Betel nut & tobacco chewing habits in Durban, Kwazulu Natal

by

Sabeshni Bissessur

A thesis submitted in partial fulfilment of the requirements for the degree MSc (Dent) in Dental Public Health, University of the Western Cape

September 2009

Supervisor: Prof Sudeshni Naidoo

Abstract

Betel nut/quid chewing is a habit that is commonly practiced in the Indian subcontinent. This age-old social habit is still practiced by Indians in Durban, Kwazulu Natal (South Africa). The betel nut/quid is prepared in a variety of ways. The quid may be prepared with or without tobacco. This habit is said to be associated with the development of premalignant lesions, namely, Oral Submucous Fibrosis (OSF) which increases the susceptibility for malignancy of the oral mucosa and the foregut. The aim of this study was to investigate the prevalence of betel nut/quid chewing (with or without tobacco), the associated habits (smoking and alcohol consumption) and awareness of the harmful effects of the chewing habit among Indians in Durban, KwaZulu-Natal.

A cross-sectional study design was chosen utilising a self-administered questionnaire and semi-structured interviews to collect data. Consenting participants were requested to complete a self-administered, structured questionnaire. The study population included any person in the Durban area who chewed betel nut/quid/tobacco. Only persons willingly and who consented to be part of the study, were included. The sample size was based on convenience. People were approached at the pan shops, leisure markets, traditional functions and at the dental practice the researcher operated at. A total of 101 respondents were interviewed.

A significantly higher proportion of females chewed betel nut/quid from the total of the respondents. The results showed that the habit is increasingly practiced in the younger age group (20-39 years). There was evidence to show that the chewing habit is used more by the employed than the unemployed (p=0.055). Of the sample population, 78% were born in South Africa and the rest were immigrants from Pakistan, India and Dubai. All respondents from the migrant community were males. The most important reasons for chewing betel nut were for enjoyment and at special functions. More than two third indicated family members (aunts, uncles and cousins) influence as a reason for chewing, in comparison to influences by parents or grandparents. The study also indicated that parents were far more likely to influence betel nut chewing if grandparents did so (p-value= 0.000). In addition, the study revealed that family members (aunts, uncles and cousins) were far more likely to influence betel nut chewing if parents did so (p=0.000).

The most popular ingredients chewed were betel nut, betel leaf, lime and pan masala and the most popular combinations were betel nut/lime/betel leaf quid preparation, betel nut alone, betel nut/betel leaf/lime/tobacco/pan masala and betel nut/betel leaf/lime/pan masala. Two thirds of the respondents do not know that betel nut chewing is harmful to their health, thus indicating a lack of awareness on the risks associated with the chewing habit, and the majority have not attempted to give up the habit. Most of the respondents retained their chewing habits after being informed about the risks. A little more than half the study population reported neither smoking nor drinking.

The present study found that betel nut/quid chewing habits continue to be enjoyed by many people and most are unaware of the hazardous effects of the habit. More younger people are using the habit as compared to previous studies. This is probably because it is an affordable and easily accessible habit. It is recommended that aggressive awareness programmes on the harmful effects of betel nut/quid chewing be developed, similar to that for smoking cessation. Government health warnings need to be instituted, for example, by having written warnings on packagings. Taxes need to be imposed on the betel nut and condiments thereby reducing access to most people. Age restrictions need to be imposed on purchasing of the betel nut/quid thus making access difficult for the children.

Keywords: Betel nut; betel quid; areca nut; pan masala; oral submucous fibrosis

Declaration

I, the undersigned, hereby declare that the work contained in this dissertation is my original work and that it has not been previously in its entirety or in part submitted at any university for a degree.

…… ……

Sabeshni Bissessur Date

Dedication

I dedicate this research to my loving parents Bala and Salo Pillay, to my devoted husband Satish Bissessur and to my very special son Ketan Bissessur.

Table of Contents

LIST OF TABLES

LIST OF FIGURES

LIST OF ABBREVIATIONS

OSF	Oral Submucous Fibrosis
OL	Oral leukoplakia
OLP	Oral lichen planus
OSCC	Oral squamous cell carcinoma
SP	Squamous papilloma
TSNA	Tobacco-specific *N*-nitrosamines
NNN	Nitrosonornicotine
NNK	(4-(methylnitrosoamino)-1-(3-piridyl)-butanone)
BCM	Betel chewers mucosa

ACKNOWLEDGEMENTS

Taking on the role of daughter, wife, mother and professional is a challenging and adventurous task on its own, and adding a Masters programme to this equation has been very challenging. Therefore without the following people my research would not have been successful:-

First and foremost I would like to thank the higher power for giving me the strength and guidance to pursue this postgraduate course.

I would like to thank my very special supervisor, Professor Sudeshni Naidoo, for her never failing professional guidance and invaluable input and for steering me in the right direction from the very start to the end of my research. I appreciate that you always took the time to communicate with me at all times irrespective of your very busy schedule. You have inspired me and enriched me as a postgraduate student in many ways.

I would also like to express my sincere gratitude and thanks to Prof. Aubrey Sheiham for making it possible for me to pursue postgraduate study.

I want to say “thank you” to my soul mate, Satish Bissessur. Without your steadfast support, unfaulting love, care and organizational skills, my research would not have been possible. Thank you for standing by me at all times, even through the impossibilities, thus making it possible. Experiencing this research project together with you, only reiterated how strong a bond we share. Thank you for being the very special person you are. Thank you to my precious son, Ketan Bissessur, who never complained when he had to walk through the different areas during research with me. I am simply blessed to have such a loving, understanding and encouraging child by side.

Thank you to my supportive and dedicated parents, Bala and Salo Pillay, who never stop encouraging me in all aspects of my life, making me the person I am today. I love you always. Thank you to Nischal and Joan Bissessur, who also supported me through my research. I appreciate all the time that you took to make my research possible and for always spurring me on to achieve a successful outcome. Thanks guys, you also make up a very special part in my life.

CHAPTER 1: INTRODUCTION

Chewing *areca nut*/betel quid is an ancient practice common in the Indian subcontinent and it is estimated that 600 million people chew it worldwide (Reichart and Philipsen, 2005). It is a habit that is also practiced among the Indians in Durban, KwaZulu-Natal, South Africa. The nut is chewed alone or in a quid form. The quid is prepared by wrapping chopped *areca nuts* (betel nuts) in a leaf of the vine, *Piper betel*. Tobacco and lime may be added to improve the taste. The quid is known colloquially as 'pan' (Ahmed, 1997). In addition, a variety of condiments are added to the quid including fennel sweets, coconut, honey/syrup and catechu. Furthermore, spices—such as cardamom, saffron, cloves, aniseeds, turmeric, and mustard—or sweeteners may also be added as flavourants (Centers for Disease Control and Prevention, 2007). The choice of quid preparation depends on personal preferences.

The chewing habit is enjoyed among all sections of society, including men, women and quite often, children (Gupta, 2004). In Durban (South Africa), *areca nut* is sold in various forms and served at restaurants, enticing the younger generation to consume it and this has potential for addiction/habit forming. The habit is associated with oral cancer, oral leukoplakia and oral submucous fibrosis (OSF). It is important to make people aware of the harmful effects of *areca nut*/quid use. However encouraging people to abandon the habit, may not be so simple, as *areca nut* is said to be the fourth most commonly used psychoactive substance in the world, after caffeine, nicotine and alcohol, and several hundred million people use it (Gupta, 2004). The chemical composition of the nut is varied, containing a number of psychoactive alkaloids, with arecoline being present in the greatest quantity. There is evidence that arecoline may act as a GABA uptake inhibitor that may have relaxant qualities. As such, the *areca nut* appears to produce the similar effects that tobacco does, therefore supporting it to be an addictive habit (Winstock, 2000).

Many are unaware of the effects of chewing *areca nut*/betel quid and its associated risk factors. The synergistic effects of smoking, betel nut use and alcohol drinking have been documented for oral leukoplakia and cancer in South Asia (Ariyawardana, 2007). Therefore, it is important to bring about an awareness of the risks of combining alcohol and smoking to the *areca nut*/quid

chewing habit. In Durban (South Africa), no recent literature on the prevalence of the habit has been documented, however past published data suggests that it was a habit that was more common among the elderly (Seedat, 1985).

The purpose of the present study was to assess the betel-nut chewing habits in the Indian population of Durban, Kwa-Zulu Natal. It was important to ascertain the various forms in which areca nut is chewed, and to determine the associated risk factors (slaked lime, tobacco leaves, smoking and alcohol consumption). In addition, it is also important to determine the knowledge of the health risks associated with the habit, as well as the relationship between betel nut chewing, demography and high risk behaviors (alcohol consumption and smoking). The chapter following include a review of the literature, methodology, results and a discussion of the findings.

CHAPTER 2: LITERATURE REVIEW

2.1 Introduction

This chapter includes pertinent literature and provides a historical background to global *areca nut*/quid chewing habits. It also describes the risk factors and it's effects on the oral cavity.

2.2 History and characteristics of betel quid chewing around the world

The habit of chewing betel quid*/areca nut* has been reported from many countries including Pakistan, Sri Lanka, Bangladesh, Thailand, Cambodia, Malaysia, Indonesia, China, Papua New Guinea, several Pacific islands and migrant populations like those in South Africa and Eastern Africa, the UK, North America and Australia (Gupta, 2002). The chewing of betel quid is practiced in several different ways in various countries, while the major components are comparatively consistent (Lee et al., 2003). Betel nut chewing habits still continue among the South African Indian population. The Indian populous in South Africa is 1.2 million with Durban having the largest population of Indians outside India (Statistics South Africa, 2005).

In **South Africa** the *piper betel vine* is locally grown, but the *areca nut* is imported from India. *Areca nut* is chewed on its own or in a quid form. For the quid, the *areca nut* is cut into pieces or shaved into thin slivers that are added to a mixture of coconut, sweets, fennel seeds, cardamom, syrup, lime or tobacco that may or may not be added depending on personal preferences. The latter ingredients are then wrapped in a betel leaf or the leaf is made into cone shape and the preferred ingredients are filled into the leaf. The *areca nut* is eaten raw, baked or boiled. *Areca nut* and condiments are available at the leisure markets, a selection of Eastern restaurants, paan shops and supermarkets. Traditionally, the *betel nut* and condiments are offered to guests on a tray or packed in little bags or boxes at weddings and christenings. Culturally, *areca nut* and betel leaf are first offered to the Deities (Hindu Gods) and then consumed. In the city of Durban (S.A), it was found that 30.7% of women practiced the chewing habit while only 5.5% of men were chewers. The habit was more common in the elderly, 71.9% of women over 60 years and 10.3% of men in the same age group (Seedat & van Wyk, 1988 (a)).

In **Malaysia**, betel quid usage is highest among indigenous groups, who also add *tobacco* to the quid. In mainstream/urban Malaysian society, the ethnic Indians incorporate *tobacco* in betel quid, but the Malays do not (Gupta, 2004). In rural Sarawak, *areca nut* is essentially an item of local produce. *Areca nut* is known as *pinang*. It was reported that 22% of men and 47% of women used *areca* daily. The habit tended to begin in young adulthood and women were more regular chewers than men (Strickland and Duffield, 1997; Gupta, 2002) and nearly a quarter were current chewers. Again, the habit was more prevalent in women. **Malay** quid users do not use *tobacco* in their quid mixture (Gupta and Warnakulasuriya, 2002).

In **Sri Lanka** the habit of *areca* chewing stems from ancient times and traditionally it is chewed with a betel leaf sprinkled with *lime. Tobacco* may be added to the quid. The betel leaf is usually chewed with one or more of three other ingredients, namely, *areca nut* (*Areca catechu*), lime (*calcium hydroxide*), and the leaf of a special grade of *tobacco* (Senewiratne, 1972). A large scale epidemiological study in rural villages in the Central Province of Sri Lanka, reported that half of men and women chew the betel quid (Warnakulasuriya, 1992). In a nationwide survey (1994-95) of 4000 adults over 35 years of age, the reported prevalence was 33.7% among 35-44 year olds and 47.7% among 65-74 year olds (Ministry of Health, 1998).

In **Kerala**, India, *raw areca nut, tobacco* and *shell lime* are preferred. Typical users smear one or two betel leaves with *shell lime* and place them in their mouths, and while chewing a few pieces of *areca nut* are added. About 5 g of *tobacco* from a strip are then snapped off by hand or cut with a knife and added to the bolus in the mouth. The bolus is kept in the mandibular groove. On average a person may chew a quid five to ten times a day (Bhonsle, 1992).

In **Vietnam** betel quid chewing is still prevalent. However, the chewing habit is said to be on the decline. Only 6.7% of the female population still indulge in the habit. The association of betel quid chewing and oral cancer is still of important, however Reichart and Nguyen (2008) believe that eventually the betel quid chewing habit will vanish from Vietnam and only play a role in socio-ritual contexts.

In **Guam,** unripe *areca nuts* are chewed by themselves or with betel leaves. Some habitual chewers in Guam add *smokeless tobacco* (Gupta, 2004). In **Papua New Guinea**, betel quid chewers apply the *lime* separately with a spatula to the commissure of the mouth (Pindborg et al., 1992). Among aboriginal groups of Southeast Asian countries, betel quid chewers commonly add *tobacco* to the quid and additionally smoking habits are also common among such populations (Gupta, 2004). *Areca nut* is known here colloquially as *daka. Lime* is available in the powdered form (Gupta, 2002).

The hill tribes of **Thailand, Cambodia, Myanmar and Laos** include condiments like *cloves, cinnamon* and the *roots of certain local plants* in their betel quid (Awang, 1983). In Thailand *areca nut* is known colloquially as *mak* (Gupta, 2002). In most countries, the habit appears to be confined to the elderly, while retaining ceremonial value in some areas. In Thailand, a decline was recorded several decades ago (De Young, 1995) and reconfirmed recently (Reichart, 1995).

Betel chewing enjoys island-wide popularity among the 20 million inhabitants of **Taiwan** and the number of current and ex-users was estimated at 2.0 million. An increased consumption has been reported especially among children and youth, due to an upsurge in marketing and production of *areca nut* and the sale of ready-made quid in the shops. Lu et al (1993) reported that among 2442 junior high school students in Changshua country, 6.4%, 3.7% and 3.0% of students in rural, semi-urban and urban areas respectively were chewers. More than half of the habitual chewers first tried it with a family member, most often the father or grandfather (Lu et al., 1993). In other school surveys in Taiwan, betel quid use was found to be more common among boys than girls and among students who smoked, consumed alcohol and had friends who chewed betel quid (Lu et al., 1993 and Yang et al., 1996; Ho et al., 2000). In Taiwan, the betel quid is prepared in two different ways. In one, used mainly by Aborigines, fresh *areca nut* was simply wrapped with betel leaf and in another, popular mainly among Chinese, a lengthwise piece of betel fruit and a *lime paste* was sandwiched between two halves of an *areca nut*. A high proportion of chewers also smoke and drink, but *tobacco* was not chewed together with the betel quid (Ko, 1992). They also consume *Laohwa quid,* where a split *areca nut* is sandwiched with the *inflorescence (flower)* of *piper betel Linn,* spiced with red lime. Another preparation, the *stem quid*, where a split *areca*

fruit is sandwiched with the stem of the *piper betel Linn,* spread with white *lime* is used exclusively by Aborigines in a home grown enviroment (Wen et al., 2005).

Apart from the Province of Taiwan, betel chewing is also found on the **Chinese mainland** commonly in the Hunan and Hainan Island Province (Zhang and Reichart, 2007). The *areca nut* chewing is carried out in the following way: the betel fruit is cut in orange-like slices and peeled. On a betel leaf from *piper betel, slaked lime* is smeared. The *areca nut* and the betel leaf is then placed in the mouth and chewed. The Chinese do not chew *tobacco* together with the *areca nut*, in contrast to other countries (Pindborg et al., 1984). In Xiangtan, Hunan province, the betel quid chewed usually does not contain *areca 'nut* but consists of the husk (Zhang et al., 2008).

In the Pacific island of **Palau**, *areca nut* is chewed in the green unripe state, one half at a time with *slaked lime (made from fire-burned coral*) and *tobacco*, wrapped in a piece of betel leaf. The ingredients for a single chew (including *tobacco* from half a cigarette) are sold in many shops. A prevalence study conducted in 1995 on 1110 residents of two states, found that 72% of males and 80% of females chewed *areca nut* (betel quid), 80% of whom incorporated *tobacco* in their quid (Gupta, 2004).

In **Cambodia**, most users add *tobacco* to their quid, while others use it to rub the gums/clean the teeth after chewing betel quid. Most users are elderly women. In a community based study, over a third of women over the age of 15 years chewed betel quid. Most of the women chewers were above the age of 39 and men over the age of 50. Smoking was the most prevalent tobacco habit in men, but was uncommon in women. The betel quid is usually chewed first and then a large wad of finely cut *tobacco* is used to clean the teeth. It is then kept in the mouth for a period of time (Gupta, 2004).

Among primary school children in Karachi, **Pakistan** nearly three quarter of children used *areca nut* and 35% used betel quid daily. More boys chewed *areca nut* than girls (72% *vs.* 30%). Most areca users first tried it with a family member (42%) or a friend (26%), and most (68%) consumed three or more packets a day. Most betel quid users reported using sweetened *areca nut* (Shah, 2002).

Betel quid is prepared in many different ways especially so in **India**. The most common way is to use half a large leaf, one medium or two small-sized betel leaves, smear them with *slaked lime* and a small amount of a *catechin-containing substance (catechu, gambir, or kath*, but not in the southern region), along with pieces of *areca nut*.

Only ripe *areca nut* is used, usually after curing (generally by roasting or boiling in water). Betel quid can be prepared plain (or astringent) or sweet. Sometimes *cardamom* and often *tobacco* are added to the plain variety. In the *sweet variety, cardamom, cloves, coconut, sugar crystals, camphor, amber, nutmeg, mace* and even *colouring agents* are commonly added. In north eastern parts of India, fermented *areca nut* called *'Tamol'* is frequently used. Habitual users generally include *tobacco,* which can be raw and unprocessed or processed with a *mixture of spices* and often sweetened with *unrefined sugar* or *artificial sweeteners* and flavoured (Gupta, 2004).

2.3 Betel Quid Use in Migrant Communities

Betel quid and *areca nut* chewing are also widely practiced in many Asian migrant communities elsewhere in the world. The habit is popular among immigrants resident in the United Kingdom, other parts of Europe, North America, Australia and South Africa. The United Kingdom is the largest importer outside of Asia, and imports having doubled since the early 1980's. Young children have been found to start using sweetened *areca-nut* products, often adding tobacco later in their adolescence (WHO, 2003). South Asian communities in the UK are considered a high-risk group for oral cancer, primarily because of their betel-quid chewing habits. The major betel quid-using communities in the UK include those originating from Bangladesh, Pakistan, Sri Lanka and India, especially Gujarat. Over 80% of adults of Bangladeshi decent in London use betel quid regularly with no gender difference. Tobacco is commonly, but not universally added (Gupta, 2004).

South Asian immigrants in the United States are among the fastest growing segment of the population and India was the second highest country of origin for legal immigrants admitted in 2001. New York City is a magnet for immigrants from India and Bangladesh. Indians represent the second largest Asian group, comprising one-fourth of the City's Asian population. Paan and Gutka are legal and easily available in South Asian neighborhoods in New York City, at

approximately a dollar for two sachets of paan. The exact extent of *paan* and *gutka* use in the U.S. is unknown. However, the growing popularity of *gutka* use has concerned the public health community (Changrani, 2006).

The Indian population in South Africa owe their presence to the system of indentured labour that the British Raj in India and the British colonies began in 1837 and ended in 1917. They constitute a heterogeneous society composed of many distinct ethnic groups and many of their attitudes and patterns of social life are traditional (Seedat & van Wyk, 1988 (a)). *Areca nut* and accompaniments are readily available at social gatherings, leisure markets, restaurants and various supermarkets. It was previously reported that the habit was age-related and that the majority of the chewers were female in the age group of 65 years and older (Seedat & van Wyk, 1998 (a)). There is now a large number of Indians from Pakistan living in South Africa and many pan outlets are owned by the Pakistan Indians.

2.4 Common Preparations

Globally there are wide variations in the ingredients and preparation of betel quid. *Areca nut* is obtained from *areca catechu* (Gupta, 2002). There are several forms of *areca nut (green unripe; baked roasted or boiled; fermented; or processed with sweeteners and flavours),* betel *(leaf or inflorescence)* and ingredients consisting of *spices, condiments, tobacco and lime* (Gupta, 2004). Globally, *areca nut* is most commonly accompanied by the *leaf of Piper betel*. This has led to *areca nut* being labeled erroneously as betel nut in the English literature. Apart from the leaf, other parts of the betel vine, such as *stem, inflorescence (flower; pods) or catkins* are also consumed with the *areca nut*. Consumption of the *inflorescence* is common in Melanesia and in parts of Taiwan (Gupta, 2002). Lime (*calcium hydroxide*) which is often used in combination with *areca nut* is obtained in coastal areas by heating the covering of shellfish (*sea shells*) or harvested from corals. In central areas of a country it is quarried from limestone. In Asian markets lime is sold as a paste mixed with water which is white or pink. *Catachu* is an extract of the Acacia tree *A. catechu* or *A. suma*. Catachu is often smeared on the betel leaf that is used to wrap the *areca nut* flakes (Gupta, 2002).

2.5 Newer, Imperishable Forms of Betel Quid

More recently, imperishable forms of betel quid have been marketed and their use has become common, especially among younger people (Gupta, 2004). In South Africa, these imperishable preparations can be purchased at leisure markets, supermarkets and are served at traditional gatherings and certain Indian restaurants.

Supari: Areca nut is known as *supari* in many North Indian languages. Some commercial *supari* preparations are made by cutting dry areca nuts into bits and roasting them in fat to which flavourings and sweetening agents and condiments are added. *Supari* is marketed in attractive aluminium foil packs, in tins and simple paper packets. Offering *supari* to guests, especially after meals, is a prevalent and well accepted social custom (Bhonsle, 1992).

Paaku: This is the South Indian term for areca nut. Some commercial preparations of *paaku* are made by cutting roasted areca nuts in small bits. Roasted coconut, flavouring agents and sweetening agents are then added to this. They may be sold in simple plastic packets or foil packets. Traditionally *paaku* is offered at weddings and other social gatherings.

Mainpuri: In the Mainpuri district of Uttar Pradesh and in nearby areas, this preparation is very popular. It contains mainly tobacco, slaked lime, finely cut areca nut, camphor and cloves. In a study of 35 000 individuals in the Mainpuri area, 7% of the villagers used this product (Bhonsle, 1992).

Mawa: This is a preparation containing thin shavings of areca nut with the addition of some tobacco and slaked lime. Its use is becoming popular in Gujarat, especially among the young; the habit is also prevalent in other regions of the country. *Mawa* is sold as a 10cm mass in cellophane. Some 5-6 g of areca-nut shavings are placed on the cellophane and about 0,3 g of tobacco are added; a few drops of watery slaked lime are sprinkled over this, and the contents are tied with a thread into a ball.

At the time of use, the packet is rubbed vigorously on the palm to homogenize the contents. It is then opened and a portion is taken into the palm. Sometimes only half of the *mawa quid* is chewed at once. A person may chew as many as 5-25 times a day (Bhonsle, 1992).

Gutka: Betel quid with tobacco, also known as gutka (ghutka or gutkha) is a dry, relatively nonperishable commercial preparation that consists of betel leaf (piper betel), tobacco, areca nut (areca catechu), catechu (extract from the Acacia catechu tree), and slaked lime (calcium hydroxide). Spices such as cardamom, saffron, cloves, anise seeds, turmeric, and mustard-or sweeteners are also added as flavourants. Gutka is available in tins or sachets. It is consumed by placing a pinch of the mixture in the mouth between the gum and cheek and gently sucking and chewing. The excess saliva produced by chewing may be swallowed or spat out (CDC, 2007).
Hogesoppu: Is a leaf tobacco used frequently by women in Karnataka, either by itself or with *pan* (Bhonsle, 1992).

Zarda: This is prepared by cutting tobacco leaves into small pieces and boiling them in water with slaked lime and spices until the water evaporates. It is then dried, and colouring and flavouring agents are added. It may be chewed by itself, with areca nut or in betel quid. It is available in small packets or tins (Bhonsle, 1992).

Pan Masala: This is a commercial preparation containing areca nut, slaked lime, catechu and condiments, with or without tobacco. It comes in attractive foil packets (sachets) and tins, which can be stored and carried conveniently. *Pan Masala* is available with or without tobacco. *Pan Masala* without tobacco is also extremely popular. Chewing paan without tobacco is known as *tambula* in Sanskrit. Pan Masala contains many of the ingredients of paan, but it is not perishable (Bhonsle, 1992)

2.6 Chewing habits and the lesions of the oral mucosa

A variety of mucosal lesions and conditions have been associated with betel-quid and tobacco habits, including smoking. A number of lesions, however, have been reported exclusively among betel-quid or tobacco chewers by investigators using various criteria for diagnosis and classification (Zain et al., 1999).

2.6.1 Chewer's Mucosa

This is a condition of the oral mucosa where, because of either direct action of the quid or traumatic effect of chewing, or both, there is a tendency for the oral mucosa to desquamate or peel. Loose and detached tags of tissue can be seen and felt. The underlying areas assume a pseudomembranous or wrinkled appearance. The area may also show evidence of incorporation of ingredients of the quid in the form of yellowish or reddish-brown encrustations (Zain et al., 1999). Chewer's mucosa was first defined by Mehta et al. (1971), and the same definition has used by other investigators, including Reichart et al. (1996).

This lesion should be distinguished from morsicatio buccarum and/ or labiorum, cheek or lip biting, which are very similar to betel chewer's mucosa in terms of clinical appearance (without stains) and histology. The differences are: cheek biting is unintentional, whereas chewer's mucosa results from an intentional habit, and the average age of the individuals with chewer's mucosa is usually higher, 50 years and older (Reichart et al., 1996), whereas in cheek biting it is generally found in younger age groups around 20-35 years (Reichart et al., 1996; Van Wyk et al., 1977).

2.6.2 *Areca Nut*-related Lesions

Areca nut chewers, as in chewers of other kinds of quids, may have clinically healthy mucosa with no textural or colour changes. However, buccal mucosa, either bi- or uni-laterally, may show an ill-defined whitish grey discolouration that can not be rubbed off. The mucosa, in addition, may show a rough linen-like texture and histologically show ortho- and/or para-

keratinized epithelium (Zain et al., 1999). Rarely, typical localized leukoplakias, erythroplakia, erythroplakia-like lesions (possibly due to trauma) and frank malignancies may be seen among areca nut chewers (Seedat & van Wyk, 1985).

2.6.3 Quid-induced Lesions

A localized lesion of the oral mucosa corresponding to the regular site of placement of a quid and characterized by one or more of the following characteristics (Zain et al., 1999):

- Change of normal colour
- A wrinkled appearance
- Thickening of the mucosa
- Scrapable or non-scrapable epithelial surface
- Presence of ulceration

Examples of such quid-induced lesions are (Zain et al., 1999):

- Tobacco and lime user's lesion
- Snuff-induced lesions
- *Areca*-quid lesions

2.6.4 Oral Submucous Fibrosis

Oral submucous fibrosis (OSF) is a chronic, progressive, high-risk precancerous condition of the oral mucosa seen primarily on the Indian subcontinent and in South-east Asia (Ranganathan, 2004). There is a higher occurrence of oral leukoplakia (OL) and cancer patients with OSF and it is believed to be an important risk factor for oral cancer among youth (Saraswathi et al., 2006).

2.6.4.1 Aetiology

Recent epidemiological studies in India and evidence from Indians living in South Africa point to the habit of chewing *areca nut* as the major aetiological factor of OSF. In recent years, commercial preparations like *pan masala* have become available abroad.
The main ingredient is *areca nut* together with *lime* and *catechu* wrapped in a betel leaf with or without tobacco. Many patients with OSF give a history of chewing *pan masala.*

It has been reported that *pan masala* chewing produces OSF changes in a shorter period of time than betel quid chewing (Kiran, 2007). In addition to local factors, systemic factors have also been suggested to play a role in the development of OSF. These include anaemia, chronic iron and vitamin B deficiency and genetic predisposition (Hazarey, 2007). Other suggested aetiologic factors include the chronic consumption of irritant chili pepper (Chen et al., 2006). *Arecoline*, the most abundant alkaloid in *areca nut*, has been observed experimentally to stimulate collagen synthesis by fibroblasts *in vitro* (Canniff and Harvey, 1981).

2.6.4.2 Clinical Features

The disease is characterized by blanching and stiffness of the oral mucosa, trismus, a burning sensation in the mouth, hypomobility of the soft palate and tongue, loss of gustatory sensation, and occasionally, mild hearing loss due to blockage of the Eustachian tubes (Chopra, 2000). Blanching is defined as a persistent, white, marble-like appearance of the oral mucosa that may be localized diffuse or reticular. This blanching however needs to be distinguished from the pale appearance of the mucosa due to vascular or hematological disorders, or from the loss of normal pigmentation (Zain et al., 1999). The disease is classified clinically into two phases (i) an eruptive phase, characterized by formation of erythema, vesicles, ulceration and a burning sensation in the mouth and (ii) a fibrosis induction phase, characterized by the disappearance of the vesicles and healing of the ulcers by fibrosis. The burning sensation decreases and blanching and stiffness of the oral and oropharyngeal mucosa occur. The two phases appear in a cyclic manner (Chopra, 2000).

There are several indications that OSF predisposes to cancer. Superimposed leukoplakias, occasionally of the speckled type, are often present and a considerable number of OSF cases are associated with epithelial dysplasia (WHO, 1980). Malignant transformation rates as high as 7.6% have been reported from the Indian subcontinent over a 17 year period. OSF shows characteristic histopathological features consisting of an atrophic epithelium with juxtaepithelial hyalinization and collagen of varying density (Kiran, 2007). OSF is a disease that produces changes similar to those of scleroderma but is limited to oral tissue (Chen et al., 2006). Reduced mouth opening, altered salivation and altered taste sensation were found to be significantly more prevalent in women when compared to men (Hazarey et al., 2007).

2.6.4.3 Prevalence of OSF and Habits

The importance of OSF lies in the inability to open the mouth and dysplasia giving rise to malignancy. The incidence of malignant change in patients with OSF ranges from 2 to 10%. The younger the person is, the more rapid the progression of the disease. *Areca nut* chewing, tobacco smoking and hypersensitivity to chillies are the precipitating/causative agents in genetically predisposed patients. People who have been diagnosed clinically or are suspected of oral submucous fibrosis, need to be encouraged to either restrict or eliminate their chewing habits so as to retard the disease process which is a premalignant condition. Furthermore, these patients require careful observation and follow-up visits (Chopra, 2000). Reverse smoking is a habit where the lit end of the cigarette is put into the mouth, the heat lies inside the mouth, while the cigarette is being held by the teeth and lips, the seal provided by the lips allows the slow inhaling of the cigarette. Air is supplied to the zone of combustion through the non heated extreme of the cigarette, at the same time the smoke is being expelled from the mouth and the ashes are thrown out or swallowed (Alvarez, 2008).

A study on reverse smokers reported changes in the oral mucosa. Biopsies showed the presence of a thick band of connective tissue found either over the muscle of the tongue or in the connective tissue over salivary glands on the palate and localized sometimes periductally. These findings were defined as being suggestive of OSF (Alvarez, 2008). During the 1960s and 1970s, OSF was a comparatively rare condition found mainly among older individuals. The popularity

of *areca nut* mixtures, like *mawa, pan masala* and especially *gutka,* has spawned an epidemic of OSF among young individuals in India. The high occurrence of OSF in the younger age groups has given rise to the notion that there will be a parallel increase in the incidence rates of oral cancer in this group, as suggested by data from a population-based cancer registry demonstrating a significant increase in oral cancer in the young (<50 years) (Gupta, 2007). In recent years a marked increase in the occurrence of OSF was observed in many parts of India like Bihar, Madhya Pradesh, Gujarat and Maharashtra and the younger generation are suffering more due to incoming of *areca nut* products in different multicoloured attractive pouches (Ahmad et al., 2006). It was found that exclusive areca nut chewing habit was significantly more prevalent in women (Hazarey et al., 2006), unlike for *Gutkha* (*Areca* quid with tobacco) and *kharra/Mawa* (crude combination of *areca nut* and *tobacco*) that was higher in men (Hazarey et al., 2006). A strong association between *gutkha* chewing and OSF has been confirmed and it has been found that *gutkha* produced OSF earlier than raw *areca nut* (Babu et al., 1996).

2.6.4.4 Treatment and Prognosis

All available treatments provide only short-lived symptomatic relief (Chopra, 2000). Successful treatment of oral submucous fibrosis with local injections of chymotrypsin, hyaluronidase, and dexamethasone has been reported. In resistant cases, surgical excision of the fibrotic bands with submucosal placement of fresh human placental grafts was found to be successful (Gupta, 1988). Habit restriction should be there in clinically suspected cases, to retard the disease process and as it is a premalignant condition, there is need for careful observation and follow up in each and every case (Chopra, 2000). Once the betel nut chewing habit has induced OSF there is no reversal of the disease after cessation of the habit and all the clinical and histological features of the disease remain. However, there are some indications that such changes can remain in remission once the habit is stopped (Seedat & van Wyk, 1988 (b)).

2.6.5 Oral Lichen planus

This lesion commonly affects the oral mucosa and lesions may occur in the mouth in the absence of skin lesions. A review of published studies concluded that the risk of developing squamous cell carcinoma in patients with oral lichen planus (OLP) is approximately 10 times higher than that in the unaffected general population (Drangsholt et al., 2001).

2.6.5.1 Aetiology

The aetiology is associated with various betel quid/tobacco habits. The prevalence of oral lichen planus (OLP) in betel quid chewers in Hunan (Mainland China) was 0.1% (Tang, 1993), 0.1% (Jian, 1989) and 0.15% (Liu, 1988). The prevalence of OLP in cases of OSF in Hunan was 3.2% (Gao, 2005), 1.3 % (Tan, 2004), 2.4 % (Tang, 1993) and 5.9% (Gao, 1990). The prevalence of OLP in cases of OSF in Hunan province studies was higher than the prevalence of OLP in non-OSF cases, which was 0.2% (Gao, 1990).

2.6.5.2 Clinical Features

Oral mucosal lesions are usually multiple and often have a symmetrical distribution. They commonly take the form of minute white papules that gradually enlarge and coalesce to form a reticular, annular or plaque pattern. A characteristic feature is the presence of slender white lines (Wickham's striae) radiating from the papules. In the reticular form there is a lace-like network of slightly raised grey-white lines, often interspersed with papules or rings. The plaque form may be difficult to distinguish from oral leukoplakia (OL), but in lichen planus there is usually no change in the flexibility of the affected mucosa. In some patients the lesions are atrophic, with or without erosions. Oral lesions of lichen planus may also include bullae, but these are rare. When the tongue is affected, the white patches rarely display a reticular pattern and the margins of the patches appear diffuse (WHO, 1980).

2.6.5.3 Treatment and Prognosis

There is currently no cure for oral lichen planus. Excellent oral hygiene is believed to reduce the severity of the symptoms, but it can be difficult for patients to achieve high levels of oral hygiene during periods of active disease. Treatment is aimed primarily at reducing the length and severity of symptomatic outbreaks. Asymptomatic reticular and plaque forms of OLP do not require pharmacologic intervention (Edwards, 2002).

The most widely accepted treatment for lesions of OLP involves topical or systemic corticosteroids to modulate the patient's immune response. Patients are instructed to apply a thin layer of the prescribed topical corticosteroid up to 3 times a day, after meals and at bedtime. The advantage of topical steroid application is that side effects are fewer than with systemic administration. Systemic steroid therapy should be reserved for patients in whom OLP lesions are recalcitrant to topical steroid management. Because of the possibility of increased risk of malignant transformation, periodic reassessment of all patients with OLP is recommended (Edwards, 2002).

2.6.6 Betel-quid lichenoid lesion

A new clinical entity, betel-quid lichenoid lesion, has been proposed to describe an oral lichen planus-like lesion associated with the betel quid habit (Zain et al., 1999). A quid-induced lichenoid oral lesion has been reported exclusively among betel quid users (Daftary, 1980). It resembles oral leukoplakia (OL) but there are specific differences. It is characterized by the presence of fine, white, wavy, parallel lines that do not overlap or criss-cross, are non-elevated, and in some instances radiate from a central erythematous area. The lesion generally occurs at the site of placement of quid. This lesion was described as a lichen planus-like lesion but is now termed a betel-quid lichenoid lesion. This lesion may regress with decrease in frequency, duration or change in site of placement of the quid. There may be complete regression when the quid habit is given up (Zain et al., 1999).

2.6.7 Oral Leukoplakia

Oral leukoplakia (OL) is defined as a white patch, or plaque, that cannot be characterized clinically or pathologically as any other disease (WHO, 1980). Of all potentially malignant lesions and conditions of the oral mucosa, OL is the most common (Reichart, 2001). The annual incidence of malignant transformation shows wide geographical variations, most probably due to different tobacco habits. Although 6% of all OL will transform over a 10 year period, histologically dysplastic lesions transform in 16-36% of cases (Lumermann, 1995).

2.6.7.1 Aetiology and Prevalence

The aetiology of the condition is not well defined. Oral leukoplakia (OL) is said to be associated with various factors such as poor diet, poor oral hygiene, local irritants such as caries, sharp teeth, etc., alcohol and tobacco (Pindborg, 1967). Betel-nut chewing has also been associated with OL. A study carried out in Guam (in a population accustomed to betel-nut chewing), found OL among 0.2% of the population, 41% of whom were betel nut chewers (Gerry et al., 1952). A study carried out in India found 3.48% with OL and 76.5% reported chewing *pan*, smoked *bidi* cigarettes or had both these habits.

The prevalence of oral leukoplakia (OL) was found to be higher among tobacco users (4.5%) than among non-users (0.09%). Among those who used tobacco, OL was higher among those who used both forms of tobacco (7.1%) than among those who either chewed *pan* (4.2%) or smoked *bidi* (3.7%) (Mehta et al., 1961). A report on the epidemiology of OL among dental out-patients in Madhya Pradesh found 6.5% to have OL. One-third of the study population had a positive history of tobacco chewing or smoking or betel-nut chewing. All of the OL patients were found among this group (Mangi et al., 1965). The reported prevalence of OL in Hainan, China ranges from 2.1% to 2.5%. In betel quid chewers who also smoke, the reported prevalence is 20.3%. The prevalence of OL in Hunan province ranges from 0.1% to 0.5% (Zhang and Reichart, 2007).

2.6.7.2 Clinical Features

These lesions are characterized by the presence of a white patch anywhere on the oral mucosa; they may vary from a quite small and circumscribed area to an extensive lesion involving a large area of mucosa. The appearance is variable; the surface may be smooth or wrinkled and sometimes smooth surfaced lesions may be traversed by small cracks or fissures giving an appearance aptly likened to cracked mud. Lesions may be white, whitish-yellow or grey and some appear homogenous, while others are nodular, showing white areas intermingled with red zones; this is often called a nodular (speckled) oral leukoplakia. In those lesions in which there is much epithelial hyperplasia, the affected mucosa may lose some of its normal softness and flexibility.

Before reaching a diagnosis of oral leukoplakia (OL), it is important to consider whether the whiteness of the mucosa could be due to leukoedema (a relatively common appearance that is often regarded as normal variation). Leukoedema is seen typically on the buccal mucosa and has been described as resembling an ill-defined 'grey veil' lying on the mucosa. The affected area appears slightly more grey or white than the rest of the mucosa, but when the area is gently scraped with the blunt edge of the mouth mirror, the greyness diminishes or disappears (WHO, 1980).

2.6.8 Oral Cancer

2.6.8.1 Prevalence

Globally, oral cancer is one of the ten most common cancers (Gupta et al., 1996). Generally, about 2% are located in the oral cavity. Epidemiologic studies have shown significant differences of incidence and prevalence within Europe (Black et al., 1997) and the rest of the world (Franceschi et al., 2000). The incidence of oral cancer is highest among men in Northern France (49.4/100,000 men) and Southern India (more than 20/100,000 men) (Reichart, 2001). The incidence of oral cancer increases with age with marked geographical differences and differences in risk factors. In Western countries 98% of cases of oral carcinoma occur in individuals over 40 years of age (Parkin et al., 1993).

In India the peak age is at least one decade earlier than that reported for Western countries. The occurrence of oral carcinoma prior to the age of 35 years in these high prevalence areas is due to various forms of use of tobacco, both chewed and smoked (Gupta et al., 1996). In some areas of South East Asia, in particular Thailand, the prevalence of oral cancer seems to be on decrease because traditional oral habits such as betel quid chewing have largely been given up (Reichart, 1995; Reichart, 1996). Of particular importance is a rise in incidence and prevalence of oral carcinoma among younger men born after 1920 (Boyle et al., 1990). In European countries the incidence of oral cancer has risen in Ireland from 1.78 to 3.14/100,000 for men and 0.87to 1.19/100,000 for women in the past years (Crown et al., 1992). An increase in prevalence has also been noted in some parts of the USA where prevalence has increased four-fold in men aged 30-39 years and three-fold in women during the period 1935-1985 (Chen, 1991). In industrialized countries men are affected almost twice as often as women (Black et al., 1997). In high prevalence areas such as some parts of India, however, the incidence of oral cancer for women is equal to or greater than that for men (Reichart, 2001).

2.6.8.2 Aetiology

The location of an oral carcinoma is often associated with various smoking and/or chewing habits involving tobacco and/or *areca nut*. Depending upon where the quid is kept, the carcinoma may be located in a buccal or labial sulcus. Reverse smoking is associated with carcinoma of the palate and posterior part of the dorsum of the tongue (WHO, 1980).

In epidemiological studies, betel quid chewing and cigarette smoking are two important risk factors for oral squamous cell carcinoma (OSCC), and the 2 agents seem to act synergistically (Chang et al., 1989; Jacob et al., 2004). It has been reported that betel quid chewing and cigarette smoking are two common and significant risk factors for OL, OSF, and squamous papilloma (SP), regardless of their differing etiologies and morphologies.

Because of the similar significance of these two factors in OSCC, it is plausible that the pathogenesis of OSCC occurs with any of these lesions and then, in certain circumstances, undergoes malignant transformation (Chen et al., 2006). A survey of young persons with oral cancer suggested that most were exposed to traditional risk factors of tobacco smoking, drinking alcohol and a low consumption of fruit and vegetables (Mackenzie et al., 2000).

2.6.8.3 Clinical Features of Oral Cancer

A carcinoma may develop into a white patch (an area of leukoplakia) or into a red area (an erythroplakia) but many carcinomas arise in an area of mucosa that previously appeared normal. Despite the serious nature of the lesion, there may be little or no pain. Except in some early and small lesions, there is usually induration- the tissue feels firm and thickened-either throughout the lesion, or at the margins if there is ulceration. Where the tumor occurs on a mobile part of the mucosa, there may be fixation and loss of mobility because the tumor has involved the deeper tissues. The appearance of the surface of the tumor is very variable: it may be relatively smooth and white or red, but commonly the surface is nodular or ulcerated and the ulcer may have a raised rolled margin. In the later stages there may be a soft fungating mass that bleeds readily. If the carcinoma arises on the lip, where the surface can become dry, there is often a crusted or scaly appearance or the surface can appear warty.

One variety of oral squamous cell carcinoma, the verrucous carcinoma, tends to grow slowly and to involve the deeper tissues at relatively late stage. The verrucous carcinoma is a predominantly exophytic growth, and presents as a painless warty mass that usually has a white nodular surface. For complete confidence in diagnosis, squamous cell carcinoma requires histological examination. However, if this is not possible a provisional diagnosis has to be made on the basis of the clinical findings described above: associated with these findings at the site of the primary lesion there may be involvement of the lymph nodes draining the area, and the affected nodes feel enlarged, firm or hard, and they may be tender. It must be remembered that inflammatory enlargement of lymph nodes occurs in association with oral ulcers other than carcinoma. Occasionally a patient may have more than one carcinoma in the mouth at the same time, but usually the carcinoma is a solitary lesion (WHO, 1980).

2.7 Risk factor identification

Tobacco and alcohol remain the primary factors in the etiology of oral cancer and precancer (Reichart, 2001). Betel quid chewing has also been indicated as a risk factor for oral cancer and precancer.

2.7.1 Tobacco and the various forms

Tobacco is by far the most important risk factor for oral cancer and precancer (Moreno-Lopez et al., 2000). About 95% of cases of oral and phyrangeal cancer in the USA have been attributed to smoking (Reichart, 2001). Tobacco may be smoked, chewed or snuffed. Worldwide, numerous smoking and chewing habits exist with widely differing risk as to the induction of oral cancer and precancer (Gupta et al., 1996; IARC, 1985).

2.7.1.1 Smoking

Smoking is the most common form of tobacco use and it demonstrates a very high relative risk for oral cancer (Gupta et al., 1996). Risk estimates have increased over time. There is a strong dose-response relationship between the use of tobacco and the development of oral cancer (National Institutes of Health, 1998). Most products used for smoking are prepared from *Nicotiana tabacum* (Hoffmann, 1998). A study on the prevalence of oral cancer and pre-cancer and associated risk factors among tea estate workers in central Sri Lanka revealed the smoking prevalence to be 31%. The most prevalent type of tobacco used was *bidi* smoking. *Bidi* is a locally manufactured smoking product with crude sun-dried tobacco wrapped in a leaf and is considerably cheaper than cigarettes. A recent meta-analysis has shown that *bidi* smoking carries a higher risk for oral cancer compared with cigarette smoking (Ariyawardana, 2007).

2.7.1.2 Smokeless tobacco

Smokeless tobacco is used in the West, especially in Scandinavia ('snuff') and USA (Reichart, 2001). In South and South-East Asia smokeless tobacco encompasses betel quid (Reichart, 2001) and others like *nass, naswar, khaini, mawa, mishri* and *gudakhu* (Gupta, 1996). In North Africa chewing habits are also prevalent (e.g. shammah). In contrast to smokeless tobacco used in Scandinavia and the U.S, chewing habits in South and South-East Asia are strongly related with oral cancer, precancer and oral submucous fibrosis (Reichart, 1990; Reichart, 1996). The fact that oral cancer is still a major health problem on the Indian subcontinent is largely due to the chewing of betel quid or pan masala (Reichart, 2001).

Most products used for smokeless tobacco ('chewing' tobacco) are prepared from *Nicotiana rustica*. Processed tobacco contains at least 3050 different compounds (Hoffmann, 1998). A number of these have been identified as toxic, tumorigenic and carcinogenic. In addition to polynuclear aromatic hydrocarbons, the most important carcinogens in tobacco are tobacco-specific *N*-nitrosamines (TSNA), such as NNN (nitrosonornicotine) and NNK (4-(methylnitrosoamino)-1-(3-piridyl)-butanone). TSNA are the likely causative agents for oral cancer and precancer, both in smokers and chewers of tobacco products (Reichart, 2001).

2.7.2 Alcohol

Alcohol has long been considered a factor in oral carcinogenesis and excessive alcohol consumption is the second most important risk factor for oral cancer (Moreno-Lopez et al., 2000). Alcohol and tobacco act synergistically. While smokers who do not use alcohol have a two-to four-fold risk of oral cancer compared to non-smokers and non-drinkers, the risk of smokers who are heavy drinkers is increased six to fifteen times compared to non-smokers and non-drinkers (Van der Waal, 1998). Exclusive tobacco consumption seems to be more likely to give rise to oral epithelial dysplasia than exclusive alcohol consumption alone (Jaber, 1999). Studies on oral mucous membrane permeability have shown that chronic alcohol ingestion may increase permeability for tobacco-associated nitrosamines and polycyclic hydrocarbons (Squier, 1986). The study among tea estate workers in Sri Lanka also revealed 61% (both men and women)

regular consumption of alcohol. This reported use of alcohol among tea labourers is much higher than in the general population suggesting that tea labourers are a high-risk group for oral cancer (Ariyawardana, 2007).

2.7.3 *Areca nut*/quid

Areca nut chewing is implicated in OL and OSF, both of which are potentially malignant in the oral cavity. Oral cancer often arises from such precancerous changes in Asian populations. In 1985 the International Agency for Research on Cancer concluded that there is limited evidence to show that areca nut chewing directly leads to oral cancer. There is, however, new information linking oral cancer to *pan* chewing without tobacco, suggesting a strong cancer risk associated with this habit (Trivedy et al., 2002).

Compounding the ill effects of chewing *betel nut/quid* is smoking and alcohol consumption. The synergistic effects of smoking, betel quid use and alcohol drinking have been documented for oral leukoplakias and cancer for populations in South Asia. It has been reported that Sri Lanka has the highest reported incidence of oral cancer in the world. Oral and pharyngeal cancers constitute the most common cancer for Sri Lankan men and rank fourth for women (Ariyawardana, 2007).

2.8 Oral Mucosa of Betel Quid Chewers and the Histopathological Changes

The oral mucosa of betel-quid chewers has been reported to demonstrate diverse histopathological changes (Jeng et al., 2001). Betel chewers' mucosas (BCM) show a tendency toward desquamation of oral epithelium. The underlying area shows pseudomembranous or wrinkled-like appearance (Reichart, 1998). Histologically, BCM show encrustrations of brownish amorphous betel quid substances on the irregular epithelial surface. These encrustations can be stained with von Kossa stain, indicating the presence of calcium hydroxide particles (Reichart, 1998). Occasionally, some superficial epithelial cells in BCM show a ballooning appearance with fine intracellular and extracellular granular materials as observed by light and electron microscope (Reichart, 1998; Reichart, 1984).

Surface epithelial hyperplasia with marked rete peg and subepithelial inflammatory cell infiltration may be observed in long-standing lesions (Reichart, 1998). Mechanical trauma or chemical factors are considered to be the possible etiology of BCM that has been regarded to be a precursor lesion of OSF (Reichart, 1998). On the other hand, mucosa of betel quid chewers with OSF typically display epithelial atrophy or hyperplasia, associated with hyperkeratosis and pyknotic changes in the basal cell nuclei. Further, epithelial hyperplasia, vacuolization of the prickle-cell layer, increased mitotic activity, nuclear pleomorphism, subepithelial inflammatory cell infiltration and epithelial atypia have also been noted frequently (Jeng, 2001). The evaluation of biopsy specimens of leukoplakia from chewers of non-tobacco-containing betel quid has also been noted to reveal epithelial parakeratosis, with a decrease in epithelial thickness and an increase in the mitotic activity of the epithelium. Vacuolated and signet epithelial cells have been observed in some leukoplakia biopsy specimens (Lee et al., 1970) suggesting that some betel quid components may possibly induce the differentiation and proliferation of, and a toxic response from the oral epithelium (Jeng et al., 2001).

Prominent connective tissue changes associated with OSF have also been noted (Pillai et al., 1992; Meghji, 1997; Cox, 1995; Sirsat, 1977; Mani, 1977), with very early connective tissue changes being reported to be marked edema, a strong fibroblast response, inflammatory-cell infiltration, and dilated and congested blood vessels. Subsequently, subepithelial tissue reveals early signs of hyalinization, the presence of thick collagen bundles and a moderate number of fibroblasts, and the infiltration of chronic inflammatory cells such as lymphocytes, eosinophils and plasma cells. In advanced stages of OSF, juxta-epithelial hyalinization of the connective tissue with a markedly-reduced fibroblast response is frequently noted, often with a concomitant fibrosis of the lamina propria. Blood vessels are usually narrow or obliterated and relatively few in number (Pillai et al., 1992; Meghji, 1997; Cox, 1995; Sirsat, 1977; Mani, 1977). Mild to severe inflammatory cell infiltration is regularly observed in leukoplakias specimens from betel quid chewers (Lee et al., 1970).

2.9 Summary

This review of the literature has shown that betel quid chewing is still prevalent in South Asian populations, Southeast Asian countries and in immigrant communities in Western countries. The scientific research has shown that *areca nut* and betel quid use in any variant is detrimental to oral health. Concomitant use of alcohol and smoking increases the risk of oral cancer. A review of studies of this nature could be an excellent tool for clinicians in identifying high-risk groups and an early detection of potentially cancerous lesions.

CHAPTER 3: AIM AND OBJECTIVES

3.1 AIM

To assess the betel-nut chewing habits in the Indian population of Durban, Kwa-Zulu Natal.

3.2 OBJECTIVES

- To identify people who chew betel nut on a habitual basis.
- To identify commercial sites where betel nut can be purchased (place of purchase).
- To determine the associated risk factors (slaked lime, tobacco leaves, smoking and alcohol consumption).
- To determine whether people chewing betel nut were aware of the health risks associated with the habit.
- To make recommendations regarding the chewing habit

CHAPTER 4: METHODOLOGY

4.1 Introduction

This chapter discusses the research design and methodology used in the study. It describes the development of the research instrument and data collection method. The choice of a research method relates to the aims of a study and consequently will depend upon the nature of the enquiry and the type of information required (Bell, 1987). When conducting a study, the research method used may be qualitative or quantitative. While keeping a focus on the objectives, consideration was given to the methodology employed by other researchers in similar studies.

4.2 Study design

A cross-sectional study using a combination of qualitative and quantitative data was used. Quantitative research involves the use of numerical measurement and statistical analyses of measurements. Qualitative methods allow researchers to understand how the subjects of research perceive their situation and their role within their context. A cross-sectional study design was chosen utilising an administered questionnaire to collect data.

4.3 Study sample

A convenience sample was used. Convenience sampling refers to selecting people who are easily available to participate, however this almost always introduces bias. However, bias can occur even if random sampling is used (Katzenellenbogen, 2007). People were approached at the pan shops, leisure markets, and traditional functions and at the dental practice the researcher operated at and a sample of 101 people were selected for the study.

4.4 Establishing contacts

Participants were contacted via colleagues at dental practices, leisure markets, pan shops, traditional gatherings and by word of mouth. Through referrals, the researcher was invited to selected venues of people's place of employment, and was allowed to make contact with and provide information about the study to any persons who practice the habits of betel nut/quid/tobacco chewing.

4.5 Inclusion criteria

People who chewed betel nut on a habitual basis

4.6 Instrument used

An administered questionnaire was used with open ended and close ended questions. The questionnaire focused on reasons for chewing betel nut, the ingredients used, awareness of health risks, frequency of chewing and the relationship between smoking/alcohol consumption and betel nut chewing (Appendix 1). The researcher administered the questionnaire and the interview was conducted in English. A focused, scheduled-structured researcher administered questionnaire was found to be the most appropriate way to elicit the information required. Each participant was personally interviewed by the researcher.

4.7 Piloting the questionnaire

The questionnaire was tested on five participants before the study commenced to establish if the questions were relevant, unambiguous and appropriate. The pilot study provided an indication of the time taken to complete the questionnaire and all relevant aspects were clarified to ensure that the questionnaire yielded the expected response. Each interview took about ten minutes. After the pilot study, irrelevant and problematic items were identified and consequently deleted or reformulated. This resulted in important improvements to the questionnaire. A final draft with 25 items was then printed and used for the final study (Appendix 1).

4.8 The role of the researcher

Cornwell (1984) sees the interviewer as being more than a recording instrument, because the relationship of the interviewer to the interviewee affects the content of the interview. This has been defined by some authors as bias, and many factors can influence the responses given by the interviewee in one way or another. Foot-Whyte (1982) points to three factors that may influence as informants reporting in an interview situation:-

- The informant may have ulterior motives for participating in the interview
- They may also desire to please the interviewer so that their opinions will be well received and idiosyncratic factors such as mood of the informant.
- Individual peculiarities in the connotation of certain words or extraneous factors may all influence the informant.

Foot-Whyte (1982) suggests that these three factors when present may cause serious misinterpretation of the informant's statements and to minimize the problems of interpretation, the interview in the present study was carefully structured and carried out. The advantage of utilizing an interview for the present study was that the personal contact can facilitated the responses and the quality information collected and the respondent did not be literate. Disadvantages include the fact that it was time consuming and expensive.

4.9 Obtaining consent

Prior to the interview, all respondents were given verbal information about the study and asked to read and sign a consent form (Appendix 2) if they were willing to participate in the study. This consent form included the researcher's qualifications and contact details, as well as the institution the researcher was registered with.

4.10 Validity and reliability

The researcher was the only one involved in data collection and interviews, thereby ensuring standardization in the manner the questions were asked and recorded. The researcher followed a clearly structured format and asked questions in a standard way.

4.11 Data analysis

Questionnaire data were categorized, coded and then entered into the computer. The data was captured in Excel. Basic descriptive analysis was done using the Excel environment. The database was imported into SPSS® to perform complex statistical analyses. Descriptive statistics were used to describe the demographic factors. The independent t-test was used to determine correlation between the scale variables. The Chi-square test was used to determine the association between the nominal and the ordinal variables.

4.12 Ethical considerations

The protocol was submitted to the Senate Research Ethics Committee of the University of Western Cape for ethical approval. Informed consent was obtained prior to the interview. Participation in the study was entirely voluntary and the participants were allowed to withdraw from the study at any time should they wish to do so. It was emphasized that strict confidentiality would be maintained at all times and that no names or personal details will be mentioned in the write-up of the study. Anonymity was achieved by not using the participant's names on the questionnaire and the questionnaire was recorded as a serial number.

CHAPTER 5: RESULTS

5.1 Introduction

This chapter provides an overview of the results obtained from the study. It describes the demography of the sample, their chewing habits, what they chew, where they obtain it from, and their knowledge of risk factors associated with the habit.

5.2 Demography

The sample consisted of 101 respondents with a mean age of 35 years. Slightly more than half were female (n=56) and in the 20 to 39 year age group (Table 1). Nearly a quarter (23%) were migrants and 17% were from Pakistan. All the migrants were male and had learnt the habit in the countries of their birth.

Table 1: Age distribution

Age (years)	Frequency	Percent	Cumulative Percent
under 20	9	8.9	8.9
20-29	28	27.7	36.6
30-39	34	33.7	70.3
40-49	16	15.8	86.1
50-59	11	10.9	97.0
60 or above	3	3.0	100.0
Total	**101**	**100.0**	

Mean = 35 years, Standard deviation (S.D) = 11.704

Table 2: Gender distribution

GENDER	South African		Total
	No	Yes	N
Male	23	22	45
Female	0	56	56
Total	23	78	101

5.3 Employment status

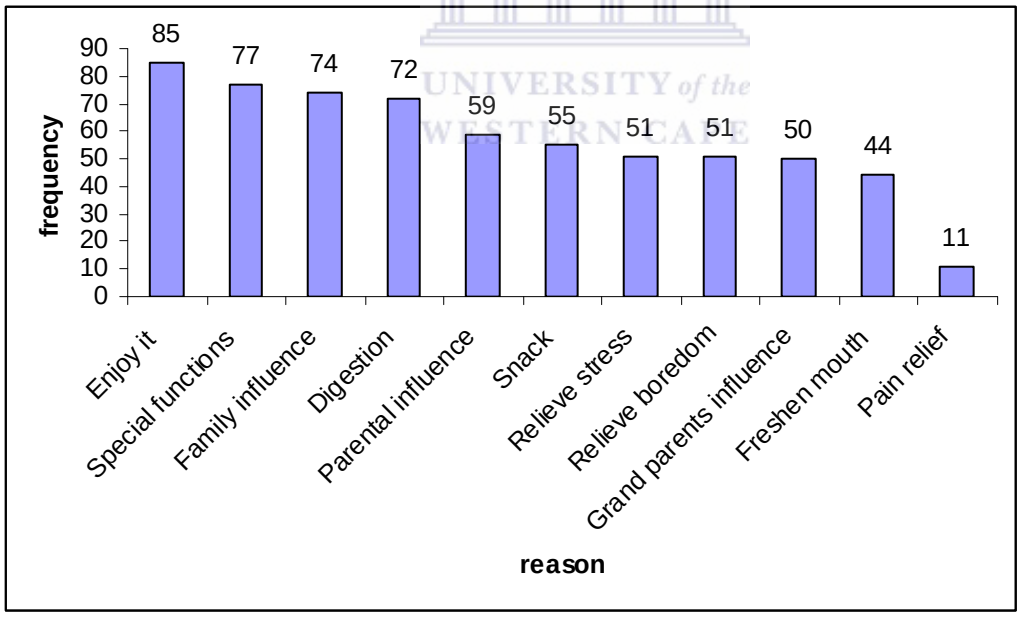
Nearly two thirds were employed. The majority were housewives, employed people and sales people (Figure 1). Sales people, management/business and employed/self employed were classified as employed, while house wives and unemployed people were classified as not employed.

Figure 1: Employment status

5.4 Reasons for chewing betel nut/quid

The most important reasons for chewing betel nut/quid were enjoyment and during special occasions and the most important perceived benefit derived from chewing betel nut was digestion (Figure 2). Medical benefits do not feature prominently as reasons for betel nut chewing, about half cited stress relief and just below 11 percent cited pain relief as a reason. Respondents cited more than one reason for chewing betel nut. The influence of parents, grandparents and other family members (i.e. aunts, uncles and cousins) were also cited as reasons for chewing betel nut, with the majority of the respondents indicating familial influence as the strongest (73.27%). Parents were more likely to influence betel nut chewing compared to the grandparents (Table 3). Family members were more likely to influence betel nut chewing compared to the parents (Table 4).

Figure 2: Reasons for chewing betel nut/quid



***Family refers to aunts, uncles, cousins etc.**

Table 3: Parents and grandparents as reasons

How they react?		Grandparent		Total
		No	Yes	
Parent	No	34	8	42
	Yes	17	42	59
Total		51	50	101

Chi-square = 26.681 p-value =0.000.

Table 4: Parents and family as reasons

How they react?		Parents		Total
		No	yes	No
Family	no	19	8	27
	yes	23	51	74
Total		42	59	101

Chi-square = 12.571 p-value =0.000.

5.5 Length of time of chewing betel nut

More than two thirds of the sample reported chewing for 18 years or less, 13.5% for between 13-18 years and about 10% for 25 years or longer (Table 5).

Table 5: Distribution of length of time of chewing betel nut

Time -years	Frequency	Percent	Cumulative Percent
1-6	27	28.1	28.1
7-12	36	37.5	65.6
13-18	13	13.5	79.2
19-24	10	10.4	89.6
25-30	6	6.3	95.8
above 30	4	4.2	100.0
Total	**96**	**100.0**	

Mean = 12.36 Median = 10 Standard deviation = 9.70

5.6 Place of purchase

The supermarket was the most popular place for purchasing the ingredients, followed by informal paan stalls and specialty shops.

5.7 Opinion on effects on health

Nearly two thirds did not know whether betel chewing is harmful to their health, over a third (37%) considered it harmful and 4% of the respondents considered it beneficial (Table 6).

Table 6: Effect on health

	Frequency	Percent
Beneficial	4	4.0
Harmful	37	37.4
Don't know	58	58.6
Total	**99**	**100.0**

5.8 Have you tried to give up the habit?

Less than a fifth (16%) had tried to give up the habit.

5.9 Thinking of trying to give up the habit?

Of the study sample, only 11.7% reported considering giving up the chewing habit and a significant 88.3% has no intentions of giving up the habit.

5.10 Additives in the preparations

Ninety eight percent of the respondents chew the betel nut in combination with other ingredients. Various additives were used. Twenty percent reported chewing betel nut exclusively. Seventy three percent used a betel leaf to form the quid. Fifty seven percent included lime in the betel nut and leaf mixture and twenty percent include tobacco to the quid (Table 10).

Table 7: Additives used

Additives	% of chewers
Betel nut/supari	98
Betel leaf	73
Lime	57
Pan masala	45
Tobacco	20
Catechu	15

5.11 Impact of lifestyle practices

There were 15 people who smoked, consumed alcohol and chewed betel nut, and 14 people who smoked, chewed tobacco and pan masala or consumed alcohol, chewed tobacco and pan masala. There were only 7 people of the study population who smoked, chewed tobacco, pan masala and consumed alcohol (Table 8).

Table 8: Number of people involved in smoking, consuming alcohol, chewing tobacco, chewing pan masala

Combination	Number
Smoke, consume alcohol, chew betel nut	15
Smoke, tobacco and pan masala or consume alcohol, tobacco and pan masala	14
Smoke, consume alcohol, tobacco and pan masala	7

Table 9 shows the number of respondents who smoke and consume alcohol. Those who smoked were far more likely to consume alcohol. The proportion of males that smoked was far higher than females.

Table 9: Smoking and consuming alcohol

How they react?		Alcohol		Total
		No	Yes	(n)
Smoke	No	59	6	65
	Yes	21	15	36
Total		80	21	101

Chi-square = 14.801 p-value of 0.000

5.12 Aware that betel nut chewing causes mouth cancer?

Nearly two thirds (57%) were unaware that chewing betel quid causes mouth cancer.

5.13 Frequency of use versus gender and age

More females were involved in betel nut chewing. More than a quarter of the females reported chewing betel nut/quid three times and more than three times a day. There was no difference in frequency of use of males and females (Table 10). Respondents over the age of forty were more likely to chew betel nut/quid more than three times a day. There was no difference in frequency of use for age groups (Table 11).

Table 10: Frequency of use versus gender

		Gender		Total
		Male	Female	
Use	< once a day	6	11	17
	once	11	7	18
	twice	10	12	22
	three times	7	10	17
	> three times	6	5	11
	all day	4	11	15
Total		44	56	100

Chi-square = 5.061 p-value of 0.408

Table 11: Frequency of use versus age

Frequency per day	less or equal to 1	2 or 3	More than 3
Age (years)			
Under 30	15	15	6
30-39	13	12	9
40 or over	7	11	12

Chi-square = 4.440 p-value of 0.444

CHAPTER 6: DISCUSSION

This chapter discusses the results of the study on betel nut/quid chewing habits of a convenience sample of the Indian population in the Durban, Kwazulu-Natal. Study variables will be discussed under their headings.

6.1 Demography

In previous studies among the Durban Indian population, it was found that just over a third of women practiced the chewing habit as opposed to 5.5 per cent of men (Seedat & van Wyk, 1988 (a)). In the present study, chewing among both males and females was high. The high numbers of males with the chewing habit could be due to the influx of male migrants from the south eastern countries (who have come to South Africa looking for better employment opportunities).

Studies carried out abroad have demonstrated a dominance of female areca nut/quid chewers (Strickland and Duffield, 1997; Gupta and Warnakulasuriya, 2002; Gupta, 2004). However, in Central Province of Sri Lanka, it has been reported that there is an equal number of men and women with the chewing habit (Warnakulasuriya, 1992). Surveys carried out in Thailand and Pakistan revealed that more boys indulged in areca nut chewing than girls (Lu et al., 1993 and Yang et al., 1996; Shah, 2002). In Taiwan, the quid chewing behaviour is predominantly viewed as a male habit (Chen et. al, 1996).

The age distribution in the present study varied from 20 to 60 years and above. More than two thirds were younger than 40 years with the majority of the chewers in the age categories of 20-29 and 30-39 years. It has been previously reported that the habit is more prominent in the age group of 65 years and older (Seedat & van Wyk, 1998 (a)), but areca nut chewing is now common in younger age groups. Several factors may be responsible for the increased popularity of the habit in the younger groups including the fact that betel nut and its condiments are readily available at very little cost and it is not taxed. Various paan preparations are served at eastern restaurants as a means of promoting digestion and it is now a fashionable habit. It is a socially acceptable habit as

it plays an important role in Indian culture and religious rituals. In addition, exposure to migrant communities and their methods of serving betel nut/quid makes it an attractive habit to acquire. At betel nut vending stores cardamom syrups, coconut, fennel seeds, tobacco and lime are added to the betel quid making it more palatable and appealing to younger people including children. It has been reported that young children usually start using sweetened *areca nut* products, and often add tobacco to the combination later in their adolescence (WHO, 2003). Therefore, it is important that this is a habit that children should not acquire as it promotes harmful and addictive effects.

The chewing habit was found to be more prevalent in the employed than unemployed individuals. It is a habit enjoyed by people from different social strata and is not confined to the employed but is a shared habit. This is contrary to the chewing habits in Ceylon, where a study indicated that people who belong to a higher social status tend to look down upon the practice of betel nut chewing (Senewiratne, 1973) that is more prevalent in lower-socio-economic groups.

In the present study more than three quarters of the sample were born in South Africa and the rest were migrants from Pakistan, India and Dubai, the majority being from Pakistan. All migrants were male. The migrant communities have brought various areca nut and quid habits with them that have become acceptable practice to South Africans. The areca nut and condiments are readily available in a variety of preparations all around the city and at leisure markets, where many of the migrants are proprietors of paan stores.

6.2 Reasons for chewing betel nut/quid

Pleasure, enjoyment and chewing during special occasions were the most important reasons for chewing betel nut. This is probably indicative of the addictive aspect of the areca nut. It is said to be the fourth most commonly used psychoactive substance in the world, after caffeine, nicotine and alcohol (Gupta, 2004). A higher proportion of males tend to chew betel nut/quid more for enjoyment than females. Digestion was the most important benefit derived from chewing betel nut and a higher proportion of males cited this as a reason. It has been shown that the chemical composition of the nut is varied and it has a stimulating effect upon increasing peristalsis and tone in the intestine (Winstock, 2000).

Medical benefits do not feature prominently as reasons for betel nut chewing, but there is evidence that suggests that arecoline in the areca nut may act as a GABA uptake inhibitor and promotes relaxation (Winstock, 2000). This could explain why nearly half of the respondents reported that chewing areca nut/quid aided in stress relief.

A significantly higher proportion of respondents indicated that family member (aunts, uncles, cousins) influence was a reason for chewing.

6.3 Length of time of chewing betel nut/quid

Many respondents reported having chewed betel nut for 18 years. It is important to make people aware of the harmful effects of indulging in this habit especially over long periods.

6.4 Place of purchase

The majority of respondents indicated that they purchased betel nut and its condiments from supermarkets, thereby indicating it to be an easily accessible product to all, including children. Betel nut was also purchased at various special shops (prayer, paan shops, tuck shops) and at other informal paan shops. In the city of Durban there are four to five paan shops in the same street, and these paan shops are run by migrant individuals.

6.5 Effects on health

Two thirds of the sample was unaware that betel nut chewing is harmful to their health. Epidemiological studies (Neville et. al, 1995; Murthi et. al, 1995; Canniff et. al, 1986) in India and evidence from Indians living in South Africa (Seedat & van Wyk, 1988 (c)) point to the habit of chewing *areca nut* as the major aetiological factor of OSF. In recent years, commercial preparations like *pan masala* have become available in India and abroad. The main ingredient of these products is *areca nut* along with *lime* and *catechu* wrapped in a betel leaf with or without tobacco. Many patients with OSF give a history of chewing *pan masala.*

It has been reported that *pan masala* chewing produced OSF changes in a shorter period of time than betel quid chewing (Kiran, 2007). It has also been noted from a study carried out in South India that there is a higher occurrence of OL and cancer observed in OSF patients and it is believed to be an important risk factor for oral cancer among youths (Saraswathi et al., 2006). Education and awareness programmes on betel nut/quid chewing and risk factors are needed to reiterate that long term areca nut/quid use leads to oral submucous fibrosis (OSF) which is a precancerous lesion. Those who were aware that the habit is harmful still continue to chew. In Vietnam betel nut/quid use is on the decline due to the increase in oral cancer in elderly women (Reichart and Nguyen, 2008).

6.6 Have you tried to give up the habit?

The majority had not attempted to give up the chewing habit and only a very small percentage reported even considering giving up the habit. Some of the respondents said that they felt ill if they did not chew the nut/quid. The areca nut reportedly produces similar effects to tobacco, therefore supporting the fact that it is an addictive habit (Winstock, 2000).

6.7 Additives used

In the present study, the most popular ingredients used were betel nut, betel leaf, lime and pan masala. Tobacco and catechu were used by a few. The most popular combinations used were: betel nut/lime/betel leaf quid preparation, betel nut alone, betel nut/betel leaf/lime/tobacco/pan masala and betel nut/betel leaf/lime/pan masala. A higher proportion of males reported using betel leaf, lime, and catechu combination. In addition, males under 40 years of age were more inclined to chew tobacco and interestingly no females reported chewing tobacco in their quid mixture, similar to the Malay quid users who do not use tobacco in their quid mixture (Gupta and Warnakulasuriya, 2002).

6.8 Added risk factors (smoking and alcohol)

Research has shown that the areca nut and tobacco act as co-carcinogens, with a higher risk for oral cancer (Ahmed et. al, 1997). Smoking and alcohol compounds the carcinogenic effects of the substances in use.

The synergistic effects of smoking, betel quid use and alcohol drinking have been documented for oral leukoplakia and oral cancer in populations in South Asia (Ariyawardana et. al, 2007). In the present study, just over half reported not smoking and consuming alcohol. However, those who smoked were more likely to consume alcohol. The proportion of males that smoked was higher than females. Female respondents seemed reluctant to admit to smoking and alcohol consumption. This could be due to the fact that it is socially unacceptable in the Indian community to see females indulging in either habit.

6.9 Frequency of chewing

On an average, respondents chewed the betel nut or quid twice a day. More females chewed betel nut. Nearly half of the female populations in this study chewed betel nut/quid three times and more than three times a day. Respondents over the age of forty were more likely to chew betel nut/quid more than three times a day. Respondents under the age of 30 were more likely to chew betel nut two or three times a day. This could be due to the fact that they chewed the quid/nut after their meals for digestion.

6.10 Aware that betel nut /quid chewing causes mouth cancer

Less than half of the study population was aware that betel nut chewing causes mouth cancer (Table 12). This contrasts with the widespread knowledge of the health risks associated with smoking. None of the betel nut quid packets in South Africa carry any similar health warnings found on cigarette packagings. In India however, packets of betel quid must carry a government health warning (Ahmed et. al, 1997).

6.11 Limitations of the study

The study had a convenience sample of people who are existing chewers but it did not focus on factors that would either increase or decrease the prevalence of the chewing habit. One of the limitations of the study however, was related to the question on smoking and alcohol consumption where it is possible that female participants may have been reticent to disclose their habits.

CHAPTER 7: CONCLUSIONS & RECOMMENDATIONS

Betel nut/quid chewing continues to be widespread in South Asian populations, including immigrant communities outside the region as well as among certain tribal groups in South East Asian countries and also in Taiwan in increasing measure (Gupta, 2004). From the present study, it can be surmised that the betel nut/quid chewing habit is still prevalent among the Indians in Durban, and is now being practiced more by the younger age groups. From the literature reviewed, it can be concluded that betel nut/quid use in any form is unsafe for oral health. The commercial forms, for example, pan masala or ghutka, are chewed either on its own or as an additive to the quid and this combination has been found to pose even higher risks (Gupta, 2004). In view of this, intervention programmes are strongly advocated.

There is an urgent need for an effective health promotion policy aimed at reducing the use of areca nut/quid and to reduce the incidence of oral cancer in the South African population. The common risk factor approach for oral cancer should be adopted for health education and health promotion messages. Education programmes are needed to persuade chewers to quit the chewing habit and inform them of the risk for OSF and oral cancer. Betel nut/quid as well as pan masala are very easily available and cheap, and taxes should be imposed on these products so as to reduce access. There should be government health warnings on prepacked preparations and hopefully a phasing out of this harmful practice.

REFERENCES

Alvarez G, Alvarez ME, Jimenez GR, Mosquera SY, Gaviria Nunez AM, Garces AA, Alonso DA, Zabala CA, Echeverri GE, Isaac MM and Ramirez OD. Reverse smokers's and changes in oral mucosa. Med Oral Patol Oral Cir Bucal 2008; 13(1):E1-8.

Ahmed S, Rahman A and Hull S. Use of betel quid and cigarettes among Bangladeshi patients in an inner-city practice:prevalence and knowledge of health effects. British Journal of General Practice 1997; 47:431-434.

Ahmad MS, Ali SA, Ali AS, Chaubey KK. Epidemiological and etiological study of oral submucous fibrosis among gutkha chewers of Patna, Bihar, India. J Indian Soc Prev Dent 2006; 24:84-9.

Ariyawardana A, Sitheeque MAM, Ranasinghe AW, Perera I, Tilakaratne W, Amaratunga EAPD, Yang Yi-Hsin and Warnakulasuriya S. Prevalence of oral cancer and pre-cancer and associated risk factors among tea estate workers in the central Sri Lanka. J Oral Pathol Med 2007; 36:581-587.

Awang MN. Areca catechu (betel) nut and oral submucous fibrosis (dissertation). London: University of London, 1983.

Babu S, Bhat RV, Kumar PU, Sesikaran B, Rao KV, Aruna P, et al. A comparative clinico-pathological study of oral submucous fibrosis in habitual chewers of panmasala and betel quid. Clin Toxicol 1996; 34:317-22.

Bell J. Doing your research project. Oxford University Press. Buckingham, England 1987.

Black RJ, Bray F, Ferlay J, et al. Cancer incidence and mortality in the European Union: cancer registry data and estimates of national incidence for 1990. Eur J Cancer 1997; 33:1075-1107.

Bhonsle RB, Murti PR and Gupta PC. Tobacco habits in India. Oxford University Press 1992.

Boyle P, Macfarlane GJ, Maisonneuve P, et al. Epidemiology of mouth cancer in 1989: a review. J R Soc Med 1990; 83:724-730.

Connives JP and Harvey W. The etiology of oral submucous fibrosis: the stimulation of collagen synthesis by extracts of areca nut. Int J Oral Surg 1981; 10:163-167.

Centers for Disease Control and Prevention. Fact Sheet-Betel Quid with Tobacco (Gutka) February 2007.

Chang PC, Chang CS, Lai KS, Chou MJ and Choo KB. High prevalence of human papillomavirus infection and possible association with betel quid chewing and smoking in oral epidermoid carcinomas in Taiwan. J Med Virol 1989; 28:57-61.

Changrani J, Gany FM, Cruz G, Kerr R and Katz R. Paan and Gutka use in the United States: A pilot study in Bangladeshi and Indian-Gujarati immigrants in New York City. J immigr Refug Stud. 2006; 4(1):99-110.

Chen JK, Eisenberg E, Krutchkoff DJ, et al. Changing trends in oral cancer in the United States, 1935 to 1985: a Connecticut study. J Oral Maxillofac Surg 1991; 49:1152-1158.

Chen PC, Pan C, Kuo C and Lin C. Risk of Oral Nonmalignant Lesions Associated with Human Papillomavirus, Betel Quid Chewing, and Cigarette Smoking in Taiwan. Arch Pathol Lab Med 2006; 130:57-61.

Chopra A, Sethi PS, Singh J, Dimple. Oral Submucous Fibrosis. Indian J Dermatol Venereol Leprol 2000; 66:255-256.

Cooper D, Schindler PR (1998). Business Research Methods. 6th edition. Boston: Unwin McGraw-Hill.

Cornwell J. Hardened Life: Accounts of health and illness from East London. p1-17, Tavistock Publications, London 1984.

Cowan CG, Gregg TA, Kee F. Trends in the incidence of histologically diagnosed intra-oral squamous cell carcinoma in Northern Ireland. Br Dent J 1992; 173:231-233.

Cox SC, Walker DM. Oral submucous fibrosis: a review. Aust Dent J 1995; 41:294-9.

Daftary DK, Bhonsle RB, Murthi PR, Pindborg JJ and Mehta FS. An oral lichen planus-like lesion in Indian betel-tobacco chewers. Scand J Dent Res 1980; 88:244-9.

De Young JE. Village life in modern Thailand. Los Angeles: Berkley University of California, 1995.

Drangsholt M, Truelove EL, Morton TH, Jr. and Epstein JB. A man with a thirty year history of oral lesions. J Evid Base Dent Prac 2001; 1(2):123-35.

Edwards PC and Kelsch R. Oral Lichen Planus: Clinical presentation and Management. J Can Dent Assoc 2002; 68(8):494-9.

Foot-Whyte W. Interviewing in Field Research. In Burgess RG ed. Field research resource book and filed manual. p111-119, George Allen and Unwin, London 1982.

Franceschi S, Bidoli E, Herrero R, et al. Comparison of cancers of the oral cavity and pharynx worldwide: etiological clues. Oral Oncol 2000; 36:106-115.

Gao ML, Tang JQ, Zhu ZT and Jian XF. A pathological study of oral submucous fibrosis. Chin J Stomatol 1990; 25:363-5.

Gao YJ, Ling TY, Yin XM, Yao ZG and Tang JQ. A retrospective study of malignant transformation of oral submucous fibrosis. J Clin Stomatol 2005; 21:119-20.

Gerry RG, Smith ST and Calton ML. Oral Surg 1952; 5:884-894.

Gupta D and Sharma SC. Oral Submucous Fibrosis-A new treatment regimen. Journal of Oral and Maxillofacial Surgery 1988; 46:830-833).

Gupta PC, Ray CS. Epidemiology of Betel Quid Usage. Ann Acad Med Singapore 2004; 33(Suppl):31S-36S.

Gupta PC, Warnakulasuriya S. Global epidemiology of areca nut usage. Addiction Biology 2002; 7:77-83.

Gupta PA, Murti PR, Bhonsle RB. Epidemiology of cancer by tobacco products and the significance of TSNA: a critical review. Toxicology 1996; 26:183-198.

Hazarey VK, Erlewad DM, Mundhe KA and Ughade SN. Oral submucous fibrosis: study of 1000 cases from central India. J Oral Pathol Med 2007; 36:12-7.

Hoffmann D, Hoffmann I. Chemistry and toxicology. In:Cigars. Smoking and tobacco control. Monograph 9. National Institutes of Health, National Cancer Institute 1988; pp 55-104.

Ho CS, Gee MJ, Tsai CC, Lo CI, Wang SC. The prevalence of betel chewing among the students of the different senior high schools in southern Taiwan. Kaohsiung J Med Sci 2000; 16:32-8.

International Agency for Research on Cancer (1985) Tobacco habits other than smoking; betel quid and areca-nut chewing; some related nitrosamines, vol 37. IARC monographs on the evaluation of carcinogenic risk of chemicals to humans. International Agency for Research on Cancer Science Publications, Lyon.

Jaber MA, Porter SR, Gilthorpe MS, et al. Risk factors for oral epithelial dysplasia – the role of smoking and alcohol. Oral Oncol 1999; 35:151-156.

Jacob BJ, Straif K, Thomas G, et al. Betel quid without tobacco as a risk factor for oral precancers. Oral Oncol 2004; 40:697-704.

Jeng JH, Chang MC and Hahn LJ. Role of areca nut in betel quid-associated chemical carcinogenesis:current awareness and future perspectives. Oral Oncology 2001; 37:477-492.

Jian XC, Liu SF, Shen ZH and Cheng HB. A clinical study of oral submucous fibrosis. Chin J Stomatol 1989; 24:299-302.

Katzenellenbogen J, Karim SA, Joubert G, Ehrlich G. Epidemiology-A Research Manual for South Africa (2nd edition). Oxford University Press Southern Africa, 2007.

Kiran Kumar K, Saraswathi TR, Ranganathan K, Uma Devi M and Joshua Elizabeth. Oral Submucous Fibrosis: A clinico-histopathological study in Chennai. Indian J Dent Res 2007; 18(3):106-111.

Ko YC, Chiang TA, Chang SJ, Hsieh SF. Prevalence of betel quid chewing habit in Taiwan and related sociodemographic factors. J Oral Pathol Med 1992; 21:261-264.

Lee KW, Chin CT. The effects of betel nut chewing on the buccal mucosa: a histological study. Br J Cancer 1970; 24:433-41.

Lee CH, Ko YC, Huang HL, Chao YY, Tsai CC, Shieh TY and Lin LM. The precancer risk of betel quid chewing, tobacco use and alcohol consumption in oral leukoplakias and oral submucous fibrosis in Southern Taiwan. British Journal of Cancer 2003; 88:366-372.

Liu SF, Jian XC and Shen ZH. A study of oral submucous fibrosis. J Clin Stomatol 1988; 4:81-3.

Lu CT, Lan SJ, Hsich CC, Yang MJ, Ko YC, Tsai CC, et al. Prevalence and characteristics of areca nut chewers among junior high school students in Changhua county, Taiwan. Community Dent Oral Epidemiol 1993; 21:370-3.

Lumermann H, Freedman P and Kerpel S. Oral epithelial dysplasia and the development of invasive squamous cell carcinoma. Oral Surg Oral Med Oral Pathol Radiol Endod 1995; 79:321-329.

Mackenzie J, Ah-See K, Thakker N, Sloan P, et al. Increasing incidence of oral cancer amongst young persons:what is the etiology? Oral Oncol 2000; 36:387-389.

Mangi SL, Shrivastava AN and Saifi AQ. J. All-India dent 1965; 37:307-309.IV. Connective tissue changes. J Oral Med 1977; 32:70-4.

Mani NJ. Studies on oral submucous fibrosis.

Meghji S, Warnakulasuriya S. Oral submucous fibrosis:an expert symposium. Oral Dis 1997; 3:276-97.

Mehta FS, Sanjana MK, Shroff BC and Doctor RH. Indian J. med. Res. 1961; 49:393-399.

Mehta FD, Pindborg JJ and Hamner III JE. Oral cancer and precancerous conditions in India. Copenhagen: Munksgaard, 1971.

Ministry of Health, Sri Lanka. National Oral Health Survey 1194-1995. Colombo: Ministry of Health; 1998.

Moreno-Lopez LA, Esparza-Gomez GC, Gonzalez-Navarro A, et al. Risk of oral cancer associated with tobacco smoking, alcohol consumption and oral hygiene: a case-control study in Madrid, Spain. Oral Oncol 2000; 36:170-174.

National Institutes of Health (1998) Monograph 9. Smoking and Tobacco control. Cigars health effects and trends. National Institutes of Health, National Cancer Institute, USA.

Parkin DM, Pisani P and Ferlay J. Estimates of the worldwide incidence of eighteen major cancers. Int J Cancer 1993; 54:594-606.

Pillai R, Balaram P, Reddiar KS. Pathogenesis of oral submucous fibrosis. Relationship to risk factors associated with oral cancer. Cancer 1992; 69:2011-20.

Pindborg JJ, Kui-Hua Z, Chin-Ren K and Fa-Xing L. Pilot survey of oral mucosa in areca nut chewers on Hainan Island of the People's Republic of China. Community Dent Oral Epidemiol 1984; 12:195-6.

Pindborg JJ, Kiaer J, Gupta PC and Chawla TN. Studies in Oral Leukoplakias. Bull. Wld Hlth Org 1967; 37:109-116.

Pindborg JJ, Murthi PR, Bhonsle RB, Gupta PC. Global aspects of tobacco use and its implications for oral health. In: Gupta PC, Hamner J III, Murthi P, editors. Control of Tobacco-related cancers and other Disease. Proceedings of an International Symposium; 1990 Jan 15-19; Mumbai, India. India: Oxford Univ Press, 1992:13-23.

Ranganathan K, Uma Devi M, Joshua E, Kirankumar K and Saraswathi TR. OraSubmucous fibrosis: a case control study in Chennai, South India. J Oral Pathol Med 2004; 33:274-277.

Reichart PA, Philipsen HP. Betel and Miang. Vanishing Thai habits. White Lotus, Bangkok, 1996.

Reichart PA, Schmidtberg W and Scheifele CH. Betel chewer's mucosa in elderly Cambodian women. J Oral Pathol Med 1996; 25:367-70.

Reichart PA, Philipsen HP. Betel and Miang. Vanishing Thai habits. 2nd ed. Bankok: White Lotus LTD. Co., 2005.

Reichart PA. Oral cancer and precancers related to betel and miang chewing in Thailand: a review. J Oral Pathol Med 1995; 24:241-3.

Reichart PA, Boning W, Srisuwan S, Theetranont C, Mohr U. Ultrastructural findings in the oral mucosa of betel chewers. J Oral Pathol 1984; 13:166-77.

Reichart PA, Philipsen HP. Betel chewer's mucosa-a review. J Oral Pathol Med 1998; 27:239-42.

Reichart PA. Identification of risk groups for oral precancer and cancer and preventive measures. Clin Oral Invest 2001; 5:207-213.

Reichart PA, Schmidt-Westhausen A and Theetranont C. Oral cancer in Northern Thailand. Exp. Pathol 1990; 40:229-231.

Reichart PA and Nguyen X. Betel quid chewing, oral cancer and other oral mucosal diseases in Vietnam: a review. J Oral Pathol Med 2008.

Saraswathi TR, Ranganathan K, Shanmugam S, Sowmya R, Narasimhan PD and Gunaseelan R. Prevalence of oral lesions in relation to habits:cross-sectional study in South India. Indian Journal of Dental Research 2006; 17:121-5.

Saunders, Mark NK, Lewis P, and Thornhill A (2000). Research Methods for Business Students. 2nd Edition. Harlow, England

Seedat HA. Oral submucous fibrosis in Durban, Natal: a study of its epidemiology, etiology and morphological features. PhD Thesis. University of Stellenbosch, 1985.

Seedat HA, van Wyk CW. Betel nut chewing and Submucous fibrosis in Durban. SAMT 1988 (a); 74:568-571.

Seedat HA, van Wyk CW. Oral submucous fibrosis in ex-betel nut chewers: a report of 14 cases. J Oral Pathol 1988 (b); 17:226-229.

Seedat & van Wyk CW. Betel chewing and dietary habits of chewers without and with submucous fibrosis and with concomitant oral cancer. SAMT 1988 (c); 74:572-575.

Senewiratne B, Uragoda CG. Betel chewing in Ceylon. The American Journal of Tropical Medicine and Hygiene 1973; 22:3.

Shah SMA, Merchant AT, Luby SP and Chotani RA. Addicted schoolchildren: Prevalence and characteristics of areca nut chewers among primary school children in Karachi, Pakistan. J. Paediatr. Child Health 2002; 38:507-510.

Sirsat SM, Pindborg JJ. Subepithelial changes in oral submucous fibrosis. Acta Pathol Microbiol Scand 1967; 70:161-73.

Statistics South Africa, May 2005 estimates. www.statssa.gov.za

Strickland SS and Duffield AE. Anthropometric status and resting metabolic rate in users of the areca nut and smokers of tobacco in rural Sarawak. Ann Hum Biol 1997; 25:453-74.

Squier CA, Cox P, Hall BK. Enhanced penetration of nitrosonornicotine across oral mucosa in the presence of ethanol. J Oral Pathol 1986; 15:276-279.

Tang JQ, Zhu ZT, Ling TY, Gao ML and Jian XF. A study of 335 cases of oral submucous fibrosis. West China J Stomatol 1993; 11:130-2.

Tan H, and Ling TY. The clinical analysis of oral submucous fibrosis. J Oral Sci Res 2004; 20:529-31.

Van Wyk CW, Staz J and Farman AG. The chewing lesion of the cheeks and lips: its features and prevalence among a selected group of adolescents. J Dent 1977; 5:193-9.
Van der Waal I. Tobacco and oral cancer and precancer. Oral Dis 1998; 4:52-53.

Warnakulasuriya KAAS. Smoking and chewing habits in Sri Lanka: implications for oral cancer and precancer. In: Gupta PC, Hamner JE, Murtu PR, editors. Control of tobacco-related cancers and other diseases. Bombay: Oxford University Press; 1992, pp. 113-18.

Wen CP, Tsai SP, Cheng TY, Chen CJ, Levy DT, Yang HJ and Eriksen MP. Uncovering the relation between betel quid chewing and cigarette smoking in Taiwan. Tobacco Control 2005; 14:16-22.

Winstock AR, Trivedy CR, Warnakulasuriya KAAS and Peters TJ. A dependency syndrome related to areca nut use: some medical and psychological aspects among areca nut users in the Gujarat community in the UK. Addiction Biology 2000; 2:173-179.

World Health Organization. International Agency for Research on Cancer (IARC) Monograph on the evaluation of carcinogenic risks to humans. Betel-quid and Areca nut chewing and some Areca-nut derived nitrosomes, Vol 85. Lyon, France: IARC;20043.

World Health Organization. IARC Monographs Programme finds betel-quid and areca nut chewing carcinogenic to humans. Geneva 2003.

World Health Organization. Guide to epidemiology and diagnosis of oral mucosal diseases and conditions. Geneva 1980.

Yang MS, Su IH, Wen JK, Ko YC. Prevalence and related risk factors of betel quid chewing by adolescent students in southern Taiwan. J Oral Pathol Med 1996; 25:69-71.

Zain RB, Ikeda N, Gupta PC, Warnakulasuriya K, Van Wyk CW, Shresta P and Axell T. Oral mucosal lesions associated with betel quid, areca nut and tobacco chewing habits: consensus from a workshop held in Kuala Lumpur, Malaysia, November 25-27, 1996. J Oral Pathol Med 1999; 28:1-4.

Zhang X, Reichart PA. A review of betel quid chewing, oral cancer and precancer in Mainland China. Oral Oncology 2007; 43: 424-430.

Zhang X, Li C, Liao Q and Reichart PA. Areca chewing in Xiangtan, Hunan province, China: interviews with chewers. J Oral Pathol Med 2008; 37:423-9.

Appendix 1: Questionnaire for patients

Personal details

Name : _____

Gender :_____

Age (at last birthday) : _____

1) Were you born in South Africa? _____

2) If no, where were you born? _____

3) How long are you living here for? _____

4) Have you lived in any other country? _____

5) If yes, which country? _____

6) What is your occupation? _____

Habits

7) Do you chew betel nut/pan/supari?

Yes		No	

If No, go to question 20.

Reason		**Yes**	**No**	**Don't know**
	Parental influence			
	Grandparents influence			
	Family/relatives influence			
	I enjoy it			
	For digestion			
	To relieve stress			
	To freshen my mouth			
	For pain relief			
	As a snack			
	To relieve my boredom			
	At special traditional functions			
	Other, please specify:			

8) If yes, for how long have you been chewing? Months ____ Years ____

9) Did you learn the habit here in South Africa?

Yes		No	

If no, where? _____

10) Where do you purchase the betel nut or ingredients from? _____

11) Do you think betel chewing is:

Beneficial to your health	Harmful to your health	Don't know	

12) Which of the following ingredients do you eat?

	Ingredient	**Yes**	**No**	**Don't know**
	Betel leaf			
	Betel nut/supari			
	Lime			
	Catechu			
	Tobacco			
	Pan masala			
	Other, please specify:			

13) How often do you eat the above?

	Duration	**Yes**	**No**
	Once a day		
	Twice a day		
	Three times a day		
	> three times a day		
	All day		
	Once a week		
	Week-ends only		
	Other: please specify		

14) Do you chew tobacco alone? _____

Yes		No	

15) Do you use tobacco for cleaning your teeth?

Yes		No	

16) Have you tried to give up this habit?

Yes		No	

17) If yes, were you successful? _____

18) If you were not successful, what was the reason(s)? _____

19) Are you trying to stop the habit or thinking about stopping? _____

20) If you are not chewing betel nut NOW, have you chewed it in the past? _____

21) If yes, for how long have you stopped the habit? _____

22) What was your main reason for giving up chewing? _____

23) Do you smoke?

Yes		No	

24) Do you consume alcohol?

Yes		No	

25) Are you aware that betel nut chewing may cause mouth cancer?

Yes		No	

Appendix 2: Informed consent form

I am a Masters student from the Department of Community Oral Health at the University of the Western Cape. Oral Submucous Fibrosis is a premalignant condition and is caused by the chewing of Betel Nut/Nut. There is a large population of the Durban community that chew Betel Nut and they are probably unaware of the risks associated with this habit. We are interested in interviewing you on regarding any chewing habits that you may have to see if there are ways in which we can prevent any mouth problems from developing or help with any mouth problems you may have.

The interview will take about 10-15 minutes. There are no risks in participating. All information gathered in the study will be treated as strictly confidential. No one will have access to this information except the researcher. Neither your name nor anything that identifies you will be used in any reports of this study. All information collected will be maintained and stored in such a way so as to keep it as confidential as possible. Your participation is voluntary and you may withdraw from the study at anytime without any penalties.

If you would like to take part in the study, please sign the bottom of this letter. If you would like to know anything more about the study, please contact Ms Sabeshni Bissessur on telephone number at work 031-2624471 or at home on 031-2692891.

Thank you for your co-operation.

Yours sincerely

Ms Sabeshni Bissessur

I understand what will be required of me to take part in the study. I agree to participate in the research being undertaken by Ms Sabeshni Bissessur. I understand that at any time I may withdraw from this study without giving a reason and without affecting my treatment in the future.

Name:……. ……..
(print in block letters) (signature)

Telephone Number: ……. ……
(Witness)

Date: …….