



Original Research Article

Risk Factors Associated with Oral Sub Mucous Fibrosis (OSMF): A Case Control Study

Devashri Mukherjee¹, Anu Mary Oommen², Anil Ghom³, Kuryan George²

¹Community Health Department, Bangalore Baptist Hospital, Bangalore, Karnataka- 560024. India.

²Department of Community Health, Christian Medical College, Vellore.

³Oral Medicine and Radiology Dept., Maitri Dental College, Anjora, Chhattisgarh.

Corresponding Author: Devashri Mukherjee

Received: 26/05/2014

Revised: 13/06/2014

Accepted: 23/06/2014

ABSTRACT

Objective: To identify risk factors for oral sub mucous fibrosis (OSMF) and the severity of OSMF in the state of Chhattisgarh.

Methods: A case control study was conducted in a dental hospital in Chhattisgarh region. All cases diagnosed with OSMF and consecutive controls with other dental problems were enrolled at a dental hospital over three months. Both cases (50) and unmatched controls (100) underwent interviews (behavioural risk factors like tobacco use, alcohol use etc), clinical and haematological testing.

Results: Use of gutkha (OR 145.4, 95% CI 15.2-1397), khaini (OR 57.42, 95% CI 4.6- 711.01), gudakhu (OR 20.7, 95% CI 1.4-298.4), poor oral hygiene (OR 11.2, 95% CI 1.5 -83.5) and age less than 35 years (OR 7.9, 95% CI 1.4-44.5) were found to be significantly associated with OSMF. The association of anaemia with OSMF (OR 1.7, 95% CI 0.30 to 9.45) was not significant. Age less than 35 years (OR 9.10, 95% CI 1.8 to 45.8) was associated with severe grades of OSMF.

Conclusion: Tobacco products, poor oral hygiene and younger age (< 35 years) were significantly associated with OSMF. As younger age was associated with severe forms of OSMF young people need to receive health education regarding prevention of OSMF. Anaemia was not found to be significantly associated with OSMF.

Keywords: Risk factors, Oral sub mucus fibrosis, Chhattisgarh

INTRODUCTION

Oral sub mucous fibrosis (OSMF) is an oral precancerous chronic progressive disorder which presents with an intolerance to spicy food, rigidity of lip, tongue, and palate leading to varying degrees of limitation of mouth opening and tongue movement. The hallmark of the disease is sub mucosal fibrosis that affects most parts

of the oral cavity, pharynx, and upper third of the oesophagus. [1,2]

The prevalence of OSMF in India varies from 0.03% to 3.2%. [3] The main clinical features* are blanching of the mouth, restriction of tongue movements and mouth opening which worsen as the condition progresses. The cheek mucosa becomes rigid and vertical bands can be palpated making it difficult to blow air or

open the mouth. ^[4] OSMF has a high chance of developing into oral cancer with a malignant transformation rate of 7-13% if left untreated and unattended. It mainly progresses to oral squamous cell carcinoma. ^[5, 6] In recent years, a marked increase in the occurrence of OSMF has been observed in

Bihar, Madhya Pradesh, Gujarat and Maharashtra. ^[7] Apart from known risk factors like tobacco, areca nut use and chilly consumption, anaemia has also been suggested as a possible risk factor for OSMF. ^[1, 6]

***Terminologies:**

Khaini: It is a mixture of crushed sun-dried tobacco leaves and slaked lime which is vigorously rubbed between thumb and palm before placing in the mouth to be either chewed or sucked upon. It is commonly used in Chhattisgarh.

Gutkha: It is a granular brownish or white coloured dry mixture of crushed areca nut, tobacco, catechu, lime and aromatic condiments like essences and sweeteners.

Gudakhu: Gudakhu is a paste of tobacco leaf dust and sugar molasses which is used predominantly by women and directly applied on teeth and gums. It is common in Bihar and Chhattisgarh

***Clinical presentation of OSMF described by Bailoor DN (1993)**

Grade 1 (Mild OSMF)

1. Mild blanching of oral mucosa.
2. No restriction in mouth opening, Central incisor tip to tip of the same side. (Normally in males it is 5.03 cm and in females it is 4.5 cm)
3. No restriction in tongue protrusion, mesio-incisal angle of upper central incisor to the tip of the tongue when maximally extended with mouth wide open. (Normally in males it is 6.73cm and in females it is 6.07cm)
4. Cheek flexibility, CF= V1-V2. Two points measured between at one third the distance from the angle of the mouth on a line joining the tragus of the ear and the angle of the mouth, the subject is then asked to blow his cheeks fully and the distance measured between the two points marked on the cheek V1. CF =V1-V2. (Mean value for males- 1.2 cm, females- 1.08 cm)
5. Burning sensation in mouth only on taking spicy food or hot temperature liquids.

Grade 2 (Moderate OSMF)

1. Moderate to severe blanching.
2. Mouth opening reduced by 33%.
3. Tongue protrusion reduced by 33%.
4. Flexibility also demonstrably decreased.
5. Burning sensation even in absence of stimuli.
6. Palpable bands felt.
7. Lymphadenopathy either unilateral or bilateral.

Grade 3 (Severe OSMF)

1. Burning sensation is very severe.
2. More than 66% reduction in the mouth opening, cheek flexibility and tongue protrusion, in many the tongue may appear fixed
3. Ulcerative lesions may appear in cheek, thick palpable bands felt, lymphadenopathy is bilaterally evident. ^[17]

In addition to the above staging, in 1995 "Khanna and Andrade" developed a group classification system for the surgical management of trismus.

Group I: This is the earliest stage and is not associated with mouth opening limitations. It refers to patients with an inter-incisal distance of greater than 35 mm.

Group II: Refers to patients with an inter-incisal distance of 26-35 mm.

Group III: These are moderately advanced cases. This stage refers to patients with an inter-incisal distance of 15-26 mm. Fibrotic bands are visible at the soft palate, pterygomandibular raphe and also at anterior pillars of fauces.

Group IVA: Trismus is severe, with an inter-incisal distance of less than 15 mm and extensive fibrosis of all the oral mucosa.

Group IVB: Disease is most advanced, with premalignant and malignant changes throughout the mucosa.

It is believed that chronic iron deficiency increases the susceptibility of

oral mucosa to irritants such as areca nut, chillies and tobacco products. ^[1] Anaemia

may also be a consequence of OSMF due to compromised mouth opening in late stages of OSMF. Some studies have suggested that serum iron levels are important markers to predict the prognosis and progression of OSMF. [1, 8] However none of the studies

MATERIALS AND METHODS

Study design and setting

The study was an unmatched case control study with cases as patients identified to have OSMF attending a private dental college and controls as patients with other dental disorders attending the same health centre. . The study after approval from the ethics and review board of a tertiary health care institution was conducted in the Out Patient Department (OPD) of a private dental college in Chhattisgarh from November 2012 to January 2013

Participants

All patients aged 18 years and above identified as newly diagnosed OSMF and those consenting to be part of the study were included as cases. Patients above 18 years coming to the OPD with other dental problems (periodontitis, gingivitis, root canal treatment, dental caries and scaling) were recruited as controls. All the diagnostic parameters were checked in the controls also. Patients with major physical disability, oral cancer, AIDS, pre-existing OSMF or incompetent to provide reliable answers (e.g. mentally retarded, severe hearing impairment), were excluded.

Definitions and measurements:

Diagnosis of cases of OSMF was based on clinical and surgical management classifications given by Bailoor DN (2005) and Khanna and Andrade (1995), [4, 9] based on the presence of any one of the following signs: blanching of oral mucosa, reduction in tongue protrusion, mouth opening and cheek flexibility. Blanching was looked for visually using a mouth mirror. Inter-incisal mouth opening was checked using vernier

have provided any concrete information and suggested further research on the association of anaemia with available evidence being contradictory. Hence this study was planned to investigate primarily whether anaemia was associated with OSMF.

callipers, tongue protrusion with a scale and cheek flexibility with the help of divider and scale.

The severity (grades 2 and 3) of OSMF was assessed by recording severe reduction in cheek flexibility (below 6 mm), tongue protrusion (below 22 mm) and inter incisal mouth opening (below 35 mm) measurements. [4]

Alcohol consumption, tobacco, areca nut and betel quid use (daily use and frequency), chilly consumption and family income were obtained through an interview based questionnaire administered in the local language. The questionnaire was based on WHO GATS questionnaire. [10] Height and weight were recorded with a measuring tape and bathroom weighing scale respectively. Oral examination was done by moving the Shepard's hook explorer on the tooth surfaces to measure the debris and calculus based on existing diagnostic criteria. [11]

A blood sample for haemoglobin estimation, peripheral smear and sickle cells was collected from all subjects to diagnose anaemia (iron deficiency, Vitamin B12 deficiency and sickle cell anaemia). Anaemia was categorized by the haemoglobin thresholds given by the World Health Organisation. [12] Haemoglobin assessment and the type of anaemia were identified using a fully automated haematology analyzer (Trivitron Healthcare Pvt. Ltd.) and peripheral smear respectively. Sickle cell anaemia diagnostic test used was a Haemoglobin S and Haemoglobin A solubility test (SickleVue, The Tulip groups, India).

Table 1: Sources of data measurements:

Data	Tool used for measurement
Use/consumption of alcohol, tobacco, betel quid ,chillies, areca nut ,smoking habits, socioeconomic status, age, gender.	Interviewer administered Questionnaire
Anthropometric measurements: height and weight	Height: measuring tape Weight: bathroom weighing scale
Clinical examination : oral hygiene and OSMF	Oral hygiene index simplified using Shepards hook explorer no.6 and stages of OSMF (8)
Lab investigations: Haemoglobin assessment and tests to identify type of anaemia	Haemoglobin count using fully automated haematology analyzer (19 parameters) and peripheral smear. Sickle cell diagnostic test using haemoglobin S and haemoglobin A solubility test- Sicklevue.)

All patients were given the required treatment, health education including motivation to quit unhealthy habits and a copy of the blood report.

Bias: The lack of masking may have led to information bias but as the investigator used an objective questionnaire it is unlikely to have caused a major bias. As it was a hospital based study there is a possibility of selection bias if males were more likely to have come to seek treatment.

Study Size: The sample size was calculated based on an odds ratio of 3 for anaemia and OSMF and a prevalence of 30% anaemia among controls, with a case: control ratio of 1:2. [13]

Statistical Analysis:

The data entry was done in Epi data 3.1 and Statistical Package for Social Sciences 16 (IBM SPSS Statistics) was used for analysis. Chi-square test was used to find associations of categorical variables (age, gender, alcohol, spicy food, anaemia, tobacco and individual tobacco products) and odds ratios with confidence intervals were calculated. A stratified analysis was done to identify potential confounders. Stratum specific odds ratios were calculated and if the stratum specific odds ratios were different it was concluded that there was interaction between the two variables. Mantel Haenszel odds ratios were calculated and checked to look for a difference from the crude odds ratio to identify possible confounders. [14] Logistic regression analysis was done to

obtain a final adjusted model of significant risk factors for OSMF and also to find out the risk factors for severity of OSMF

Table 2: Socio-demographic details of cases and controls.

Variables	Cases, n=50	Controls, n=100
Gender		
Male	49 (98%)	79 (79%)
Female	1 (2%)	21 (21%)
Age in years, mean (SD)	30.52 (12.65)	29.95 (11.91)
Religion		
Hindu	48 (96%)	93 (93%)
Muslim	2 (4%)	3 (3%)
Christian		1 (1%)
Sikh		1 (1%)
Jain		1 (1%)
Residence		
Rural	36 (72%)	61 (61%)
Urban	14 (28%)	39 (39%)
Married		
Yes	28 (56%)	44 (44%)
No	22 (44%)	55 (55%)
Monthly family income in rupees (median)	8500	10000
Employment rates	(76%)	(54%)

RESULTS

The socio demographic details of the cases and controls are shown in Table 2. The proportion of males was higher among the cases. To obtain the required sample size 193 patients were approached for consent and 150 consented, with 43 refusing due to reluctance in giving the blood test.

The results of the bivariate analysis are shown in Table 3. Mantel Haenszel odds ratio and stratified analysis were used to identify potential confounders and interaction among the variables. Gender, daily tobacco use, alcohol, family income, gutkha use, food type, age and marriage

were identified as causing confounding or interaction. These risk factors and variables with p values less than .05 in the bivariate analysis were entered into an unconditional logistic regression model to find the adjusted effect of anaemia on OSMF, which was found out to be non-significant.

After adjusting for sex, age, use of alcohol, spicy foods, employment and education the factors which were significantly associated

with OSMF were gutkha, khaini, gudakhu, poor oral hygiene and age less than 35 years (Table 3).

Gutkha use was shown to have the highest association with OSMF with 41 cases (82%) out of 50 consuming gutkha while only 17 (17 %) controls consumed it. This was also confirmed by a positive dose response relationship for OSMF and gutkha use (Table 4).

Table 3: Association of Risk factors with OSMF
R= Reference category

Risk factor	Unadjusted odds ratios	95% confidence interval, P value	Adjusted odds ratios	95% confidence Interval, P value
Gender Male Female (R)	13.025	1.7 - 99.9, 0.001	2.50	0.10-58.8, 0.57
Smokeless tobacco use (daily) Yes No (R)	24.33	8.7 - 67.7, 0.000	-	-
Poor oral hygiene Good oral hygiene (R)	6.09	2.17 - 17.75, 0.001	11.2	1.5 - 83.5, 0.019
Alcohol use (daily), Yes No (R)	5.95	2.83 - 12.5, 0.000	1.32	0.40-4.3, 0.64
Use of spicy foods regularly, Yes No (R)	5.3	2.3 - 12.1, 0.001	2.35	0.7-8.2, 0.182
Khaini use (daily), Yes No (R)	2.57	1.07 to 6.17, 0.03	57.4	4.6 - 711.2, 0.002
Gutkha use (daily), Yes No (R)	22.42	9.13 - 54.2, 0.000	145.37	15.2 - 1397, <0.001
Gudakhu use (daily), Yes No (R)	6.68	1.3 - 34.42, 0.017	20.7	1.4 - 298.4, 0.026
Unemployment, Yes No (R)	0.371	0.17 - 0.79, 0.01	0.46	0.1-2.1, 0.30
Education, ≤ 8 th std. ≥ 9 th std. (R)	2.33	1.15 - 4.7, 0.02	0.80	0.22-2.9, 0.74
Age ≤ 35 years Age > 35 years (R)	1	0.45 - 2.2, 1.0	7.9	1.3 - 44.7, 0.020
Anaemia (WHO definition), Yes No (R)	0.695	0.29 - 1.26	1.7	0.30-9.40, 0.54

Table 4: Dose response relationship of gutkha consumption and OSMF.

Frequency of gutkha use	Unadjusted odds ratios (Reference group: no gutkha use)	P-value	95% confidence interval
≤ 2 packs /day	3.9	0.07	0.86 - 18.4
3 to 4 packs / day	11.8	<0.001	3.5 - 39.5
≥ 5 packs / day	89.0	<0.001	22.5 - 352.03

To identify the risk factors associated with severe grades of disease, the three grades of disease were clubbed into two groups as mild (OSMF grade 1) and severe (OSMF grades 2 and 3). Among the 50 cases there were 13 (26%) with grade 1, 19 (38%) with grade 2 and 18 (36%) grade 3 OSMF. Of the total cases 16 (32%) had bud-shaped

uvula, 6 (12%) shrunken, 13(26%) hockey-stick type and 15 (30%) had no uvula distortion.

Unadjusted analysis was followed by a backward conditional multivariate logistic regression analysis to identify factors associated with severity of OSMF. All

variables with p less than 0.05 in the bivariate analysis (gutkha, khaini, betel-quid, oral hygiene and age) were included in a multivariate stepwise backward conditional logistic regression model after checking for multi co-linearity using variation –inflation tests (Table 5).

Table 5: Association between risk factors and severity of OSMF.

Risk Factor	Unadjusted odds ratios	95% Confidence interval, P-value	Adjusted odds ratios	95% Confidence interval, P-value
Poor oral hygiene Good oral hygiene (R)	0.20	0.051 to 0.78, 0.03	0.16	0.033 - 0.777, 0.023
Betel quid use (daily), Yes No (R)	0.093	0.009 to 0.990, 0.05	-	-
Khaini use (daily) Yes No (R)	0.166	0.041 to 0.67, 0.02	-	-
Gutkha use (daily) Yes No (R)	5.15	1.12 to 23.7, 0.04	-	-
Age ≤ 35 years Age > 35 years (R)	7.56	1.76 to 31.5, 0.007	9.101	1.8 - 45.8, 0.007

*outcome variable risk: (OSMF grade 2 and 3), outcome variable reference: (OSMF grade 1)

DISCUSSION

This study was done to find out the risk factors associated with OSMF including anaemia. There is little information about OSMF and associated risk factors in this region. Though a ban has been imposed on gutkha all over the state, it does not seem to be implemented. Tobacco chewing was found to be quite prevalent in this region and more so in the younger age group.

Our study did not find a significant association between anaemia and OSMF which is consistent with the findings of study done by Pooja Singh et al [15] who found no significant difference in the haemoglobin levels of OSMF patients and healthy individuals. However Karthik et al [1] and Rupak et al [8] reported a significant difference in the haemoglobin and serum iron levels in both these groups. Studies with a larger sample size may be needed to establish the significance and magnitude of this association.

The finding of male predominance among OSMF cases was similar to other studies elsewhere in India where the male: female ratios of OSMF cases were 3.1, 2.3:1, 10:1 and 5:1 respectively. [7, 16-18] The reason for a male predilection may be the easy accessibility and acceptability of gutkha use along with changing lifestyles. However there is also a possibility of a selection bias if female cases of OSMF were few because it was a hospital based study and women with this condition may not have sought treatment.

The mean age of OSMF cases in our study was 31 years which was similar to studies by Rupak et al, Katharia et al and Maher et al. [8, 19, 20] More than 75% of cases were below 35 years of age in accordance with a study by Sinor et al. [21] People less than 35 years were 5.3 times more likely to develop OSMF as compared to the older population and this age group was also significantly associated with severity of the disease (OR 9.10, 95% CI: 1.8 to 45.8).

Although Ahmad et al and Shiau YY et al found that OSMF was associated with lower socio economic status; such an association was not found in the present study. [22, 23]

Gutkha use was the most significant risk factor in our study with an adjusted odds ratio of 145 (95% CI: 15.2 to 1397). Of the cases 90% were gutkha and other tobacco product users compared to only 27% of the controls, which was similar to the studies of Ahmed et al [7] who reported 97% of cases as gutkha and other tobacco product users and that of Bathi et al [24] whose study showed an odds ratio of 26 for OSMF and Gutkha. The large positive dose response relationship seen in the current study corroborates the findings reported by Ahmed et al in studies done in Bihar and Bhopal. [7, 22] Khaini is a mixture of tobacco and slaked lime which may or may not be combined with sliced areca nut pieces. In the current study Khaini users were 57.5 times more likely to have OSMF. This is a local product used in states like Chhattisgarh and to our knowledge there are no other studies which report an association with OSMF.

Interestingly, in Chhattisgarh areca nuts with flavouring agents and tobacco pouches are available in every corner of the road despite there being a ban on gutkha. The lack of awareness regarding the harmful effects of tobacco and about this precancerous condition among the population may have developed an ignorant attitude towards quitting tobacco.

Although other studies have documented betel quid as a risk factor, [25, 26] our study did not find any significant association between betel quid use and OSMF. However betel quid was found to be protective against severe forms of disease, a finding consistent with other studies reporting that betel quid users have milder grades of OSMF due to the presence of antioxidants in the betel leaf which quench the mutagenic radicals. [27, 28]

Poor oral hygiene is associated with most oral diseases and in our study poor oral hygiene was 11.2 times greater among cases than controls. Vivek Agarwal et al had also observed that most OSMF patients have poor oral hygiene. [29] However poor oral hygiene was associated with lower grades of the disease. There is a possibility that patients with stains or poor oral hygiene caused due to tobacco product consumption undergo scaling more often than the non-users. Therefore these patients may get diagnosed earlier than those with good oral hygiene and quit or lessen the usage of tobacco products, in turn averting the progression of the disease.

Although other studies have shown that spicy food intake and alcohol intake are associated with OSMF and oral cancer [30-32] there was no association of these risk factors with OSMF in our study.

Given the high association of smokeless tobacco products and precancerous lesions stringent measures need be taken to restrict their availability with nation-wide ban on their sales Tobacco related awareness sessions must be included in the curriculum of schools and colleges to educate the younger generation and discourage them from consuming tobacco. As oral health is neglected in most small cities and rural areas, routine oral health check-ups and awareness camps must be conducted to increase awareness and detection of this precancerous condition and its consequences.

CONCLUSIONS

Smokeless tobacco use especially gutkha, khaini and gudakhu showed a significant association with OSMF with a positive dose relationship of gutkha consumption and OSMF. Younger age was associated with the more severe forms of OSMF as compared to older persons. In view of the dangers of these smokeless

tobacco products it is time to take strict actions to ensure the implementation of the ban of gutkha across Chhattisgarh state and other parts of the country as well. The rising prevalence of this irreversible but preventable condition warrants targeted prevention and awareness strategies to reduce the burden of oral cancer in long term.

Conflict of Interest: None

Source of Funding: Fluid research fund of the hospital –Number: 22X996

REFERENCES

1. Karthik H, Nair P, Gharote HP, Agarwal K, Ramamurthy Bhat G, Kalyanpur Rajaram D.. Role of hemoglobin and serum iron in oral sub mucous fibrosis: a clinical study. *Scientific World Journal* 2012; 2012: 254013; doi: 10.1100/2012/254013.
2. Pindborg JJ, Barmes D, Roed-Peterson B. Epidemiology and histology of oral leukoplakia and leukoedema among Papuans and New Guineans. *Cancer* 1968; 22(2): 379-84.
3. L Aravindh, P Jagadesh, P Mahesh Kumar, Ramasubramaniam, N Raj Vikram. Oral lesions associated with Tobacco. *Indian Journal of Drugs and Diseases* 2012; 1(1):10–1.
4. Bailoor D, Nagesh KS. *Fundamentals of oral medicine and radiology*. 1st ed. New Delhi: Jaypee Brothers medical Publishers 2005. p.185.
5. Gupta MK, Mhaske S, Ragavendra R, Imtiyaz. Oral sub mucous fibrosis - Current Concepts in Etiopathogenesis. *People's Journal of Scientific Research* 2008; 1:39–44.
6. Tilakratne WM, Kinikowski NF, Saku T, Peters TJ, Warnakulasuriya S. Oral sub mucous fibrosis: Review on aetiology and Pathogenesis. *Oral Oncol* 2006; 42(6):561–8.
7. Ahmad MS, Ali SA, Ali AS, Chaubey KK. Epidemiological and etiological study of oral sub mucous fibrosis among gutkha chewers of Patna, Bihar, India. *J Indian Soc Pedod Prev Dent* 2006; 24(2):84-9.
8. Rupak, George G, Padiyath, Sheeba, Kumar, Kiran KR. Oral sub mucous fibrosis and iron deficiency anaemia relationship revisited- results from an Indian study. *E-Journal of Dentistry* 2012; 2(2):159-165. Available from: <http://www.ejournalofdentistry.com/mobile/6-4.html>.
9. Khanna JN, Andrade NN. Oral submucous fibrosis: a new concept in surgical management- Report of 100 cases. *Int J Oral Maxillofac Surg* 1995; 24(6):433-9.
10. Global Adult Tobacco Survey (GATS India 2009-10), MOHFW, International Institute Of Population Sciences.[Internet] [cited 2012 May 16] Available from: director@iips.net, gatsindia@iips.netor
11. Soben Peter. *Essentials of preventive and community dentistry*. 3rd ed. New Delhi: Arya (medi) Publishers 2003. pp. 132-35.
12. Sullivan KM, Meih Z, Strawn LG, Parvanta I. Haemoglobin adjustments to define anaemia. *Trop Med Int Health* 2008; 13(10):1267-71.
13. National Family health Survey Database -3 National Reports (2005-2006) [cited 2012 June 25] Available from: http://www.rchiips.org/nfhs/nfh_s3_national_reports.html.
14. Schlesselman JJ. *Case control studies- Design, conduct, analysis*.

- Oxford university press: 1982. p. 354.
15. Singh P, Gharote H, Nair P, Heghde K, Saawarn N, Guruprasad R. Evaluation of cachexia in oral sub mucous fibrosis. *Journal of Indian Academy of Oral Medicine and radiology* 2012; 24(2): 130-2
 16. Reddy V, Wanjari P, Reddy N, Reddy P. Oral Submucous Fibrosis: Correlation of Clinical Grading to various habit factors. *International Journal of Dental Clinics*. 2011;3(1):21-4.
 17. Kiran Kumar K, Saraswathi TR, Ranganathan K, Uma Devi M, Elizabeth J. Oral sub mucous fibrosis: A clinico-histopathological study in Chennai. *Indian J Dent Res* 2007;18(3):106-11.
 18. Hazarey VK, Erewald DK, Mundhe KA, Ugadhe SN. Oral sub mucous fibrosis: study of 1000 cases form central India. *J Oral Pathol Med* 2007; 36(1):12-7.
 19. Katharia SK, Singh SP, Kulshreshtha VK. The effects of placental extract in management of oral sub mucous fibrosis. *Indian J Pharmacol* 1992; 24(3):181-83.
 20. Maher R, Aga P, Johnson NW, Sankaranarayanan R, Warnakulasuriya S. Evaluation of multiple micronutrient supplementations in the management of oral sub mucous fibrosis in Karachi, Pakistan. *Nutr Cancer* 1997; 27(1):41-7.
 21. Gupta PC, Sinor PN, Bhonsle RB, Pawar VS, Mehta HC. Oral sub mucous fibrosis in India: A new epidemic? *Natl Med J India* 1998; 11(3):113-6.
 22. Ahmad MS, Ali SA, Ali AS, Chaubey KK. Comparative Severity of Oral Sub mucous Fibrosis among gutkha and other areca nut products chewers. *Priory Medical Journals* [cited 2012 Jul 20]. Available from:<http://www.priory.com/den/areca.html>.
 23. Shiau YY, Kwan HW. Sub mucous Fibrosis in Taiwan. *Oral Surg* 1979; 47(5):453-7.
 24. Bathi RJ, Parveen S, Burde K.. The role of gutka chewing in oral sub mucous fibrosis - a case control study. *Quintessence Int* 2009; 40(6): p.19-25. Available from: <http://www.ncbi.nlm.nih.gov/pubmed/19587880>
 25. Jeng JH, Chang MC, Hahn LJ. Role of areca nut in betel quid-associated chemical carcinogenesis: current awareness and future perspectives. *Oral Oncol* 2001; 37(6):477-92.
 26. Lee CH, Ko YC, Huang HL, Chao YY, Tsai CC, Lin LM et al. The precancer risk of betel quid chewing, tobacco use and alcohol consumption in oral leukoplakia and oral sub mucous fibrosis in southern Taiwan. *Br J Cancer* 2003; 88(3):366-72.
 27. Chhaya VA, Sinha V, Rathore R, Modi N, Parmar V, Chhaya R et al . Oral Sub mucous Fibrosis - Laser Treatment. *World Articles on Ear Nose Throat* 2010; 3(2): 39-44.
 28. Supadmadevi G, Jayanthi K, Shah B, Kamala R. Evaluation between Betel Quid and Pan Masala/Gutkha Habitual Chewers with OSMF. *World Journal of Dentistry* 2012; 3(1):37-40.
 29. Agarwal V, Singh M. Endodontic management of a patient with oral sub mucous fibrosis using custom modified endodontic instruments. *J Conserv Dent* 2012; 15(1):89-91.
 30. Canniff JP, Harvey W, Harris M. Oral sub mucous fibrosis: its

- pathogenesis and management. Br Dent J 1986; 160(12):429-34.
31. Pillai R, Balram P, Reddiar KS. Pathogenesis of oral sub mucous fibrosis. Relationship to risk factors associated with oral cancer. Cancer 1992; 69(8):2011-20.
32. Balaram P, Sridhar H, Rajkumar T, Vaccarella S, Herrero R, Nandakumar A et al. Oral cancer in southern India: the influence of smoking, drinking, pan chewing and oral hygiene. Int J Cancer 2002; 98(3):440-5.

How to cite this article: Mukherjee D, Oommen AM, Ghom A et. al. Risk factors associated with oral sub mucous fibrosis (OSMF): a case control study. Int J Health Sci Res. 2014; 4(7):1-10.

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