

“Correlation between Areca/Betel Nut Chewing Habit with Facial and Dental Characteristics in School Going Children - A Prospective Cross-Sectional Survey”

Palak Shah¹, Dolly Patel², Kaushal Shah³

¹(Department of Orthodontics & Dentofacial Orthopaedics, AMC Dental College and Hospital, Gujarat University, India)

²(Department of Orthodontics & Dentofacial Orthopaedics, AMC Dental College and Hospital, Gujarat University, India)

³(Department of Orthodontics & Dentofacial Orthopaedics, AMC Dental College and Hospital, Gujarat University, India)

Corresponding Author: Palak Shah

Abstract:

Aim:The aim of this survey was to study the prevalence of areca/betel nut chewing & establish correlation with facial and dental characteristics in school going children.**Method:**A population-based questionnaire study was carried out in school going children of rural area of Dhamatwan Village, Daskroi District, Ahmedabad, Gujarat, India. This prospective cross-sectional study was conducted in school going children aged between 13-17 years(Class of 7th, 8th, 9th, 10th and 11th) (14.75 ± 1.117 years) with a sample size of 214 were included in the study. The subjects were examined clinically by a single investigator and questionnaire based on areca/betel nut chewing habit got filled after interviewing school children.Extra-oral Facial profile examination and Intra-oral examination in sagittal, vertical and transverse planes were done. Mouth opening, Tongue protrusion and Cheek flexibility was measured.**Results:** A total of 100 (46.73%) subjects reported to have areca/betel nut chewing habit. The incidence of Oral Submucosal Fibrosis (OSMF) among school children was 24 (11.21%). Difference amongst Chewer and Non-Chewer Group according to gender was statistically significant (P value <0.001). Cheek flexibility in Chewer Group compared to Non-Chewer group is decreased (P value 0.042)**Conclusion:**The frequency and duration of areca/betel nut chewing habit is independently related with severity of Oral Submucosal Fibrosis (OSMF) in low age group children. Alarmingly, there is high incidence of Oral Submucosal Fibrosis (OSMF) (11.21%) in school children. But due to no significant restricted mouth opening at early stage and lack of education about the initial symptoms, majority of subjects are insidiously present.

Key Words:Areca/Betel nut, Oral Submucosal Fibrosis(OSMF), Public Awareness, Malocclusion

Date of Submission: 07-05-2018

Date of acceptance: 22-05-2018

I. Introduction

Worldwide, estimates of OSMF shows a confinement to Indians and Southeast Asians, with overall prevalence rate in India to be about 0.2% to 0.5 %. It is a precancerous condition with incidence of 0.5% in general population in India.^{1,2}It has been suggested that ingestion of chilies, genetic susceptibility, nutritional deficiencies, altered salivary constituents, autoimmunity and collagen disorders may be involved in the pathogenesis of this condition.³The condition is well recognized for its malignant potential rate of 7.6% and is particularly associated with use of areca/betelnut in various forms with significant duration and frequency of chewing habit. It leads to Squamous Cell Carcinoma of oral cavity, pharynx, esophagus and stomach in 7-13% of cases.^{4,5}

Areca/Betelnut is a substance of abuse used commonly in Western Pacific and South Asian countries. The fourth most common substance of abuse worldwide and is used by 10% of the world population.¹ Commercially available in various forms, Areca/Betelnut is linked with the Oral Submucosal Fibrosis (OSMF).

The clinical symptoms of OSMF includes ulceration, burning mouth sensation, blanching of buccal mucosa and gradual decrease in mouth opening. The decrease in mouth opening is due to the formation of fibrotic bands in the oral and para-oral mucosal soft tissues. The inflammatory process in buccal mucosa is exacerbated by a compound called Arecoline which is the main component of Areca/Betelnut. This substance causes increased deposition of collagen in lamina propria (Submucosal level of soft tissues).⁶

Generally, age range of patients with Oral Submucosal Fibrosis (OSMF) is found to be wide ranging between 20 and 40 years of age.^{7,8} Areca/Betelnut chewing habit is increasingly becoming prevalent among lower age group of school children. Studies report lower age range to be 18 years for Oral Submucosal Fibrosis (OSMF). Hence, Previous studies done focused on 18-65 years of age groups.^{11,12} However, recent prevalence of Oral Submucosal Fibrosis (OSMF) is found to be increasing amongst school going children as well especially in rural areas. There are increasing incidence of Oral Submucosal Fibrosis (OSMF) in children with various case reports in South Asian population.^{9,10} Not much literature have been found to correlate the areca/betelnut chewing habit in school going children and facial and dental characteristics.

Thus the aim and objectives of this survey was to study the prevalence of areca/betel nut chewing in school going children & establish correlation with facial and dental characteristics in school going children. Simultaneously, to create awareness among the children about orthodontic treatment and to avoid consumption of areca/betel nut.

II. Material and Methods

A population-based questionnaire study was carried out in school going children of rural area of Dhamatwan Village, Daskroi District, Ahmedabad, Gujarat, India which is adopted by AMC Dental College. After taking approval from the Institutional Ethics Committee of the AMC Dental College, Khokhra, Ahmedabad, this prospective cross-sectional study was conducted in school going children aged between 13-17 years (Class of 7th, 8th, 9th, 10th and 11th) with a sample size of 214 were included in the study. The written permission from the school's principal for the survey was obtained and the parents were notified one week in advance about the dental survey. The survey was totally based on history taking & clinical examination. The subjects were examined clinically by a single investigator and questionnaire based on areca/betelnut chewing habit was filled after interviewing school children by the same investigator. (Annexure-I) Specific questions linked with the symptoms of Oral Submucosal Fibrosis (OSMF) were also asked. A clinical examination was performed for presence of Oral Submucosal Fibrosis (OSMF). Extra-oral profile examination and Intra-oral examination in sagittal, vertical and transverse planes were done. Mouth opening was measured with distance between upper and lower central incisors edges. Tongue protrusion was measured from normal mesio-incisal angle of upper central incisor to the tip of the tongue when maximally extended with the mouth wide open. Cheek flexibility was measured between two points V1 and V2; V1 = is point at 1/3rd the distance from the angle of the mouth on a line joining the tragus of the ear and the angle of the mouth and V2 = the subject is then asked to blow his cheeks fully, and the difference was measured between these two points. (V2-V1) A brief education program about the hazards of areca/betelnut chewing habit and need for orthodontic treatment was arranged immediately after the survey. The subjects diagnosed for presence of Oral Submucosal Fibrosis (OSMF) at clinical examination were referred for further diagnostic follow up at AMC Dental College and the parents were informed in writing about the results of survey.

Study Design: Prospective Cross-Sectional Study

Study Location: Dhamatwan Village, Daskroi District, Ahmedabad, Gujarat, India

Study Duration: 4 weeks

Sample size: 214 samples

Subjects & selection method:

Inclusion criteria:

1. Age group of 13-17 years (Class of 7th, 8th, 9th, 10th and 11th)

Exclusion criteria:

1. With limitation of mouth opening due to other causes e.g. Odontogenic infections and joint disorders
2. Presence of other oral lesions e.g. Leukoplakia or Lichen-planus

Statistical analysis:

The data collection was subjected to various relevant statistical method of analysis. It was performed using IBM SPSS Statistics for Window Software (Version 20.0, IBM Corp, Armonk, NY). The descriptive analysis and inferential analysis using Pearson Chi-Square test was performed. Independent Student's t-test was used to compare Mouth opening, Tongue protrusion and Cheek flexibility between Chewer and Non-Chewer Group.

III. Result

Total of 214 children were surveyed with a mean age of 14.75 ± 1.117 years. Out of that, total 100 (46.73%) subjects reported to have areca/betelnut chewing habit. (Fig. No. 1) The incidence of Oral Submucosal Fibrosis (OSMF) among school children was 24 (11.21%) as confirmed by clinical examination and presence of fibrotic bands in buccal mucosa. (Fig. No. 2)

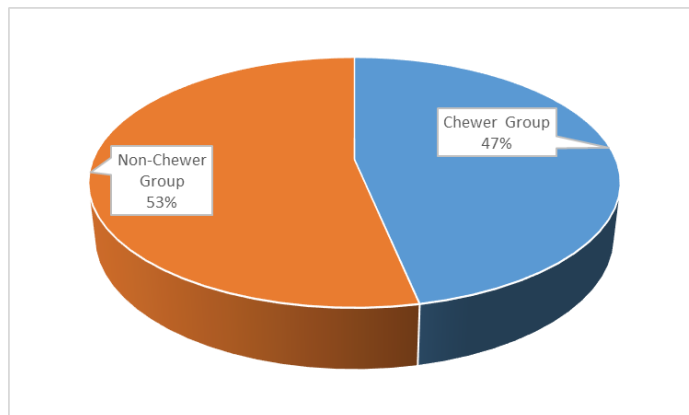


Fig. No. 1: Percentage of Chewer and Non-Chewer Group

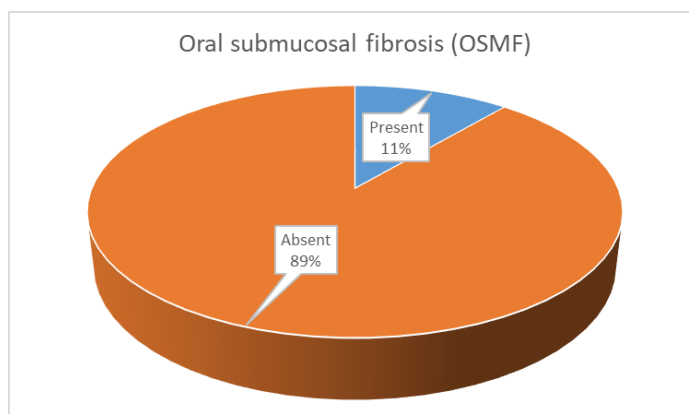


Fig. No. 2: Incidence of Oral Submucosal Fibrosis (OSMF)

Table No.1 shows 85 (58.22%) out of 146 (68.2%) boy of total sample and 15 (22.06%) out of 68 (31.8%) girl of total sample has habit of areca/betelnut chewing. (Fig. No. 3&4) Difference amongst Chewer and Non-Chewer Group according to gender was statistically significant (P value < 0.001). It indicates boys are having high prevalence of chewing habit than girls.

Total 214 (100%)	Boy (68.2%)	Girl (31.8%)
Chewer 100 (46.73%)	85 (58.22%)	15 (22.06%)
Non-Chewer 114 (53.27%)	61 (41.78%)	53 (77.94%)
	146 (100%)	68 (100%)

Table No. 1: Frequency distribution according to gender in Chewer and Non-Chewer Group

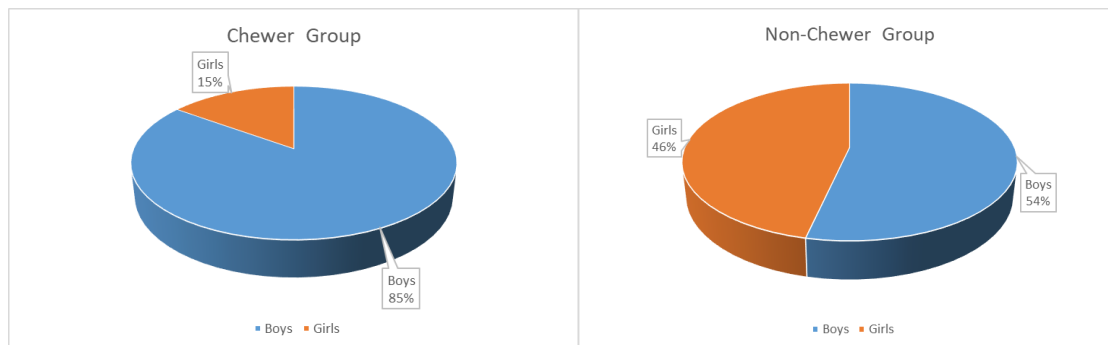


Fig. No. 3: Frequency distribution according to gender in Chewer and Non-Chewer Group

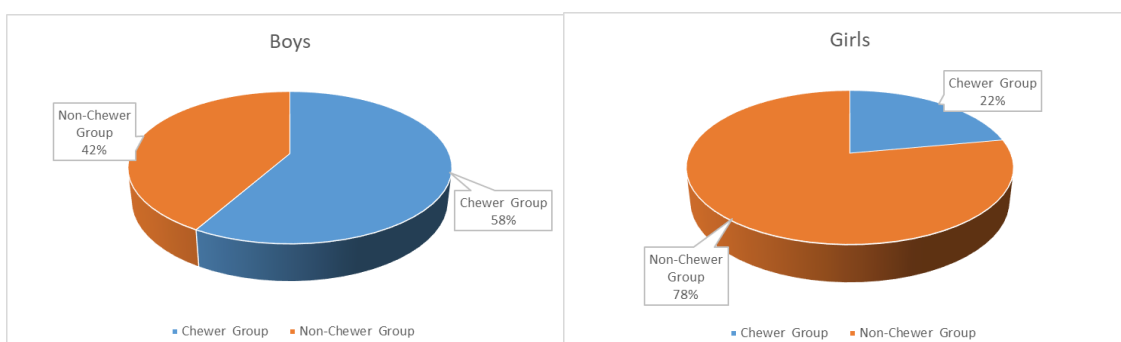


Fig. No. 4: Percentage of Chewer and Non-Chewer Group according to gender

Table No.2 shows 143 (66.82%) out of 214 total sample parents have habit of areca/betelnut chewing. Difference amongst Chewer and Non-Chewer Group related to chewing habit amongst parents was not statistically significant. (P value 0.032)

Group	Father (121)	Mother (3)	Both (19)	Total (143)
Chewer	67	1	8	76
Non-Chewer	54	2	11	67

Table No. 2: Frequency distribution for chewing habit amongst parents in Chewer and Non-Chewer Group

Table No.3 shows 87 (40.66%) out of 214 total sample have Straight, 124 (57.94%) have Convex and 3 (1.40%) have Concave Profile. Difference amongst Chewer and Non-Chewer Group for Profile was not statistically significant. (P value 0.625)

Total 214 (100%)	Straight (40.66%)	Convex (57.94%)	Concave (1.40%)
Chewer 100 (46.73%)	38(43.68%)	60(48.39%)	2(66.67%)
Non-Chewer 114 (53.27%)	49(56.32%)	64 (51.61%)	1 (33.33%)
	87(100%)	124(100%)	3(100%)

Table No 3: Frequency distribution for Profile in Chewer and Non-Chewer Group

Table No.4 shows 137 (64%) out of 214 total sample have Class I, 74 (34.6%) have Class II and 3 (1.4%) have Class III relationship. Difference amongst Chewer and Non-Chewer Group for Sagittal relationship was not statistically significant. (P value 0.771)

Total 214 (100%)	Class I (64%)	Class II (34.6%)	Class III (1.4%)
Chewer 100 (46.73%)	63 (45.99%)	35 (47.3%)	2(66.67%)
Non-Chewer 114 (53.27%)	74 (54.01%)	39 (52.7%)	1 (33.33%)
	137 (100%)	74 (100%)	3 (100%)

Table No. 4: Frequency distribution for Sagittal relationship in Chewer and Non-Chewer Group

Table No.5 shows 65 (30.37%) out of 214 total sample have Normal-bite, 1(0.47%) has Open-bite and 148(69.16%) have Deep-bite relationship. Difference amongst Chewer and Non-Chewer Group for Vertical relationship was not statistically significant. (P value 0.993)

Total 214 (100%)	Normal-bite (30.37%)	Open-bite (0.47%)	Deep-bite (69.16%)
Chewer 100 (46.73%)	30(46.15%)	1(100%)	69(46.62%)
Non-Chewer 114 (53.27%)	35 (53.85%)	0 (0%)	79(53.38%)
	65(100%)	1(100%)	148(100%)

Table No. 5: Frequency distribution for Vertical relationship in Chewer and Non-Chewer Group

Table No.6 shows out of 214 total sample 208 (97.2%) have Normal-bite and 6(2.8%) have Cross-bite relationship. Difference amongst Chewer and Non-Chewer Group for Transverse relationship was not statistically significant. (P value 0.504)

Total 214 (100%)	Normal-bite (97.2%)	Cross-bite (2.8%)
Chewer 100 (46.73%)	98 (47.12%)	2 (33.33%)
Non-Chewer 114 (53.27%)	110 (52.88%)	4 (66.67%)
	208 (100%)	6 (100%)

Table No. 6: Frequency distribution for Transverse relationship in Chewer and Non-Chewer Group

Table No.7 shows Mouth opening in Chewer Group (43.29 mm ± SD 6.67) and Non-Chewer Group (43.29 mm ± SD 5.41) with mean difference of 0.001mm amongst Chewer and Non-Chewer Group was not statistically significant. (P value 0.999)

Total 214 (100%)	Mean ± SD (mm)	Mean Difference (mm)	P value
Chewer 100 (46.73%)	43.29 ± 6.67	0.001	0.999
Non-Chewer 114 (53.27%)	43.29 ± 5.41		

Table No. 7: Comparison of Mouth opening in Chewer and Non-Chewer Group

Table No.8 shows Tongue protrusion in Chewer Group (41.01 mm ± SD 6.96) and Non-Chewer Group (40.19 mm ± SD 6.43) with mean difference of 0.817mm amongst Chewer and Non-Chewer Group was not statistically significant. (P value 0.373)

Total 214 (100%)	Mean ± SD (mm)	Mean Difference (mm)	P value
Chewer 100 (46.73%)	41.01 ± 6.96	0.817	0.373
Non-Chewer 114 (53.27%)	40.19 ± 6.43		

Table No. 8: Comparison of Tongue protrusion in Chewer and Non-Chewer Group

Table No.9 shows Cheek flexibility in Chewer Group (14.26 mm ± SD 4.54) and Non-Chewer Group (15.53 mm ± SD 4.48) with mean difference of 1.266mm amongst Chewer and Non-Chewer Group was statistically significant (P value 0.042) It suggests that Cheek flexibility in Chewer Group is decreased compared to Non-Chewer Group.

Total 214 (100%)	Mean ± SD (mm)	Mean Difference (mm)	P value
Chewer 100 (46.73%)	14.26 ± 4.54	1.266	0.042
Non-Chewer 114 (53.27%)	15.53 ± 4.48		

Table No. 9: Comparison of Cheek flexibility in Chewer and Non-Chewer Group

IV. Discussion

The 214 children were included in this survey with mean age of 14.75 ± 1.117 years. In our study, 100 (46.73%) children were found to have areca/betel nut chewing habit. High prevalence of areca/betel nut chewing habit have been reported by Khan MA et al¹³ (79.6%) and Oakley et al¹⁴ (63.4%). Khandelwal et al¹⁵ found

45.42% and Ali et al¹⁶ found 50% prevalence of chewing habit which is almost similar to our study suggesting habit of areca/betel nut chewing is increasing in school going children.

Dayal PK et al.¹⁷ had found male predominance (M: F = 4.2:1) in their study. This is consistent with the present study, which showed, a very strong male predilection 2.64:1. Earlier there was definite female predilection as reported by Pindborg et al.¹⁸ But recently there is paradigm shift in this aspect. However, it differs from study done by Pindborg et al¹⁸ who reported definite female predilection. This study was performed in Dhamatvan Village where it could be regional prevalence. In our study it was found that 85 boys out of 146 (58.22%) had high prevalence of areca/betel nut chewing habit than 15 girls out of 68 (22.06%) with Boy/Girl ratio of 2.64:1. This finding was similar to study done by Khan MA et al¹³ who reported more prevalence of areca/betel nut chewing habit in boys (66.5%) compared to girls (33.5%) with Boys/Girls ratio of 2:1^{13,15} suggesting greater prevalence of areca/betel nut chewing habit in boys than Girls.

Chewing habit amongst parents in Chewer and Non-Chewer Group was not statistically significant indicating chewing habit amongst the parents is not the only factor influencing chewing habit in school going children. The other factors like the easy availability, low cost and peer influence as well as influence of family member with habit of chewing areca/betel nut could have an impact on the prevalence of areca/betel nut chewing habit which were also reported in study done by Gupta et al¹⁹.

In our study, the incidence of Oral Submucosal Fibrosis (OSMF) was found to be 11.21% among school children which was more than reported incidence of Oral Submucosal Fibrosis (OSMF) 6.6% by Khan MA et al¹³ that may be due to the reason that wide range of age group 6-15 years with mean age of 10.4 ± 3.32 years was taken compared to our study in which 13-17 years with mean age of 14.75 ± 1.117 years has taken. Same 7.4% reported by Ali et al¹⁶ in which age group was taken 22 to 61 years with mean age of 38.8 years and 8.8% reported by Oakley et al¹⁴ in which mean age was 16.3 ± 1.5 years.

Specific diagnostic criteria included in our study were Dryness of mouth, History of Burning sensation or Irritation on chewing spicy food, Eating and Speaking difficulty, Ulceration, Blanching of Oral mucosa and band formation in Buccal mucosa with stiffness. Extra-oral Facial profile examination and Intra-oral examination in sagittal, vertical and transverse planes did not show significant difference between Chewer and Non-Chewer Group.

In our study, Mouth opening, Tongue protrusion and Cheek flexibility was also taken into consideration for evaluating the status of developing Oral Submucosal Fibrosis (OSMF) due to its possible effect on developing facial and dental characteristics of children. Though Mouth opening and Tongue protrusion does not show significant difference between Chewer and Non-Chewer Group. Khan AM et al²⁰ found mean Maximal Mouth opening to be significantly reduced in children who had the habit of chewing areca nut (3.69 cm) than those who did not have the habit (4.46 cm). As this study have taken children with the habit of chewing areca nut for 6 months or more, children who had just started chewing for <6 months were excluded from the study whereas in our study all the subjects with the habit of chewing areca nut were included into the chewer group.

It has been reported earlier by Gupta PC et al¹⁹ that patients with sub mucous fibrosis had oral cancer as an associated finding in 5.2% and leukoplakia in 26%. The clinical signs and symptoms of the disease include oral ulceration, burning sensation (particularly with spicy foods), paleness of the oral mucosa and occasional leukoplakia. The most characteristic feature is the marked vertical fibrous ridge formation within the cheeks and board-like stiffness of the buccal mucosa. The fibrosis in the soft tissue leads to trismus, difficulty in eating and even dysphagia. Cheek flexibility found to be decreased in Chewer group compared to the Non-Chewer Group. This could have long-term influence on growth in transverse dimension of jaw can lead to secondary effect on developing arches in all 3 planes and lead to malocclusion.

Summary

Factor involved in consumption of Areca/Betel nut:

- a. Level of awareness – children were not aware that areca nut use was dangerous and harmful to health.
- b. Household environment – children living in joint family and most of the family members have the habit of areca nut product in different form like gutkha, pan and supari and they were also asked to buy it for them.
- c. Reasons for initiation – peer pressure is the cause of experimentation.
- d. Availability – Easily available at roadside and nearby home.
- e. Money spent – Children spent sums ranging from 0.50 to 2 Rupees per day.
- f. Low cost – Within reach of the smallest amount of pocket money.
- g. Source of money spent – parents were the common source of money acquired and interestingly the parents were aware of how the money was being used.

The diagnosis of the disease can be made based on clinical signs and symptoms. Out of the above discussed clinical features, burning sensation on eating spicy foods, paleness of the buccal mucosa and palate, leukoplakia, stiff and inelastic buccal mucosa and trismus were characteristic features. The peak incidence of

this condition is in the 6-60 years of age group.^{13,14,15,16} But, in our study, the age of patient is just between 13 to 17 years that highlights the need for establishment of a preventive and intervention program in the school for the malicious habit, so that young children can be benefited.

V. Conclusion

1. Areca/Betel nut chewing habit is rapidly increasing among school going children in India. Areca/Betel nut and its related products are one of the main causes of the precancerous lesions, particularly Oral Submucosal Fibrosis (OSMF) that can finally lead to carcinoma of the oral cavity. Alarming, there is high incidence of Oral Submucosal Fibrosis (OSMF) (11.21%) in school children
2. There is greater prevalence of areca/betel nut chewing habit in boys than Girls ratio of 2.64:1
3. The onset of the disease is early because of easy access to the areca/betel nut containing products at an early age. The frequency and duration of areca/betel nut chewing habit is independently related with severity of Oral Submucosal Fibrosis (OSMF) in low age group children. As due to no significant restricted mouth opening at early stage and lack of education about the initial symptoms, majority of subjects are insidiously present.
4. Cheek flexibility decreases in Chewer group compare to the Non-Chewer Group that can have influence on developing facial and dental characteristics of children and cause malocclusion.
5. Extra-oral Facial profile examination and Intra-oral examination in sagittal, vertical and transverse planes did not have significant difference between Chewer and Non-Chewer Group.

It was a humble effort/small intervention in the field of correlating effects of areca/betel nut chewing habit in young adolescent patients on soft tissue around the dentition and thereby affecting the development of both the arches in all 3 planes. As this was cross-sectional study, long term effects on developing facial and dental characteristics of children need longitudinal study for better prospects in future.

Lack of awareness amongst the youth in particular necessitate dental health education program about the hazards of areca/betel nut chewing and its related products must be conducted in the school. Actively communicating its health risks to the public, strategy involving parents, teachers, and local communities could be initiated to discourage areca/betel nut use. Student population should be properly educated on this topic and health awareness should be included in the school curriculum.

References

- [1]. Akhtar S. Areca nut chewing and esophageal squamous-cell carcinoma risk in Asians: a meta-analysis of case-control studies. *Cancer causes & control: CCC*. 2013;24(2):257-65.
- [2]. Rajalalitha P, Vali S. Molecular pathogenesis of oral submucous fibrosis--a collagen metabolic disorder. *Journal of oral pathology & medicine: official publication of the International Association of Oral Pathologists and the American Academy of Oral Pathology*. 2005;34(6):321-28.
- [3]. Sudarshan R, Annigeri RG, Vijayabala GS. Pathogenesis of oral submucous fibrosis: The past and current concepts. *Int J Oral Maxillofac Pathol* 2012; 3:27-36.
- [4]. Tilakaratne WM, Klinikowski MF, Saku T, Peters TJ, Warnakulasuriya S. Oral submucous fibrosis: Review on etiology and pathogenesis. *Oral Oncol* 2006; 42:561-8.
- [5]. Murti PR, Bhonsle RB, Pindborg JJ, Daftary DK, Gupta PC, Mehta FS. Malignant transformation rates in oral submucous fibrosis over a 17-year period. *Community Dent Oral Epidemiol* 1985. 13:340-1.
- [6]. More CB, Gupta S, Joshi J, Varma SN. Classification System for Oral Submucous Fibrosis. *J Indian Acad Oral Med Radiol* 2012;24(1):24-29.
- [7]. 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 Pedod Prev Dent* 2006; 24:84-9.
- [8]. Khanolkar VR. Sub mucous fibrosis of the palate in diet. Pre conditioned Wister rats: Induction by local painting of capsaicin-an optical and electron microscopic study. *Arch Pathol* 1960; 70:171-9.
- [9]. Agrawal A, Airen Sarkar P, Shigli A. Oral submucous fibrosis in a 9-year-old Indian girl. *BMJ case reports*. 2011.
- [10]. Gupta VK, Malhotra S, Patil R, Tripathi A. Oral submucous fibrosis at pediatric age, now time to think: Series of two cases. *Indian journal of medical and paediatric oncology: official journal of Indian Society of Medical & Paediatric Oncology*. 2013;34(2):107-10.
- [11]. Ameer NT, Shukla RK. A cross sectional study of oral submucous fibrosis in central India and the effect of local triamcinolone therapy. *Indian journal of otolaryngology and head and neck surgery: official publication of the Association of Otolaryngologists of India*. 2012;64(3):240-43.
- [12]. Zhang SS, Li WH, Gao YJ, Liu ZW, Liu L, Tang JQ, et al. Betel- quid and oral submucous fibrosis: a cross-sectional study in Hunan province, China. *Journal of oral pathology & medicine: official publication of the International Association of Oral Pathologists and the American Academy of Oral Pathology*. 2012;41(10):748-54.
- [13]. Moiz Ahmad Khan, Humayun Kaleem Siddqui, Tuba Hasan, Sharjeel Bashir Prevalence of areca nut eating habits and incidence of oral Submucosal fibrosis in school children - a prospective cross-sectional survey Pakistan oral and dental journal. 2014;34(3):5.
- [14]. Oakley E, Demaine L, Warnakulasuriya S. Areca (betel) nutchewing habit among high-school children in the Commonwealth of the Northern Mariana Islands (Micronesia). *Bulletin of the World Health Organization*. 2005;83(9):656-60.
- [15]. Khandelwal A, Khandelwal V, Saha MK, Khandelwal S, Prasad S, Saha SG. Prevalence of areca nut chewing in the middle school-going children of Indore, India. *Contemporary clinical dentistry*. 2012;3(2):155-57.
- [16]. Syed Mumtaz Ali, Rehan Qureshi, Jamal. S. Prevalence of oral Submucosal fibrosis and related tobacco products. *Pakistan oral and dental journal*. 2011;31(2):4.

- [17]. Dayal PK, Subhas BG, Shah R (1996) Oral submucous fibrosis—a field study among betel nut chewers. *Karnataka State Dent J* XVI (3):12–15
- [18]. Murti PR, Bhonsle RB, Pindborg JJ et al (1985) Malignant transformation rate in oral submucous fibrosis over a 17 year period. *Community Dent Oral Epidemiol* 13:340–341
- [19]. Gupta PC, Mehta FS, Daptary DK. Incidence rates of oral cancer and natural history of oral precancerous lesions in a 10-year follow-up study of Indian villagers. *Community Dent Oral Epidemiol* 1980; 8:283–333.
- [20]. Khan AM, Sheth MS, Purohit RR. Effect of areca nut chewing and maximal mouth opening in schoolgoing children in Ahmedabad. *Indian J Med Paediatr Oncol* 2016; 37:239-41.

Palak Shah "“Correlation between Areca/Betel Nut Chewing Habit with Facial and Dental Characteristics in School Going Children – A Prospective Cross-Sectional Survey”. *IOSR Journal of Dental and Medical Sciences (IOSR-JDMS)*, vol. 17, no. 5, 2018, pp 37-44.