. Again the methodology of the survey is an important reason for these differences and also the diagnostic criteria used for OSF. In the local study there was only one examiner. Having identified the chewers first a definitive diagnostic procedure could be followed for the determination of OSF. Therefore the diagnosis of early cases of OSF was possible which will inflate prevalence rates.

The overwhelming preponderance of female chewers and females suffering from OSF reflect the pattern of practice of betel chewing among South African Indians. It also reflects the social make up of this population. As the habit is not accepted in Western Society one finds that males, who form an active part of the society, will not indulge in the habit and prefer smoking. The females on the other hand stay at home and can participate. Furthermore, smoking by females is frowned upon while betel chewing is accepted to some extent.

This above explanation is in keeping with the findings of the present study which also supports the findings of DeSa (1957), Wahi et al (1966b) and Pindborg and Sirsat (1966) that the malady affects people of all socio-economic levels but that the vast majority are housewives.

The disease has been reported in patients with a very wide age range. Paymaster (1956) believed that younger persons are usually affected. The youngest person reported so far was an eight year old Indian boy in Singapore (Pindborg and Sirsat, 1966). The oldest patient recorded was an 80 year old in India (Pindborg et al, 1968). In Durban the youngest person was 15 years and the oldest 90 years (Dockrat and Shear, 1969). Among the 85 patients reported by Sirsat and Khanolkar (1962) the age range was from 10 to 58 years. Pindborg et al (1964) found the age range in their patients to be from 22 to 65 years while the upper limit encountered by Joshi (1953) was 60 years. The maximum prevalence of OSF reported so far has been in the age range of 20 to 40 years (Pindborg and Sirsat, 1966). According to Schonland and Bradshaw (1969a) the percentage of chewers increased with age in both males and females.

In the present series the ages of chewers ranged from 10 to 94 years. The highest number of chewers (30,6%) occurred among the elderly (65+ years) with a male to female ratio of 8,5:1. The mean age of chewers without OSF was 56 years and that of chewers with OSF 43 years. Of the latter 75% fell in the age group 25-54 years. A similar "younger age distribution" was also present among referred OSF cases where the majority were from the 35 to 44 year age group.

This difference in age distribution between diseased and healthy subjects

and the fact that no correlation could be found between the frequency and duration of the habit and the disease raises the possibility of individual susceptibility. In other words those people who are more likely to develope OSF will reveal the signs of the disease at an earlier age.

The geographical distribution of survey chewers in the present study is shown in Table 5.5. Of the chewers, Chatsworth proper had the highest number of chewers without OSF and in the Chatsworth area, Bayview had the highest number of chewers without OSF. In the Durban proper area, Sydenham had the highest number of chewers without OSF. Chatsworth proper also had the highest number of chewers with OSF and in the Chatsworth proper area Risecliff had the highest number of chewers with OSF. In the Durban proper area Sydenham had the highest numbers of chewers with OSF. When considering the entire area sampled, it was found that proportionally the highest number of chewers with and without OSF was recorded in the Phoenix area. If one accepts that the habit is practiced more often by people of lower socio-economic strata then it may explain the above finding in Phoenix.

In the present study the marital status of the patients was of no significance. Persons in the 55+ age group showed the largest number of separated, widowed and divorced subjects.

Shear et al (1967) reported that from their five survey patients and five referral patients five were born in India. In the present survey of 2 058 patients six were born in India. Of the 200 patients with OSF three were born in India. Thus the birthplace is of no significance in the development of OSF.

Religion plays no specific role. In India OSF occurs in similar pattern among the Hindu and Muslim communities. In South Africa the Hundi/Muslim ratio was 4 : 3 (Dockrat and Shear, 1969); 3 : 2 (Randeria, 1972) and 5 : 1 in the present series. Christians with OSF have not been reported previously but in this study 13% had the disease. Seven per cent of chewers without OSF fell in this group. The Christians were all converted Hindus.

Of the 200 cases with OSF 195 chewed the betel nut in one form or another. The remaining five cases gave no history of the habit. However, an analysis of variables concerning the practice of the habit, the contents of the quid, the use of alcohol and tobacco failed to reveal a specific role in the aetiology of the disease for any of the variables. For instance, 137 of the 200 cases with OSF chewed the nut only while a third of the chewers without OSF did the same; chewers without OSF and the referred OSF cases chewed similar numbers of betel nut daily, while the survey OSF cases used fewer nuts; the majority of people chewed and swallowed the nut and only about 10% of the referred cases kept the quid in the buccal sulcus; forty five per cent of OSF cases preferred the bitter nut while 60% of the chewers without OSF used the black nut; sixty seven per cent of chewers without OSF and 23% of OSF cases liked paan; there were 63% lime users among chewers without OSF and 30% among paan chewers; 17% used tobacco (as snuff) in the quid and only 4 chewers smoked; and only one person drank alcohol.

Finally, no relationship could be demonstrated relating the duration of the habit with the development of the disease. The only conclusion that can be made from this study is that the development of OSF relates

to the chewing of the betel nut. No explanation can be given for the presence of OSF in those people who claim not to participate in the habit.

The presence of tobacco and lime in the quid is of special interest because it has been claimed to play a role in the origin of OSF and/or oral cancer. Orr (1933) considered lime to catalyse the liberation of carcinogenic alkaloids from tobacco in the quid. Muir and Kirk (1960) feel that it served merely to neutralise the acid taste of the nut. Schonland and Bradshaw (1969b) state that it is difficult to say if it is a suspect ingredient. Paissat (1981) states that the use of lime is endemic and there is not a single case of recorded OSF in Papua New Guinea.

As was pointed out earlier, the majority of subjects without OSF were lime users and only one of the oral cancer cases added lime to her paan. Similarly few people used tobacco and again only one of the oral cancer cases. Therefore, this investigation did not show a definite relationship.

Various investigators have tried to explain the aetiology of oral submucous fibrosis and because of the presence of subepithelial vesicles in the initial stage of the disease, it is believed by some that the disease may be due to hypersensitivity to chillies. Support for this assumption is found in the occurrence of OSF among Indians living abroad, but maintaining Indian dietary habits. However, the present study has shown statistically that food spicing is not significant, neither the amount or the type of chillies used. The use of chilli pickles, with vinegar was also not statistically significant nor was the type of chillies used in the pickles.

According to most authors the first symptom of OSF is a burning sensation in the mouth on eating spicy foods seasoned with chillies. In the present series pain was a significant symptom in patients with OSF as was intermittent burning which was significant especially in the under 39 age group. Intermittent burning sensation with the use of betel nut was a significant finding in the referred OSF cases. Such uncomfortable oral sensations can be expected if one bears in mind the atrophy of the mucosal epithelium in OSF. (See RESULTS p. 114.) Dryness of the mouth in some patients has also been mentioned as one of the symptoms of OSF (Su, 1954; Pindborg et al, 1964). In the present series dryness of the mouth was a significant factor in the referred OSF group. A dryness can be expected in patients with OSF because the minor salivary glands become atrophied due to the peri-glandular fibrosis. Numbness of the mouth was reported by only two OSF cases in the referred group.

It has been suggested that when the fibrosis advances to the pharynx, referred pain in the ears may be experienced (Rao, 1962). In the present series eight referred cases were found with this complaint. Dysphagia was found by Su (1954) and Pindborg et al (1964). Mathew et al (1967) and Balkrishnan, Narendranathan and Moni (1979) found the oesophagus to be involved in OSF. Among the patients in the present series difficulty in swallowing was a complaint by ten of the referred cases of OSF. This complaint is a logic manifestation of the disease. Fibrosis of the soft palate, fauces, tongue and upper oesophagus will certainly cause swallowing difficulties. Also there was one patient with OSF and associated oesophageal cancer and one can hypothesise that it is the result of OSF.

Vesicle formation on the palate and cheeks has been reported in the

early stages of OSF by various investigators (Joshi, 1953; DeSa, 1957; Pindborg and Singh, 1964). Occurrence of blisters especially on the palate has been reported by Pindborg et al (1964). DeSa (1957) cultured the fluid from vesicles and found that it was negative for any specific organism. A history of vesicles and ulcers in this study was given by 20 OSF cases. Two patients presented with vesicles and clinically only one case of OSF was observed with ulcers in the first molar regions. The formation of vesicles may probably be due to the fact that the oral mucosa in some of the patients is grossly atrophied and even slight trauma may produce vesicles and ulceration.

Limitation of mouth opening, which is due to gross fibrosis of the cheek tissues, is one of the serious complications of OSF. In severe cases food-intake is restricted, the oral hygiene is poor and examination of the mouth and treatment of oral conditions becomes impossible.

According to Nevakari (1960) the mean value for normal mouth opening in males is 57,5 mm and in females, 54 mm. In his opinion, openings of less than 40 mm in adults, should be regarded as abnormal and that the mouth opening increases with age more among males than females. Agerberg (1974) observed similar figures. The mean values were 58,6 mm in males and 53,5 mm in females. The lower limits of the normal range were 42 mm and 38 mm respectively. However, it is important to take the depth of the overbite into account. Rao (1962) finds that the space between the incisal edges of the upper and lower incisors is reduced to 4,6 mms. Most authors have found a reduced mandibular opening and DeSa (1957) reported the average opening in OSF to be 26 mms. In the present investigation 192 patients were examined and 50% of them were unable to open their mouths beyond 20 mm. The limitation varied from zero to 45 mm.

Coupled to the above manifestation is the inability to protrude the tongue which is caused by fibrosis of the tongue and floor of the mouth. (See RESULTS pp. 90-95.) Such inability to protrude the tongue has been mentioned in a number of previous investigations (Su, 1954; DeSa, 1957; Pindborg et al, 1964). In the study here protrusion of the tongue was measured in 82 patients and varied from 1 mm to 45 mm. A protrusion of 30 mm and more was regarded as normal. Seventy percent of the cases were unable to protrude their tongue beyond 20 mm.

The literature is lacking with regards the early clinical signs of oral submucous fibrosis, the stage before palpable fibrous bands. This aspect of early clinical diagnosis is fundamental. The oral mucosa must be observed for localised loss of colour (blanching) and the mucosa must be carefully palpated to determine its texture. A linen-like feel replaces the silky feel of the normal mucosa. As the disease process progresses the linen-like feel becomes leathery and with further progression the mucosa becomes firmer. It is much easier to incise the mucosa when it becomes linen-like and still easier when it becomes leathery. Thirty seven cases of early OSF were diagnosed on a change in the texture of the mucosa. Blanching, the other early sign, was seen in 50% of chewers with OSF. These cases were all without palpable fibrous bands.

The later signs of OSF include the development of palpable fibrous bands in various localities resulting in variable degrees of trismus. Blanching with palpable fibrous bands was seen in the majority of the referred OSF cases. In the advanced cases the circular bands of fibrosis run around the entire oral orifice resulting in reduced rima oris. According to Pindborg et al, (1964) the changes are especially marked

in the lower lip. In the present series a furrowing of the lower lips due to the fibrous bands has been observed. This fibrosis extends to other parts of the oral cavity and observations here confirm the findings of Pindborg and Sirsat (1966) that the entire isthmus faucium becomes contracted and the mobility of the soft palate is markedly impaired. As the lips and cheeks become involved an inability to whistle develop.

According to Mehta et al, (1971), oral submucous fibrosis is often associated with pigment changes. But these authors do not define the pigment changes. Is it excess pigment deposition, loss or ectopic distribution of pigments or is it the fibrosis that accentuates the normal pigmentation producing the marble-like appearance of the mucosa. Pigment incontinence was observed in a number of patients (see RESULTS p. 136) and it is possible that it contributes to the pigment changes.

Dimpling of the cheeks is another clinical sign which is the result of fibrosis in the cheeks. Apart from its diagnostic importance it does seem that bilateral angular cheilitis tends to develop in these patients. Several other types of oral lesions were also encountered in the cases of OSF. There were six cases of lichen planus confirming similar findings of Moos and Madan (1968); Pindborg, Mehta and Daftary (1970); and Mehta et al (1971). Unlike the results of Sirsat and Khanolkar (1962a), Pindborg et al (1964) and Mehta et al (1971) no cases of leukoplakia were seen. Three cases had erythroplakia a finding similar to the findings of Pindborg and Sirsat (1966) and Mehta et al (1971). In the present series there were OSF cases with generalised stomatitis or ulceration, an observation also recorded by Joshi (1953), DeSa (1957), Rao (1962) and Pindborg et al (1964). There were 13 cases of smooth tongue, a manifestation observed by Pindborg (1966), Mehta et al (1971) and

Hamner, Looney and Chused (1974) too.

Several patients suffered from a general disease but these had no correlation with OSF. Among diseases encountered were diabetes mellitus, hypertension, anaemia, allergies, thyrotoxicosis and asthma. The conditions most commonly seen were diabetes mellitus and hypertension, but as these are common among South African Indians they can have no special bearing on the development of OSF.

A high proportion of chewers with and without OSF were menopausal, but this can be expected as the overall age distribution of the habit favours the elderly.

Eighteen per cent of patients with OSF complained of a loss of weight. This is understandable because the limitation of mouth opening and the sensitive oral mucosa will certainly influence food-intake.

5.2 BLOOD INVESTIGATIONS

Data on early studies performed in India by DeSa (1957), Sirsat and Khanolkar (1962b), Rao (1962) and Paymaster (1962) are scanty. They have graded anaemia from moderate to severe. Rao (1962) noted a microcytic anaemia in half of his patients. Pindborg et al (1964) found a third of their cases were anaemic. Studies of iron status were not performed by these workers. The high prevalence of microcytic hypochromic anaemia in this study appears to be related to an iron deficiency. Serum ferritin ($\bar{}$10 ng/ml) was found in 44 (30%) of the 145 patients with oral submucous fibrosis tested and in six (75%) of the eight chewers without OSF. Serum iron and transferrin saturation confirmed iron deficiency in 40%

of the patients with OSF and 75% of subjects without OSF.

It is not clear whether the high prevalence of iron deficiency anaemia is casually related to the development of OSF or is as a result thereof. Studies conducted by Mayet (1976) in the same population from which this sample was taken showed that the prevalence of anaemia in Indian women in Durban was 38% and that it was mostly due to iron deficiency. It could be postulated therefore, that the iron deficiency anaemia is not aetiologically related to OSF and that these two conditions occur commonly in the South African Indians. Another cause of the presence of microcytic erythrocytes in the Indian population is the alpha and beta thallasaemia trait, the prevalence of which has not been studied. In our patients with microcytic hypochromic indices the haemoglobin electrophoresis patterns were normal. Therefore, none of these subjects had alpha or beta thallasaemia.

The white blood cell count was found to be within normal range for all the 152 patients with OSF and eight chewers without OSF. Peripheral blood eosinophilia (which is indicative of an allergic response) in patients with OSF was found by many investigators (Pindborg and Sirsat, 1966). DeSa (1957) found an eosinophilia in 5 (12,8%) of 39 cases. In the present series, eosinophilia (400/cu.mm.) was also seen only in 19 (12,5%) of the 152 patients with OSF and one of the eight chewers without OSF, indicating a non-correlation between eosinophilia and OSF.

Definite biochemical evidence of folate deficiency was found in two of the 71 patients with OSF and none in chewers without OSF. Folic acid deficiency, therefore is rare in this condition. The serum Vitamin B12 assay was performed in 71 subjects. All results were within the normal

range. One may conclude, therefore, that folate and vitamin B12 deficiency status are not associated with the development of OSF.

The erythrocyte sedimentation rate (ESR) was increased (10 mm/hr) in 86% of patients with OSF and 83% of chewers without OSF. This finding is in agreement with DeSa (1957) that the ESR is raised in the majority of patients with OSF. The ESR is a non-specific test that is affected by various factors such as the degree of anaemia, morphology of erythrocytes and amount of plasma proteins, especially fibrinogen, in the samples tested. In view of the multifactorial influence on the ESR it is difficult to correlate the findings with any one factor. Anaemia, present in 45% of the subjects, as well as the hypergammaglobulinaemia, present in 68%, probably accounts for the raised ESR.

Sera were examined for the presence of antibodies to parietal cells and nuclear proteins to investigate the postulate that OSF may have an auto-immune basis. Testing for smooth muscle antibodies and anti-mitochondrial antibodies form part of this routine antibody screen.

Smooth muscle antibodies and anti-mitochondrial antibodies were not detected in all the subjects examined. The anti-nuclear factor (anti-nuclear antibody) was weakly positive in two females of the 105 chewers with OSF. The test was negative in the nine chewers without OSF.

Nineteen of the 105 chewers with OSF tested for serum parietal cell antibodies were positive. One chewer without OSF was positive. They were all females and fell within the age group 25 to 64 years. This

high prevalence (18%) in the OSF group is much greater than that expected in a normal population. Doniach and Roitt (1964) found that the prevalence of parietal cell antibodies in the general population, between the ages of 30 and 60, was 8%. Irvine et al (1965) found that 5% of 629 blood donors had parietal cell antibodies and Isokosi (1970) also found a frequency of 8%. There may, therefore, be an association between betel nut chewing and the occurrence of serum parietal cell antibodies. It is probable that betel nut constituents in the form of alkaloids may act as haptenes and results in the production of antibodies to the parietal cells. Another mechanism may result from antigenic similarity between betel nut protein and parietal cell protein. Antibodies produced to betel nut antigen, therefore, may cross-react with parietal cell proteins.

A high prevalence of positive parietal cell antibodies does not appear to be related to clinically significant abnormalities or other evidence of pernicious anaemia. None of the 71 chewers with OSF were found to have evidence of Vitamin B12 deficiency. Of the 107 patients tested for mitochondrial antibodies, all proved negative. Of the 111 cases tested for rheumatoid factor only three had a significant titre (1/180). Two of these three chewers with OSF had a positive antinuclear factor as well. None of the three patients had clinical evidence of rheumatoid arthritis.

The serum protein electrophoresis estimations revealed that 67 (68%) of OSF cases had mildly elevated gamma globulin levels which were polyclonal in nature. No case of monoclonal gammapathy was found. Fractionation of the serum globulins revealed that 32 (33%) of the patients with OSF had elevated beta globulins. Of the six chewers

without OSF one had elevated beta globulins and three (50%) had elevated gamma globulins (17,6; 19 and 19,6 d/l). These elevations were polyclonal in nature. Serum immunoglobin estimations were performed on 97 patients. The serum IgG, IgA and IgM levels were increased in 31%, 28% and 38% respectively. One of the patients with OSF, a 28 year old female, had an associated auto-immune disease - Grave's disease - in 1975 which was successfully treated with Carbimazole and Neo-mercazole. No other patient showed clinical evidence of other auto-immune diseases such as Rheumatoid Arthritis, Systemic Lupus Erythematosus, Scleroderma, Morphea or Pernicous Anaemia.

Non-specific elevations of serum globulin and serum immunoglobulins are common in many inflammatory, infectious and neoplastic conditions. The significance of the increased levels of beta and gamma globulins and serum immunoglobulins in OSF is uncertain. Sirsat and Pindborg (1967a) also found increased serum gamma globulins in their patients and suggested that the pathogenesis of OSF might be "in the realm of immunopathology".

This study lends support to the postulate of Sirsat and Pindborg (1967a). The prevalence of serum parietal cell antibodies (18%) is much greater than that expected in a normal population. Probable mechanisms of production of the parietal cell antibody have been discussed. This finding in association with the increased erythrocyte sedimentation rate, hypergammaglobulinaemia and raised immunoglobulin levels further supports this hypothesis. The presence of antibodies to cells distant from the oral mucosa suggest that OSF may involve the gastric mucosa. The stomach mucosa, however, has never been studied in relation to OSF.

Liver function tests were performed to estimate serum albumin and globulin levels as an index of protein malnutrition. Serum bilirubin and alkaline phosphatase estimations form part of a battery of routine liver function tests.

On clinical examination all the patients were well nourished. The serum albumin was low in only two patients with levels less than 35 g/l (30,7 g/l and 32,2 g/l). They were otherwise well on clinical examination. The six chewers without OSF had normal levels. Sirsat and Khanolkar (1960b) painted the palate of Wistar rats with capsaicin, the active ingredient of chillies and found that, if the rats were protein depleted or if there was Vitamin B deficiency, there was a response similar to that found in oral submucous fibrosis, clinically and pathologically. Most patients in India who suffer from OSF have a lowered serum albumin but this may not be causually related to the disease and probably reflects the generally poor nutritional status of the population in India. Other tests of liver function revealed a mildly elevated serum bilirubin in 8% and mildly elevated alkaline phosphatase in 32%. The significance of this is not clear as evidence to date suggest that oral submucous fibrosis is a disease localised primarily to the upper gastro-intestinal tract.

As zinc deficiency may result in impaired tissue growth and repair, it was decided to screen a group of patients. None of the 30 patients tested had any biochemical evidence of zinc deficiency. This finding, therefore, excludes zinc deficiency as a cause of OSF.

The serological test for syphilis was negative in all 98 patients tested. Secondary syphilis is associated with oral mucosal lesions in many cases. This study shows that there is no relationship between syphilis and OSF.

5.3 MORPHOLOGICAL STUDIES

The most striking observation in the biopsies of patients with oral submucous fibrosis is the state of the epithelium. Pindborg et al (1965a), Pindborg (1966), Shear and Lemmer (1967), Mani and Singh (1976) and Shiau and Kwan (1979) demonstrated atrophy of the epithelium with loss of rete pegs. In the present series, 104 (70%) of the total 149 biopsies showed an atrophic epithelium with loss of rete pegs confirming the findings of Mehta et al (1971) that marked atrophy of the oral epithelium is the outstanding feature of the histopathology of oral submucous fibrosis. Su (1954) found the epithelium acanthotic and Mani and Singh (1976b) noticed hyperplasia of the epithelium. In the present series 32 (21%) of the 149 biopsies showed hyperplastic/acanthotic epithelium. Lal (1953) described the epithelium to be normal in some cases and in the present series 13 (9%) were normal.

The atrophy of the epithelium may develop as a result of the underlying connective tissue being markedly changed as suggested by Pindborg (1966). Sirsat and Khanolkar (1957) believe that the fibro-elastic transformation of the lamina propria produces thickened blood vessels and causes a reduced nutrition to the epithelium. From the present study a definite relationship cannot be established.

Pindborg (1966) attributes varying degrees of keratinisation of the buccal mucosa to the widespread Indian habit of chewing tobacco and smoking strong indigenous cigarettes. He found such keratinisation in 64% of his cases. In the present series there were 61% with unkeratinised epithelium as these patients did not indulge in any other additional habits.

Vacuolation of the cytoplasm as observed in large numbers of cells of the spinous cell layer suggests some form of degeneration. Pindborg et al (1965a) found some signet-cell-like degeneration and a slight liquefaction of the basal cell layer in some of their biopsies, the significance of which according to the authors is not clear. Sharan (1959) reported a similar liquefaction degeneration, but has no explanation. Pindborg (1966) found signet-cells in 13% of his cases and there is 61% in the present series. Pindborg (1966) observed inter-cellular oedema in 18% and in the present series there is 23%, and in addition, 14% have inter- and intra-cellular oedema. Mehta et al (1971) state that one of the characteristics observed in atypias of OSF is pronounced inter-cellular oedema.

Although the theory of cellular degeneration as a cause for the "signet cells" seems likely the exceptional high figure recorded here is difficult to explain. On the other hand it would seem that it is a more common feature in unkeratinized epithelium and the majority of cases of the present investigation exhibited unkeratinized epithelium. Thus one can expect a high occurrence here.

Lemmer and Shear (1968) noted dyskeratosis with atypia in one of their six cases. Pindborg in 1966 found 7% with atypia and in 1972 the percentage varied from 7,7 to 23,8 with an average of 13,2%. Wahi, Luthra and Kapur (1966) found 14,4%. In the study here in Durban 27% of cases revealed two or more features of atypia (see Table 5.49). These findings can be regarded as an indication of the possible pre-malignancy of the lesion.

Sirsat and Pindborg (1967a) and Mehta et al (1971) state that

hyalinisation of the collagen begins juxta-epithelially and as the disease develops the hyalinisation becomes more pronounced and progresses deeper into the lamina propria. In the present series only 12 of the 152 cases showed a band of subepithelial hyalinisation with dense collagen in the lamina propria. Conversely it was also observed that in some the collagen was loosely woven adjacent to the epithelium while the rest of the lamina propria was dense. Mani (1977) noticed a marked increase in the collagenous tissue with hyalinisation in severe cases. Shiau and Kwan (1979) observed hyalinisation of the collagen fibres and dense collagen which filled the entire submucosal layer. Shear and Lemmer (1967) found a dense fibrosis of the lamina propria and submucosa. In the present series the collagen was densely distributed in the lamina propria in 16% and in the lamina propria and submucosa in 49% of cases. From the above it is open to conjecture where exactly excess deposition of collagen commences.

Shear and Lemmer (1967) found the elastic tissue to be bound up in the dense collagen and the present findings substantiate this. This intermingling of elastic fibres with a background of dense collagen produces an apparent prominency and thickness of elastic bundles.

According to Sirsat and Pindborg (1967a) in the very early stage of OSF the blood vessels are sometimes normal, but more often they are dilated and congested. In the early stage the blood vessels are often dilated and congested. In the moderately advanced stage the blood vessels are either normal or constricted as a result of increased surrounding fibrous tissue. In the advanced stage blood vessels are completely obliterated or constricted. Shear and Lemmer (1967) found a plentiful blood supply in all cases, whereas Mani (1979) found a relatively small number of blood vessels. In the present study it was elucidated that

the number of blood vessels is significantly decreased in OSF and although the vessel walls are thickened, the vessel diameter remains unchanged. It is therefore concluded that there may be diminution in the blood supply.

In a subsequent report, Sirsat and Pindborg (1967c) found normal, dilated and constricted blood vessels, often in combination in the same section. In the early stages of OSF there was extreme dilatation and narrowing in the more advanced stages; this being responsible for the secondary atrophic changes in the epithelium. At this stage of our knowledge of OSF the changes in the epithelium and the connective tissues are difficult to correlate. However, in our study of chewers without clinical evidence of OSF, hyperplastic/acanthotic epithelium was consistently found with simultaneous changes in the lamina propria in the form of excess collagen deposition. Thus it would seem that changes of the epithelium are not necessarily secondary to that of the lamina propria.

No vesicles were observed but focal vascular dilatations and petechiae were seen in a few patients with OSF. The presence of these lesions juxta-epithelially may indicate the same type of connective tissue breakdown at the epithelial interface which lead to the development of sub-epithelial vesicles, previously described by Pindborg and Singh (1964).

In 71% of OSF cases there was absence of any form of cellular infiltration while in the rest the lymphocyte was the predominant cell. In some instances the polymorphs and plasma cells were present. Tissue eosinophilia was not a feature of significance. The question is whether a chronic infiltrate is part of the features of "early" OSF.

Examinations of biopsies of chewers without OSF seem to support this (See RESULTS p. 143).

In 42% of biopsy specimens the mast cell count was less than one. In these cases the peripheral lamina propria consisted of dense collagen. This confirms the findings of Sirsat and Pindborg (1967b) and that of Bhatt and Dholakia (1977) that the mast cells are diminished in the advanced disease.

Pigment incontinence with melanin, ranging from mild to severe, in the lamina propria or underneath the epithelium was observed in 56% of biopsy specimens. It is suggested that this feature is in part due to the chronic irritation caused by betel chewing.

The present study substantiates the findings of Shear and Lemmer (1967) that collagen fibres are deposited around muscle fibres, blood vessels and mucous glands. The fibrous bundles encircle individual or groups of fat cells without a decrease in the size of the fat cells. The circumferential deposition of fibrous tissue involving the muscle results in the constriction of the muscle fibrils and at times their obliteration. This will contribute to the trismus. In two cases there was degeneration of the salivary tissue with lymphocytic infiltration which could not be related to the morphological features of the disease.

The findings in the present study of the electron microscopic features of the collagen in OSF are contrary to that of Sirsat and Khanolkar (1957; 1960b) and that of Binnie and Cawson (1972). They reported that the collagen fibrils were abnormal. In fact the collagen fibrils in OSF were denser but the periodicity of the fibrils was normal and

there was not evidence of them being immature.

The post-mortem findings of a limited autopsy which revealed the development of concomitant carcinomas in different locations in the mouth gives an indication of the widespread changes in the mouth which can lead to malignancy. In other words, a malignancy may not necessarily develop in the area where the quid is held.

There is no mention in the literature of the histological features of the oral mucosa of chewers without clinical OSF. In the present series 89% of the chewers without clinical OSF showed hyperplastic/acanthotic epithelium. In a third, parakeratosis and signet-cells were observed and forty-five percent demonstrated inter-cellular oedema. A third of the chewers without clinical OSF had two or more features of atypia in the epithelium. The mitotic activity was greater than in cases of OSF indicating the hyperplastic/acanthotic nature of the epithelium. Moderately dense deposition of collagen in the lamina propria was observed in 44%. In 38% the mast cell count varied from eight to 21 per field, indicating the increased number of mast cells in the early phase of the development of OSF. In 78% there was mild to moderate cellular infiltration. Melanin deposition in the lamina propria was seen in a third of the cases.

The above findings are of significance because they indicate that a number of histologic changes have taken place before clinical signs and symptoms have manifested themselves. Therefore, had all the chewers in the survey been biopsied, a considerable larger number would have been diagnosed as suffering from OSF which means that the calculated prevalence of 2,3% in the population is a conservative figure.

Of special interest is the simultaneous hyperplasia of the mucosal epithelium and the increase of collagen in the lamina propria, suggesting an independent response by epithelium and connective tissue. It is only when the epithelium becomes atrophic that the burning sensation will manifest itself.

A tremendous amount of evidence has been collected to incriminate OSF as a precancerous condition and the frequent finding of epithelial atypia (in the present series there is 27% atypia) lends support to the premalignant nature of the lesion. Shiau and Kwan (1979) had a 23% cancer rate with OSF and Mehta et al (1981) 33%. Pindborg et al (1965) found OSF in 40% of oral cancer patients and less than 1% in non-cancerous group. In the present series of 200 clinically diagnosed cases of OSF there were 10 (5%) cases with concomitant carcinoma. One may deduce from this that the occurrence of malignancy was less than what was found by the others, in India where tobacco has been reported as an important co-factor (Pindborg, 1972). Only one of the 10 cases with oral cancer used tobacco in our series, which makes it difficult to implicate tobacco.

On routine follow-up of two patients with OSF, one developed cancer in-situ of the left cheek within two years and the other a well-differentiated squamous carcinoma of the left cheek within two and a half years. Both were chewers of the betel nut only. Therefore, it is concluded that the chewing of the betel nut is the single most important factor as the cause of cancer in these cases. It is also believed that the atrophic epithelium is predisposed to malignant change, because of its greater vulnerability to carcinogens.

Mehta et al (1972) and Paissat (1981) reported three cases and one case of oral submucous fibrosis respectively with no betel chewing or other habits. In the present series there are five such cases alleging to have no chewing habits. An explanation cannot be postulated for the development of OSF in patients with no chewing habits.

Table 5.54 shows the occurrence of chewers with OSF within families. There is a set of identical female twins who chewed the nut only for a period of one year and the severity of the lesion varied. It can be postulated that the occurrence of OSF does not follow a familial pattern.

Although OSF is generally peculiar to people of Indian origin, some exceptions have been reported in Chinese, Europeans living in India and a white South African female (Shear and Lemmer, 1967). In the present series three coloured patients were seen with OSF, two of whom chewed the nut only. In other words, all people irrespective of birth, or ethnic origin, are susceptible to the disease, provided they practise the chewing habit.

CHAPTER VII

CONCLUSION

From this study it can be concluded:

1. that the habit of betel nut chewing in its various forms is relatively common among South African Indians, especially among the women folk,

2. that the habit poses a serious health hazard to those indulging in it,

3. that there is no real evidence that the habit is on the decrease,

4. that the chewing of the betel nut is the single most important factor that can be associated with the development of OSF and possibly the resulting oral carcinoma,

5. that OSF can be regarded as premalignant,

6. that once fibrosis is established there is no regression of the disease even after secession of the habit,

7. that when clinical features of the disease are apparent, the histopathogenesis of the condition has already progressed substantially,

8. that the histologic changes in the oral mucosa appear to follow a specific pattern, ranging from early features (hyperplasia of the epithelium and a chronically inflamed lamina propria with some increase of collagen) to late features (atrophy of the epithelium and dense collagen in both lamina propria and submucosa),

9. that although there is an increase in density of collagen in both the lamina propria and submucosa of the mucosa, the histologic and electron microscopic characteristics of the collagen are still normal and

10. that there is no real evidence to implicate a systemic disease in the development of oral submucous fibrosis.

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> If the existing conditions of the settlement were attractive, then the prospects held out by rumours of the future were positively alluring to newcomers. Water would be reticulated, a school built, and other services provided for all those who had staked their claim by settling there. Older people, whose financial security and physical safety were increasingly jeopardised in the peri-urban slums of Port Elizabeth and East London, or whose tenure on the farms was at risk every time the farms changed hands or functions, could see in Tswele Tswele a haven of peace in their declining years where they could live rent free, run their stock and nurture their grandchildren in something close to what they thought of as the traditional manner."

There is quite a high level of satisfaction with life in the settlement. In 1982, 83% said that they would prefer to continue living in Tswele Tswele, either because they enjoyed living there (one half of responses), had nowhere else to go (10%), had access to land and were able to keep stock (9%) or because they came to settle there permanently (9%).

The overwhelming majority of those employed (82%) work either as weekly commuters or migrants outside the settlement. Commuters (71% of those employed) for the most part work in East London and live in alternative accommodation there during the week. Commuters contribute little cash, but bring home foodstuffs and durables which are cheaper to buy in the larger urban stores. Employment in or near the settlement is minimal (18% of those employed). Some 15% of households were involved in some form of informal activity such as hawking, house-building, informal taxi service, unlicensed shops and shebeens, manufacturing and sale of clothing etc. One third of households included a pensioner as a cash contributor.

The Tswele Tswele residents have an overwhelmingly rural origin. Over one half of the original settlers came from White farms in the adjacent Border area while another quarter came from Ciskeian rural areas (although most came there from White farms as well). Only about 15% came from urban areas such as Mdantsane, East London and Port Elizabeth. 65% of households cultivated food crops (none for sale) and many kept stock for ritual purposes.

As a result of their rural background residents are poorly educated and have few saleable skills. Even their agricultural experience on White farms has not equipped them to run a commercially viable agricultural unit. Furthermore, under the labour zoning system then in force, those working in East London (which is where the overwhelming majority of commuters work) were illegal. (Bekker et al., 1982:60) The outcome of these factors is that workers from this settlement join the back of the queue with regard to both employment and housing in East London.

However, peri-urban life has distinct advantages for different sections of the population. These are summarised neatly by Bekker et al. (1982:12).

> "As an alternative to the circumstances under which they were currently living - as labourers or labour tenants on black and white owned farms, as peri-urban squatters subject to eviction and demolition at any time, even as tenants in urban townships living in monthly fear of being unable to meet their rents - Tswele Tswele offered a reasonably secure place in which to stay, subject only to an initial payment plus some moral pressure to contribute to the official collections organised through the Tribal Authority. A good bus service linked the area to East London, the major source of employment and relatively low priced goods....

complex attracted less than 10% of them. Elukhanyeni migrants were returning to their place of origin, Humansdorp.

The SPP survey found that in all cases over 1/2 of the families in the resettled communities were 'very poor' or 'destitute'.(SPP(2):247-326)

7. Rural Settlements

There are several reasons for considering rural settlements in a discussion of urbanisation. Firstly, a number of 'betterment' villages look very much like urban places. It was estimated in 1984 that 58.1% of the Ciskei's de facto population was classified rural. (DBSA Ciskei 1(4)) About 80% of these people live in 'betterment' villages which vary in size from 34 people to 4 000. Many of these larger villages have urban facilities such as shops, clinics, schools and churches. In short, in respect of size and facilities, many 'betterment' villages closely resemble urban places.

Secondly, in terms of the Tomlinson Commission plan for rural development, families without land rights were to be moved off the land and accommodated in new villages and industrial towns. Mainly as a result of the cost involved few of these towns were ever constructed. The original impractical idea of an economic farming unit was also dropped. As a result only about ten percent of rural families in the Ciskei have access to 'full economic units' of approximately 34 ha. (Daniel, 1981: 10) This means that a large proportion of the rural population no longer have access to land, nor to agriculture and food production, while those with access to land farm on uneconomic units. In terms of economic activity, therefore, residents of these settlements can hardly be termed 'rural'.

6.3 Peddie, Keiskammahoek and Middledrift districts have all been recipients of smaller numbers of resettled people. All three are remote areas with very few employment opportunities. Many of the resettled people have agricultural origins, but agricultural jobs are scarce, while inadequate land and water diminishes the opportunities even to grow food privately. With only agricultural skills and a poor education they are at a severe disadvantage in the labour market.

Resettled people at Elukhanyeni in the Keiskammahoek district find work in and around Humansdorp, their place of origin, and there has been some seepage of families back to Humansdorp. Middledrift district had a very low growth rate of 2.7% p.a. in the 1970-80 period indicating a substantial out-migration from this district as well.

Surveys of specific communities (Elukhanyeni, Kammaskraal and Glenmore by the SPP) show high rates of migrancy (between 10-20% of the total population compared to 7.6% and 8.8% for Dimbaza and Mdantsane respectively). In all cases about 80% of the workers had to migrate elsewhere for jobs. On average the younger age-groups have lower activity rates than those over 25. In two of the surveyed communities only 40% of young males were employed compared to 80% of older males. The same pattern applied to females, where only 25-33% of those between 15-24 were employed compared to 50-66% of older females. In Kammaskraal 35.5% of the potentially economically active population was unemployed while in Elukhanyeni 68% of young males and 86% of young females were unemployed. (SPP(2):247-326)

Large urban areas are the destination for most migrants: over 60% of migrants from Glenmore and Kammaskraal worked in Port Elizabeth and the PWV-complex, while another 10-20% migrated to Cape Town. The East London/King William's Town

few suitable areas, such as the Keiskamma river valley and at Tyefu, where under strict management control milk and cash crops are produced for the market. In these two schemes and one at Shiloh only 3 000 jobs had been created by the early eighties. (Green & Hirsch, 1983:38) In the Hewu district in the north the Zweledinga rural settlement scheme is planned to accommodate 6 000 resettled people from the Glen Grey district on 10 000 ha. It is intended to create rural villages to house 1 212 families without land rights but no provision appears to have been made for the creation of employment opportunities. (Daniel, 1981:15)

In 1983 the Ciskei Rural Development Programme undertook the creation of short-term job opportunities in rural communities in the light of high unemployment rates in urban areas. The aim was to promote the development of local infrastructure, facilities and services and to employ local labour on a cash remuneration basis. During November of that year a total of 2 426 people were employed of whom 3/4 were women. These labour-intensive programmes however cost two to three times as much as capital-intensive methods would have. Although the programme was a relatively successful short-term project, it provides no answer to the problems of employing tens of thousands of unemployed and landless rural dwellers.

In summary, although we have included in our definition of 'urban' only those settlements with populations of more than 5 000, this is a very conservative estimate. There are far more 'rural' people who live very un-rural lives. The Quail Commission referred to the Ciskei as "perhaps the most overcrowded rural area of South Africa". (Quail Commission, 1980: 20) Less than 5% of rural Ciskeians make their living from agriculture. The rural and agricultural job creation schemes have provided employment to only a few thousand people. The proportion of landless rural dwellers looks as if it will increase and more and more people will be pushed to seek employment elsewhere in order to survive.

This conclusion is corroborated when one looks at where people find employment. The 'betterment plan' did not make provision for population increase. Although some sharecropping and renting of arable land does occur (de Wet & McAllister, 1983:28) most young adults who do not inherit land rights (land rights are passed on to the eldest son only) are forced to seek an income elsewhere. A 1983 survey of a rural village showed that since 1948/50 the number of people living and/or working away from home has risen from 15 - 26% (de Wet & McAllister, 1983: 17) In a Keiskammahoek village 43% of residents had no rights to arable land in 1983, as compared to 10% before 'betterment'. (de Wet & McAllister, 1983: 23) In the Amatola basin 3/4 of the men and 1/2 of the women of working age are migrants. (Bekker & de Wet, 1983: 6) As a result, one half of the resident population is at school. The largest group of absentees is in the 20-30 age group, but large numbers of men live and work away from home until at least the age of 50. 'Betterment schemes' have not only failed to stem migration to towns but have in fact increased the trend.

Finally, less than 5% of rural households make their living from cultivation or stock farming. (Bekker & Hughes, 1984:4) Food production is only a supplementary source of subsistence. The greatest part of a rural household's income is derived from cash remittances, pensions, local employment and the informal sector.

In summary, from an examination of the size and facilities of villages, the availability of land, the rate of absenteeism and the sources of income, there is little that is 'rural' about the average Ciskeian village.

Since 'betterment' has not succeeded in improving either agricultural production or the quality of life of rural dwellers, the Ciskei government has investigated other options. One has been to develop irrigation schemes in the

9 603 and 14 069 respectively in 1982 - see Appendix 1). Both of these must, therefore, be designated peri-urban areas of Zeerust with a total of 23 672 people.

3.3 By the same process of matching commuters (multiplied by 5.5) with the size of the towns from which they are reported to originate (cf. Mastoroudes, 1982), and by verifying on which access routes they lie, we have included the following settlements as peri-urban: Bathlaro (north of Kuruman in Tlhaping-Tlharo district), Bultfontein I & II & III (near Selosesha in Thaba 'Nchu district) and Madibogo (in Ditsobotla district). (see Table 1 & Appendix 1)

3.4 The settlement of Khonutsoane some 20 km. to the south of Welbedacht is an interesting case for our study. It is a resettlement village comprising 3 500 people mostly from White farms or from a deproclaimed Black township at Ottoshoop. Until 1980 they had access to substantial tracts of arable land, but the Bophuthatswana boundaries were re-drawn at independence to excise this land. At present they only have access to grazing land. About 14% of wage-earners commute on a weekly or twice-weekly basis some 20 km. to the Slurry cement factory just across the border. There they stay in hostels. Another 25% of wage-earners commute daily to either the nearby radar-station run by the SADF, or to the military camp at Zeerust. Neither the cement factory nor the radar-station are in a proclaimed town, but both offer employment (and wages) of an undeniably urban nature. 7% of wage-earners work as domestics in Zeerust, commuting on a daily or weekly basis. (Graaff, 1984)

In short, a total of 46% of the village's wage-earners are dependent for employment and other services on urban or urban-type localities on a daily to weekly basis. Agricultural activity in the village is minimal. Households

which is a mining town, all these 'White' towns are relatively small agricultural centres.

3.1 Owing to their weak economic base (and, in the case of Kuruman, the depressed state of the northern Cape mining industry), none of these towns is expected to grow very fast. Zeerust will, however, be badly hit if the plan to incorporate 71 White farms in the Marico corridor goes through. The White population on these farms forms a significant part of Zeerust's economic base. Were they to be replaced by Black farmers (who would be serviced elsewhere) this base would be substantially undermined. (Graaff, 1984)

Estimating growth rates in these towns is, as we have shown in the section on Lebowa, complicated by the interdependence of the Bophuthatswana dormitory towns and the 'White' towns which they were created to serve. Table 2 shows the same process of commuterisation as occurred in Lebowa, with White towns growing very slowly (at a negative rate in some cases), Bophuthatswana towns growing very rapidly and the commuter populations growing even faster.

3.2 The Lehurutshe-Zeerust area was the subject of a more detailed study during 1983. (Graaff, 1984) While Mastoroudes (1983) reports 2 000 people commuting into Zeerust on a daily basis in 1981, Graaff (1984) estimated the commuter figure at 3 794 in 1983 - suggesting a population of about 21 000 people dependent on commuter incomes. The town of Lehurutshe (also known as Welbedacht or Lerato) had a population of 4 000 in the same year (although the Census puts it at 2 502 in 1980). Many of the residents of Welbedacht work in a shopping-centre in the town. Information from the local bus-company showed people commuting into Zeerust not only from Welbedacht but from the settlements of Dinokana and Gopane (with populations of

Botshabelo. At present, jobs in Bloemfontein and Botshabelo are increasingly reserved for Botshabelo residents. Thaba 'Nchu residents must look to Selosesha for employment. (Cobbett et al., 1985) We do not expect Selosesha's population to grow very fast.

5.0 Mogwase (also known as Heystekrand)

Mogwase is a designated IDP on the Rustenburg-Thabazimbi railway line. It is a recently established industrial site, and by 1984 was providing employment for 2 000 workers in 8 factories. A planning document by Niewenhuizen sketches the growth possibilities for Mogwase as follows:

> "The north-western part of Bophuthatswana is well mineralised. Good agricultural land is also available in this with its more moderate climate...Heystekrand is well located as far as physical infrastructure is concerned. It is well isolated from the PWV-area and Rustenburg and will not become a mere satellite of these areas. It is, however, not so remote that industrialists will not consider it because of excessive transport and other costs.
>
> "Heystekrand would seem to be well located as the centre of a hierarchy of smaller towns and villages in this socio-economic important part of Bophuthatswana. Increased mining and agricultural activity will attract important service industries. Such industries will also be attracted by the availability of cheap land, labour and the economic philosophy of the Government which is a strong proponent of free enterprise." (Niewenhuizen, 1981)

owned on average 1.6 cattle, 0.45 sheep and 1.1 goats. (Graaff, 1984) We have little difficulty in designating the Khonutsoane population as peri-urban, despite the fact that all its members do not commute to a proclaimed town or on a daily basis.

4.0 Selosesha

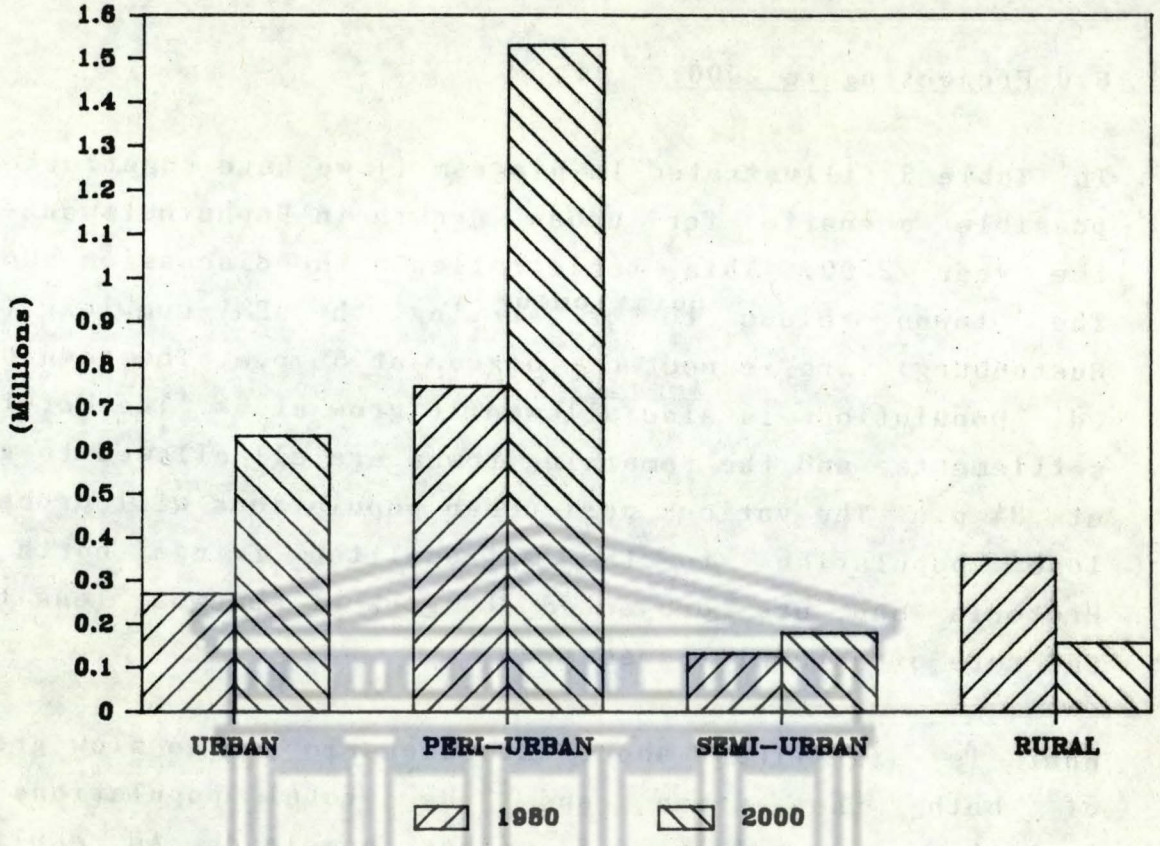
Selosesha is the IDP situated in the Thaba 'Nchu block of Bophuthatswana, very close to two other IDP's, namely Bloemfontein and Botshabelo. It lies very close to the small town of Thaba 'Nchu (population 533 in 1980) which was incorporated into the Thaba 'Nchu district in October, 1983. During 1984 the building of a hotel, the Thaba 'Nchu Sun, was started, predicted to add 600 new jobs to the existing 2 000 at Selosesha. (Survey, 1984) Following its designation as an IDP in 1982, Selosesha received no applications for concessions for two years. (Cobbett et al., 1985)

As we have argued in the section on Qwaqwa, (para 2.3) with regard to the the Bloemfontein-Botshabelo-Selosesha axis, although the axis contains three IDP's, and the former two of these appear to be attracting interest from industrialists, there are roughly 450 000 Blacks dependent on the main part of the axis, namely Bloemfontein. Bloemfontein, however, has grown slowly in the 1970-80 decade, largely due to its very small industrial base.

On the other hand, incomes and employment opportunities in the sub-region are markedly more favorable than in the Witzieshoek area of Qwaqwa. As a result we expect both the population and the unemployment level to rise substantially once Botshabelo is incorporated into Qwaqwa. Thaba 'Nchu district's growth has been slow in the 1980-85 period owing largely to the exodus of people from Kromdraai to

Diagram 1

BOPHUTHATSWANA URBANISATION 1980–2000



6.0 Projecting to 2000.

In Table 3 (illustrated in Diagram 1) we have constructed a possible scenario for urban growth in Bophuthatswana to the year 2000. This table reflects the discussion above. The towns close to or serving the PWV-complex (and Rustenburg) are expected to grow at 5% p.a. The remaining Odi population is also allowed to grow at 5%. The Moretele settlements and the remaining towns are all allowed to grow at 3% p.a. The various peri-urban populations will probably lose population to the metropolitan fringe north of Pretoria and are projected to grow at somewhat less than the rate of natural increase.

What is significant about this scenario is the slow growth of both the urban and the total populations of Bophuthatswana relative to other homelands. As result of Bophuthatswana's very high level of urbanisation and peri-urbanisation (or commuterisation), two things are evident - firstly a comparatively low rate of natural increase; and secondly a diminished possibility of rural-urban migration. (Cf. also Mostert et al. for comparative growth rates in the homelands. They put Bophuthatswana's growth rate at a low 2.57% p.a.) This is reflected in a small and declining rural population despite the very low urban growth rates.

Estimating Bophuthatswana's present and future population growth rates is made difficult by the disagreement between three different population estimates and forecasts, namely those by the official Censuses (the South African census in 1970, and the Bophuthatswana censuses in 1980 and 1985), the Dept. of Post and Telecommunications count in 1982, (Odendaal, 1982) and that by the Development Bank. (DBSA Bophuthatswana, 1985)

Comparison of these figures show considerable discrepancies, up to 50 000 in the case of Odi. For our

TABLE 3: BOPHUTHATSWANA URBANISATION 1980-2000

TOWNS (2)	1980	PROJ'D GROWTH P.A.	PROJ'D POP. 2000	% OF TOTAL
MABOPANE	48596	5.0	128940	5.5
GARANKUWA	48523	5.0	128746	5.5
TEMBA	22784	5.0	60453	2.6
MOTHUTHLUNG	6174	5.0	16381	0.7
TLHABANE	16707	5.0	44329	1.9
MMABATHO (4)	60775	4.0	133165	5.7
MOGWASE (3)	3752	4.0	8220	0.3
SELOSESHA	5500	3.0	9934	0.4
OTHER TOWNS	59079	3.0	106703	4.5
ODI PERI-URBAN (1)	264542	5.0	701909	29.9
MORETELE PERI-URBAN (1)	330279	3.0	596521	25.4
LEHURUTSHE PERI-URBAN (5)	26117	2.0	38808	1.7
BAFOKENG PERI-URBAN (1)	84723	2.0	125894	5.4
T/TLHARO PERI-URBAN (6)	10936	2.0	16251	0.7
THABA NCHU PERI-URBAN (6)	18088	2.0	26878	1.1
DITSOB. PERI-URBAN (6)	17500	2.0	26004	1.1
OTHER SETTLEMENTS (6)	135016	1.5	181847	7.7
TOTAL	1159090	3.60	2350981	100
URBAN	271889	4.35	636870	25
PERI-URBAN (8)	752185	4.03	1532264	61
SEMI-URBAN	135016	1.50	181847	7
RURAL	351556	-4.33	158418	6
OVERALL TOTAL (7)	1510646	2.57	2509400	100

(1) From the district total (taken from DBSA (1986)) is subtracted the urban population to give a peri-urban population.
(2) 1980 figures for towns taken from BENSO, 1981 unless otherwise indicated.
(3) 1982 Mogwase figure taken from Odendaal and deflated.
(4) As calculated in the text, para. 2 and deflated.
(5) As calculated in text, para.s 3.2-3.4 & deflated.
(6) Calculated from Appendix 1 and deflated to 1980.
(7) DBSA, 1986 for 1980 total. Growth rate from Mostert, 1985.
(8) Peri-urban populations of Odi, Moretele, Bafokeng, Lehurutshe, Ditsobotla & Tlhaping-Tlharo districts. (See the argument in the text para.s 2.4,2.5,3.2-4)

calculations we have used the 1980 DBSA (1986) figure of 1.51 million for Bophuthatswana's total population. For the 1985-2000 projection we have used a gross reproduction rate of 2.57% which is also the figure used for Bophuthatswana by Mostert et al. (1985) (See the Introduction section) This gives a total population of 2.5 million in 2000.

7.0 What will be the impact of abolishing Influx Control ?

In one sense the question of what would happen in the event of Influx Control being lifted has been answered in Bophuthatswana with the massive inflow of people into the Odi and Moretele districts. In view of this history the question (at least, with regard to Odi and Moretele districts where about 55% of the Bophuthatswana population live) should be reformulated to read: will people who have (been) moved before, be available for moving again ?

In order to answer the question put this way, it is necessary to emphasize one fundamental aspect of life in this area, namely that people living there are caught between two equally unpleasant forces. One is the combination of factors which brought them to the area in the first place - the deproclamation of the Pretoria townships of Lady Selbourne, Eastwood, Riverside, and Eersterus; the expulsion of farm-workers from the White agricultural sector; and the search for employment in the PWV-area. Even given the abolition of Influx Control, these factors are not reversible. People would find it difficult to go back to where they came from.

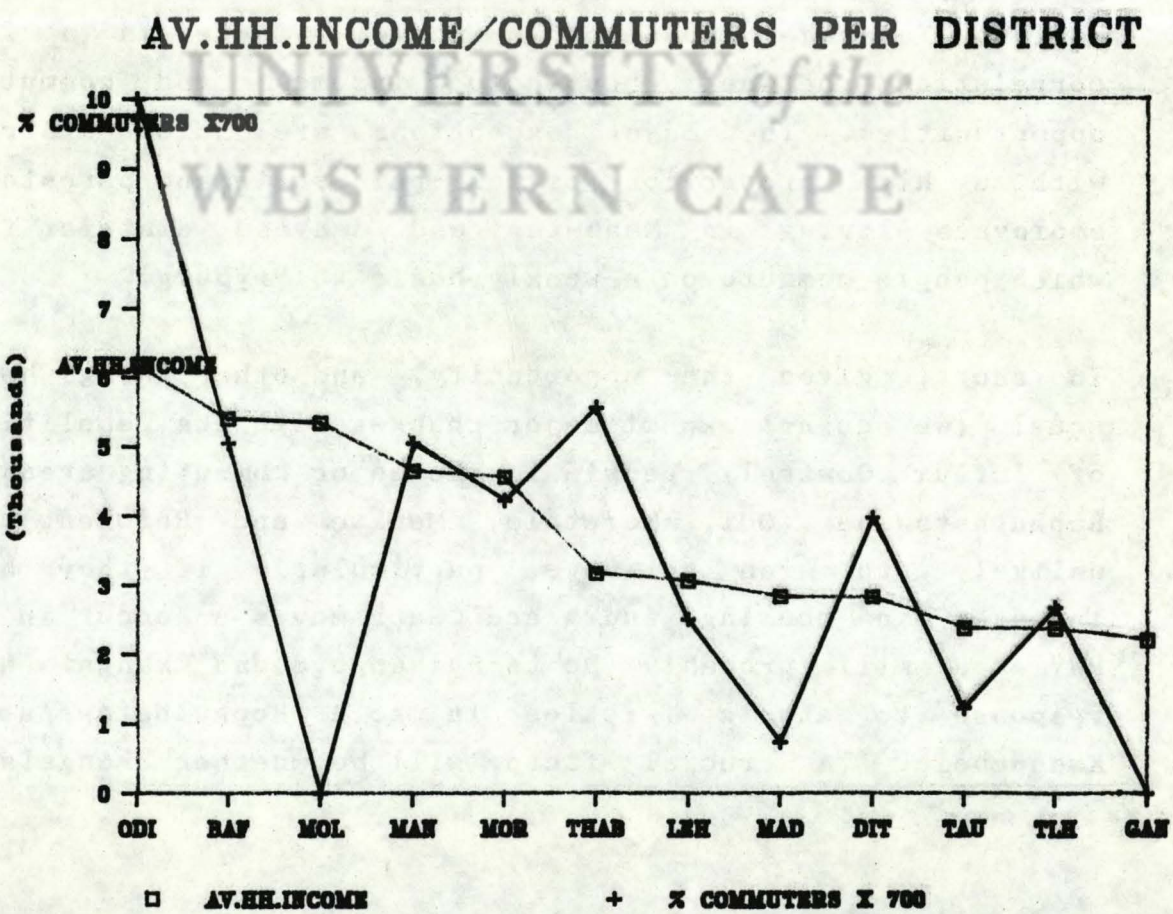
The other force of more recent origin is the continuing harrassment of non-Tswana residents by the Bophuthatswana government and its police-force. (SPP vol. 5: 314; Graaff, 1986)

TABLE 4: COMMUTERS IN BOPHUTHATSWANA PER DISTRICT

	POPULATION 1980	COMMUTERS 1981	AV. HH. INCOME
ODI	390619	66689	6188
BAFOKENG	103829	14900	5400
MOLOPO	104854		5333
MANKWE	85087		4638
MORETELE	330279	40811	4547
THABA NCHU	63660	5000	3164
LEHURUTSHE (1)	59946	2000	3053
MADIKWE	58254	600	2827
DITSOBOTLA	112719	7600	2819
TAUNG	125666	2400	2375
TLH-TLHARO	90838	3700	2371
GANYESA	39001		2204
TOTAL	1564752	62111	4445

Note: District populations from DBSA, 1986. Commuters from Mastoroudes, 1982. HH.income from BMR, 1985.
(1) Commuter figure from Graaff, 1984.

DIAGRAM 2



People caught in this dilemma have had two escape-routes: one to the neighbouring Kwandebele homeland where opportunities for employment and commuting are comparable to those in Odi and Moretele; and secondly to move to Soshanguve, the multi-ethnic town created in 1976 out of Mabopane in response to inter-ethnic friction. If the plans to develop Ekangala go ahead (see the section on Kwandebele) this would constitute a third option.

Our reading of the President's Council report on Urbanisation and the subsequent White Paper is that this is very likely to be the meaning to be placed on the words, "abolishing Influx Control", namely, the allocation of extensive 'approved' land and housing in Soshanguve and Ekangala. (Cobbett et al., 1985; Cobbett, 1985) This should be seen in combination with the aversion among commuters to life in a 'lokasie' (cf. Ehlers, 1982a) and the relatively better-off position of people with access to commuting opportunities. Table 4 and Diagram 2 plot very roughly the percentage of a district's population involved in commuting against average household income. There is a fair correlation between household incomes and commuting opportunities. The major exceptions are Molopo district with a high proportion of well-paid state and parastatal employees living in Mmabatho and Ganyesa district from which people commute on a weekly basis to Vryburg.

In short, given the opportunity, and other things being equal (we do not expect major changes with the 'abolition' of Influx Control) people in the major commuting areas of Bophuthatswana (Odi, Moretele, Mankwe and Bafokeng) are unlikely to wish to move, particularly if they have invested in housing and land. Such moves as occur in the PWV-area will probably be to Soshanguve and Ekangala as a response to ethnic friction in both Bophuthatswana and Kwandebele. (A crucial factor will be whether Ekangala is

APPENDIX 1 : SETTLEMENTS >5000 IN BOPHUTHATSWANA, 1982.

BAFOKENG			MORETELE II		
KANASTADT	7119	6265	RAMOKGOKO	4795	4220
LUKA	12019	10577	DEPUTTEN	4760	4189
PHOKENG	24437	21505	MUTLESTAD	4879	4294
DITSOBOTLA					
BATHOBATHO	1237	1089	ODI I		
GANALAAGTE	7588	6677	HEBRON	7735	6807
KRAAIPAN	5586	4916	HOEKFONTEIN I	7665	6745
KUNANA	8351	7349	JERICHO	7574	6665
MADIBOGO	20237	17809	KLIPGAT	12537	11033
VRISGEWACHT	5068	4460	MABOLOKA	29162	25663
			MADIDI	8316	7318
GANYESA			NOOITGEDACHT	5390	4743
GANYESTADT	12439	10946	OSKRAAL	5495	4836
MOROKWENG	8267	7275	VYEBOSLAAGTE	7455	6560
TLHAKGAMENG	7511	6610	WINTERVELD	92575	81466
LEHURUTSHE			ODI II		
BORAKALALO	5376	4731	BAPONG	7259	6388
DINOKANA	10913	9603	BETHANIE	6468	5692
GOPANE	15988	14069			
SELOSESHA	5796	5100	TAUNG		
WITKLEIGAT	5957	5242	DENKSDRIFT (?)	7112	6259
			DRYHARTS	6713	5907
MADIKWE			LASASANENG	5145	4528
MODIMOSANA	5131	4515	MAGOGONG	6629	5834
SILWERKRANS	12166	10706	MANOKWANE	5432	4780
TAMPOSSTAD	12187	10725	MANTHESTAD	6664	5864
			MATLAPANENG	10815	9517
MOLOPO			MOKASA II	6286	6527
DISANENG	7854	6912	SEKHING		4549
MABULE	12096	10644	MOKGARENG		4662
MAGOGWE	22694	19971			
MAJEMANTSHO	16394	14427			
MAKGOBISTAD	5544	4879	THABA NCHU		
RAMOSADI	23625	20790	BULTFONTEIN I	5103	4491
TSETSE	5327	4688	BULTFONTEIN II	10255	9024
			BULTFONTEIN II	6027	5304
MORETELE I			MOKWENA	8078	7109
BOSPLAAS	6062	5335	MOROKA	5747	5057
BOSPLAAS OOS	6881	6055			
DORSTIG (?)	9730	8562	TLHAPING-TLHARO		
GA-MAUBANA I	7637	6721	BATLHARO	12929	11378
GA-MOKONE	5586	4916			
GA-MOTLE	7490	6591	MANKWE		
KWA RATSIEPANE	5502	4842	BARATHEO	10619	9405
LEBOTLOANE	6181	5439	MABESKRAAL	1284	1137
MAKAPANSTAD	12047	10601	MODDERKUIL	5831	5165
MATENTENG	12936	11384	SAULSPOORT	11123	9852
MOGOGELO	9317	8199	TOEMASKOP	7105	6293
NUWE EERSTERUS	8694	7651			
SWARTBOOISTAT	10115	8901	TOTAL	350962	319258
TOTAL	395085	347675	TOTAL	746047	666933

Source: Odendaal, 1982 Dept. of Post & Telecommunication.
(?)- Original illegible.
1st column = houses x 7; 2nd column = houses x 6.2 as calculated by Odendaal,1982. 2nd column used in this study.

wholly or only partly incorporated into Kwandebele. As argued elsewhere residents of Ekangala are strongly opposed to falling under Kwandebele authority.)

If the numerous Bophuthatswana commuters are unlikely to move in great numbers given the abolition of Influx Control, the same cannot be said for the households living in the Tlhaping-Tlharo district north of Kuruman in and around Mothibistad. The SPP Report estimates that 67 000 people have been resettled here between 1959-1977 mostly from the Northern Cape area. The most recent were a group of 17 000 people in 1977. (SPP (3):135) In 1981 there were 3 700 commuters into Kuruman, suggesting a total of about 20 000 household members dependent on this source. For the rest the outlook is bleak. Without access to considerable areas of land for extensive cattle-ranching, the area is agriculturally arid. Both the mining and White agricultural sectors have been ejecting rather than absorbing labour in the last decade. If the intention of the White Paper to do away with Labour Bureaux and their system of preferential regional labour allocation is realized in legislation, this is a region unlikely to hold its population. We would expect significant numbers of people, particularly those most recently moved into the area, to wish to go elsewhere.

(iv) Given the size and facilities found in rural villages, the availability of land, the rate of absenteeism and the sources of income, there is little that is 'rural' about the average Ciskeian village. Less than 5% of rural Ciskeians make their living from agriculture.

(v) Given the depressed state of the economy of Region D and its shaky prospects for growth, we expect urban populations in the Ciskei to grow more slowly than elsewhere. Despite this, the rural population is expected to shrink at 3.3% p.a.

2. Bisho

Bisho was established as the capital of the Ciskei during 1980/1. It is linked by road to King William's Town's Black dormitory town, Zwelitsha, which previously was the Ciskeian administrative centre. Although boasting an independence stadium, Supreme Court building, shopping centre and hotel/casino complex, Bisho does not feature on the Development Bank's list of 446 towns and settlements. (DBSA Ciskei, 1986) A start has been made on the construction of houses for the Chief Minister and senior government officials, and such amenities provide work opportunities for people in the service and construction sectors, but most of them reside in Zwelitsha and King William's Town. Bisho's close proximity to the latter two towns suggests that the three places may in time develop into a single nucleus.

3. Large Dormitory Towns

The large dormitory towns in Ciskei, viz. Mdantsane and Zwelitsha, have not changed much in status since independence. They remain in effect the 'locations' of East London and King William's Town respectively.

SECTION 8: CISKEI

1. Introduction

Urban places in Ciskei may be classified according to their economic function and prospects of growth as follows:

(i) the capital, Bisho;
(ii) large dormitory towns, Mdantsane, Zwelitsha, Ilitha;
(iii) industrial development points, Dimbaza, Sada, Fort Jackson
(iv) other proclaimed towns;
(v) resettled communities;
(vi) rural settlements.

We shall discuss each in turn.

Our main conclusions may be summarised as follows:

(i) Urban growth in the Ciskei is, as expected, dominated by the East London-Mdantsane complex and its extension to Berlin, King William's Town and Dimbaza. 75% of the population of Ciskei's proclaimed towns live in this area.

(ii) Given the number of employment opportunities both internally and across the border, we are justified in going a step further than Simkins (1982) and designating the populations of both Mdantsane and Zwelitsha districts as peri-urban.

(iii) Detailed study of a peri-urban settlement shows that peri-urban areas as defined in this study, have important advantages for their residents in terms of living costs, security and quality of life.

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APPENDIX I

SCREENING QUESTIONNAIRE

PATIENT NUMBER [ ][ ][ ][ ] (1–4)

1. Name .....

2. Address .....
.....

3. Age [ ][ ] (5–6)

4. Sex — Male = 1, Female = 2 [ ] (7)

+5. Marital Status [ ] (8)

*6. Occupation [ ][ ] (9–10)

7. Birthplace — South Africa = 1, India = 2 [ ] (11)

+8. Home Language (Vernacular) [ ] (12)

+9. Religion [ ] (13)

10. Betel Nut or Paan — Chewed = 1, Not Chewed = 2 [ ] (14)

[W][9][1][0][1] (15–19)

+Key to Screening Questionnaire (Appendix II)

*Key to Occupation (Appendix III)

APPENDIX II

KEY TO SCREENING QUESTIONNAIRE

2. RESIDENTIAL AREA

3. MARITAL STATUS

Single	= 1
Married or living together	= 2
Divorced, separated or widowed	= 3
Married migrant working living apart from family	= 4

6. OCCUPATION

(Appendix III)

8. HOME LANGUAGE

Tamil	= 1
Telegu	= 2
Hindi	= 3
Gujarati	= 4
Urdu	= 5
Other Indian	= 6
English and/or Afrikaans	= 7
Unspecified	= 8

9. RELIGION

Hindu	= 1
Muslim	= 2
Christian	= 3
Other	= 4

APPENDIX III

OCCUPATION
(South Africa, 1962, Dept. of Statistics)

PROFESSIONAL, TECHNICAL AND RELATED WORKER

Physical Scientist ..... = 01
Physical Science Technician ..... = 02
Architect, Town Planner, Quantity Surveyor ..... = 03
Engineer ..... = 04
Surveyor ..... = 05
Draughtsman ..... = 06
Engineering Technician ..... = 07
Aircraft/Ship's Officer ..... = 08
Life Scientist ..... = 09
Life Science Technician ..... = 10
Medical Doctor, Dentist, Veterinarian ..... = 11
Nurse, Midwife, Auxiliary Nurse ..... = 12
Medical Auxiliary Services ..... = 13
Other Medical Worker ..... = 14
Accountant ..... = 15
Jurist ..... = 16
Teacher ..... = 17
Worker in Religion ..... = 18
Other Professional and Technical Worker ..... = 19
Administrative and Managerial Worker ..... = 20

CLERICAL AND RELATED WORKER

Clerical Supervisor ..... = 21
Government Executive, Control Official ..... = 22
Transport and Communication Supervisor ..... = 23
Other Clerical and Related Worker ..... = 24

SALES WORKER

Manager (Wholesale and Retail Trade) ..... = 25
Working Proprietor (Wholesale and Retail Trade) ..... = 26

Insurance/Real Estate Agent, Auctioneer ..... = 27
Technical Salesman, Commercial Traveller ..... = 28
Other Sales Worker N.E.C. ..... = 29

SERVICE WORKER

Manager (Catering and Accommodation) ..... = 30
Working Proprietor (Catering and Accommodation) ..... = 31
Other Housekeeping Service Worker ..... = 32
Building Caretaker, Cleaner ..... = 33
Launderer, Dry-Cleaning ..... = 34
Hairdresser, Barber, Beautician ..... = 35
Workers in Protective Services ..... = 36
Guide, Undertaker and other Service Worker ..... = 37

FARM AND FORESTRY WORKER, FISHERMAN, HUNTER

Farm Manager, Farm Foreman ..... = 38
Farmer, Nurseryman, Market Gardener ..... = 39
Agricultural and Animal Husbandry Worker ..... = 40
Forestry Worker ..... = 41
Fisherman, Hunter and Related Worker ..... = 42

PRODUCTION AND TRANSPORT WORKER AND LABOURER

Production Supervisor, General Foreman ..... = 43
Miner, Quarryman, Well Borer ..... = 44
Metal Processor ..... = 45
Wood Preparation Worker ..... = 46
Chemical Processor and Related Worker ..... = 47
Spinner, Weaver, Knitter, Dyer ..... = 48
Baker, Pastry-Cook, Confectioner ..... = 49
Other Food and Beverage Processor ..... = 50
Tailor, Dressmaker, Sewer, Upholsterer ..... = 51
Shoemaker, Leather Goods Maker ..... = 52
Cabinet Maker and Related Worker ..... = 53
Blacksmith, Toolmaker, Machine-Tooloperator ..... = 54
Machine Fitter, Precision-Instrument Maker ..... = 55

Mechanic (Non-Electrical) ..... = 56
Plumber, Pipe Fitter ..... = 57
Welder, Flame Cutter ..... = 58
Sheet-Metal Worker ..... = 59
Structural Metal Preparer and Erector ..... = 60
Jeweller and Precious Metal Worker ..... = 61
Glass Former, Potter and Related Worker ..... = 62
Rubber/Plastic Product Maker ..... = 63
Printer and Related Worker ..... = 64
Painter ..... = 65
Production and Related Worker N.E.C. ..... = 66
Bricklayer, Carpenter, Construction Worker ..... = 67
Stationary Engine Operator ..... = 68
Docker, Freight Handler and Related Worker ..... = 69
Ship's Rating, Barge Crew and Boatman ..... = 70
Railway Engine-Driver and Fireman ..... = 71
Railway Brakeman, Guard, Signalman ..... = 72
Driver (Road Transport) ..... = 73
Labourer N.E.C. ..... = 74

HOUSEWIFE ..... = 75

PUPIL, SCHOLAR, STUDENT ..... = 76

RETIRED ..... = 77

NOT CLASSIFIABLE BY OCCUPATION ..... = 78

APPENDIX IV

INTERVIEW QUESTIONNAIRE

PATIENTS NAME .....

ADDRESS .....

.....

PATIENT NUMBER ☐☐☐☐

1. Patient chews = 1
   Patient non-chewer but with symptoms = 2
   Patient is a control = 3 ☐ 5

2. BETEL NUT CHEWING Yes = 1, No = 2 ☐ 6

   Number per day ☐☐ 7 8

   HOW USED Chewed and swallowed = 1
   Held in Buccal Sulcus only = 2
   Chewed and held in Buccal Sulcus = 3 ☐ 9

   TYPE White Betel Nut = 1
   Black Betel Nut = 2
   Bitter Betel Nut = 3 ☐ 10

   DURATION ☐☐ 11 12

3. PAAN/CHEWING Yes = 1, No = 2 ☐ 13
   (Betel package)

   Number per day ☐☐ 14 15

CONSTITUENTS	Leaf Only	= 1	
	Leaf & Lime	= 2	
	Leaf & Nut	= 3	
	Leaf & Nut & Lime	= 4	
	Leaf & Nut & Catechu	= 5	
	Leaf & Nut & Lime & Catechu	= 6	
	Leaf & Nut & Lime & Tobacco	= 7	
	Leaf & Nut & Lime & Tobacco and Catechu	= 8	
	Other	= 9	☐ 16
OTHER - SPECIFY			☐ 17
DURATION			☐☐ 18 19

4. FOOD - SPICING

	Unspiced	= 1	
	Spiced	= 2	☐ 20
Chillies	No Chillies	= 1	
	Mildly Chillied	= 2	
	Highly Chillied	= 3	☐ 21
Type-Chillies	Powdered Chillies	= 1	
	Green Chillies	= 2	
	Both	= 3	☐ 22
Pickles	No Pickles	= 1	
	Chilli Pickles:		
	Without Vinegar	= 2	
	With Vinegar	= 3	☐ 23
Type-Pickled	Tiny Chilli	= 1	
	Large Chilli	= 2	
	Peppers	= 3	☐ 24

5. SMOKING — Yes = 1, No = 2 — ☐ 25

HOW MANY YEARS? — ☐☐ 26 27

TYPE — Cigarette = 1; Cigars = 2; Pipe = 3; Other = 4 — ☐ 28

NO. PER DAY — ☐☐ 29 30

TOBACCO CHEWING - DESCRIBE — Yes = 1, No = 2 — ☐ 31

SNUFF - DESCRIBE — Yes = 1, No = 2 — ☐ 32

6. ALCOHOL — Yes = 1, No = 2 — ☐ 33

HOW MANY YEARS? — ☐☐ 34 35

PATTERN — Daily = 1; Weekly = 2 — ☐ 36

TYPE — Wine/Beers = 1; Spirits = 2; Both = 3; Others = 4 — ☐ 37

7. COMPLAINTS

Pain — Yes = 1, No = 2 — ☐ 38

Burning/Discomfort — Yes = 1, No = 2 — ☐ 39

Inability to open Mouth — Yes = 1, No = 2 — ☐ 40

DURATION — ☐☐ 41 42

8. FEATURES WITH EXAMINATION

Burning sensation with spicy food — Yes = 1, No = 2 — ☐ 43

Burning sensation with ordinary food — Yes = 1, No = 2 — ☐ 44

Burning sensation intermittent — Yes = 1, No = 2 — ☐ 45

Burning sensation with betel leaf or betel nut

Leaf — Yes = 1, No = 2 — ☐ 46

Nut — Yes = 1, No = 2 — ☐ 47

Dryness of Mouth — Yes = 1, No = 2 — ☐ 48

Numbness — Yes = 1, No = 2 — ☐ 49

Referred Pain - Earache — Yes = 1, No = 2 — ☐ 50

Dysphagia — Yes = 1, No = 2 — ☐ 51

Vesicles — Yes = 1, No = 2 — ☐ 52

Ulcers — Yes = 1, No = 2 — ☐ 53

W	9	2	0	1

54 58

PATIENTS NAME .....

ADDRESS .....

.....

1. INTRA-ORAL EXAMINATION

1.1	Any limitation of mouth opening	Yes = 1 No = 2	☐ 5
	If "yes" how many mm		☐☐ 6 7
1.2	Any limitation of tongue movement	Yes = 1 No = 2	☐ 8
1.3	Is there any blanching	Yes = 1 No = 2	☐ 9
	Buccal Mucosa	Yes = 1 No = 2	☐ 10
	Labial Mucosa	Yes = 1 No = 2	☐ 11
	Soft Palate	Yes = 1 No = 2	☐ 12
	Hard Palate	Yes = 1 No = 2	☐ 13
	Uvula	Yes = 1 No = 2	☐ 14
	Tongue	Yes = 1 No = 2	☐ 15
	Floor of Mouth	Yes = 1 No = 2	☐ 16
1.4	Any Fibrous Bands Present	Yes = 1 No = 2	☐ 17
	Buccal Mucosa	Yes = 1 No = 2	☐ 18

Labial mucosa	Yes = 1 No = 2	☐ 19
Soft palate	Yes = 1 No = 2	☐ 20
Uvula	Yes = 1 No = 2	☐ 21
Tongue	Yes = 1 No = 2	☐ 22
Floor of mouth	Yes = 1 No = 2	☐ 23
Is there reduced rima oris If "yes" give diameter in mm	Yes = 1 No = 2	☐ 24
Is there a contracted isthmus faucium If "yes" describe:	Yes = 1 No = 2	☐ 25
Can the patient whistle	Yes = 1 No = 2	☐ 26
Any lesions of right cheek If "yes" describe:	Yes = 1 No = 2	☐ 27
Any lesions of the left cheek If "yes" describe:	Yes = 1 No = 2	☐ 28
Any lesions of palate If "yes" describe:	Yes = 1 No = 2	☐ 29
Lesions of the tongue Describe:	Yes = 1 No = 2	☐ 30
Lesions of fauces and pharynx Describe:	Yes = 1 No = 2	☐ 31
Lesions of floor or mouth Describe:	Yes = 1 No = 2	☐ 32
Lesions of the face Describe:	Yes = 1 No = 2	☐ 33

2. MEDICAL HISTORY

Allergies	Yes = 1 No = 2	☐	34
Asthma	Yes = 1 No = 2	☐	35
Steroid treatment	Yes = 1 No = 2	☐	36
Diabetes mellitus	Yes = 1 No = 2	☐	37
Rheumatoid arthritis	Yes = 1 No = 2	☐	38
Anaemia	Yes = 1 No = 2	☐	39
G.I. disorder	Yes = 1 No = 2	☐	40
Loss of weight	Yes = 1 No = 2	☐	41
Menstrual history	Abnormal = 1 Normal = 2	☐	42
Other	Yes = 1 No = 2	☐	43

W	9	2	0	2

44 48

APPENDIX V(a)

PROJECTED OCCURRENCE OF CHEWERS IN THE 1980 POPULATION

AGE	SURVEY	POPULATION FEMALES	MALES	TOTAL
10-14	2	316 (0,7%)	1 (0,7%)	626 (0,7%)
15-24	6	3 397 (4%)		3 387 (2%)
25-34	17	8 123 (12%)		8 090 (5,8%)
35-44	32	10 532 (22%)		10 446 (11%)
45-54	41	7 831 (25%)	788 (3%)	8 377 (14%)
55-64	37	4 146 (24%)	230 (1,4%)	4 323 (12,6%)
65+	51	3 125 (31%)	395 (4%)	3 450 (17,3%)
10+	186	37 470 (12%)	1 723 (0,5%)	38 699 (6,4%)
All ages		(9%)	(0,4%)	(5%)

APPENDIX V(b)

PROJECTED OCCURRENCE OF CHEWERS WITHOUT OSF

AGE	SURVEY	POPULATION FEMALES	MALES	TOTAL
10-24	1		310 (0,7%)	313 (0,4%)
15-24	2	1 132 (1,4%)		1 129 (0,7%)
25-34	4	1 911 (2,7%)		1 904 (1,5%)
35-44	19	6 254 (13%)		6 202 (6,5%)
45-54	21	3 810 (12,2%)	591 (2%)	4 291 (7%)
55-64	28	3 080 (17,7%)	230 (1,4%)	3 271 (9,5%)
65+	40	2 361 (23%)	395 (4%)	2 706 (13,6%)
10+	115	18 548 (6%)	1 526 (0,5%)	19 816 (3,2%)
All ages		(4,4%)	(0,3%)	(2,4%)

APPENDIX V(c)

PROJECTED OCCURENCE OF CHEWERS WITH OSF

AGE	SURVEY	POPULATION FEMALES	MALES	TOTAL
10-14	1	316 (0,7%)		313 (0,3%)
15-24	4	2 265 (2,7%)		2 258 (1,5%)
25-34	13	6 211 (8,8%)		6 187 (4,4%)
35-44	13	4 279 (8,8%)		4 244 (4,4%)
45-54	20	4 021 (13%)	197 (0,7%)	4 086 (6,8%)
55-64	9	454 (6%)		1 052 (3%)
65+	11	764 (7,5%)		744 (3,7%)
10+	71	18 310 (6%)	197 (0,06%)	18 884 (3%)
All ages		(4,4%)	(0,04%)	(2,3%)

APPENDIX V(d)

CRUDE PROJECTED OCCURRENCE OF ORAL CANCERS IN THE POPULATION

REFERRED OSF CASES	129	10 CANCERS
SURVEY OSF CASES	71	0
	200	10 CANCERS
		(5%)

PROJECTED OSF CASES IN 1980 POPULATION

ALL AGES	FEMALE	MALE	TOTAL
	18 310	197	18 884*
5% CANCER	916	10	944

* The total of 18 884 does not equal 18 310 + 197 as the latter figures express a calculated sex related ratio.