Association between kharra chewing and periodontal health status in oral submucous fibrosis patients of Central India, Nagpur

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Abstract:
Purpose: Kharra is a mixture of areca nut and tobacco. Arecoline, an areca nut extract, disrupts the harmony of the periodontal cells and thus leads to destruction of the periodontium. Oral submucous fibrosis (OSMF) is a premalignant condition that arises due to the consumption of kharra. The aim of this study was to evaluate and compare the effects of kharra chewing on periodontal status in patients with OSMF.

Materials and Methods: Forty-five patients were divided into Group I: healthy periodontium (n = 15), Group II: chronic periodontitis without OSMF group (n = 15), and Group III: chronic periodontitis with OSMF group (n = 15). The clinical parameters assessed for patients with chronic periodontitis were gingival index (GI), plaque index (PI), probing pocket depth (PPD; overall and regional) ≥3 mm, and clinical attachment level (CAL; overall and regional) ≥3 mm. For patients in Group III, the OSMF diagnosis and staging were based on Khanna’s classification. The level of significance was set at \( P < 0.05 \).

Results: The sample with a mean age of 35 years had a frequency of chewing kharra >6 times per day for at least 3 years. PI, PPD, and CAL in Group III were 2.1 ± 0.4, 3.2 ± 0.6, and 4.8 ± 0.6 mm, respectively. The results of the clinical parameters in Group III and Group II were higher than Group I. GI was higher in Group II as compared to the other groups.

Conclusion: The habit of chewing kharra is found to be associated with poor periodontal health in patients with OSMF.

Key words: Arecoline, oral submucous fibrosis, periodontal destruction

INTRODUCTION
Kharra chewing (areca nut and tobacco) is the most prevalent addiction in central India. Arecoline, a natural alkaid in areca nut, has genotoxic, carcinogenic, embryotoxic, and immunotoxic potential.[1] Several epidemiological and experimental investigations have established that quid chewing causes oral and oropharyngeal cancer, interferes with the microbial mechanism of neutrophils, and inhibits protein synthesis and attachment of fibroblasts. This in turn promotes bacterial colonization and periodontal infection.[2] As a result, the harmony between various periodontal structures is disrupted that leads to induced gingivitis and periodontitis. It also exerts excessive masticatory load on the tissues, leading to wearing facets, attrition, sensitivity, food lodgment, and food impaction.[3] The extracts also stain teeth and affects oral esthetics and social confidence. Arecoline also generates reactive oxygen species due to which lipid peroxidation is initiated and leads to a precancerous condition such as oral submucous fibrosis (OSMF). This chronic, insidious, disabling potentially malignant condition of the oral cavity is characterized by excessive production of collagen leading to inelasticity of the oral mucosa as well as atrophic changes of the epithelium reflected clinically as mucosal rigidity.[4]

Although considerable information is available on the effects of quid on oral tissues and dentition, this study was designed to determine the effect of kharra chewing on periodontal tissues of patients with OSMF in central India, Nagpur.

MATERIALS AND METHODS
The study was conducted on 45 patients (aged 25–60 years) visiting the Department of
Periodontology and Implantology, between February and June, 2016. It abided by the Declaration of Helsinki of 1973 (revised 2000) and was approved by the Institutional Ethics Committee. The patients were sensitized about the purpose and design of the study and a written informed consent was obtained from them. A special pro forma recorded the detailed case history with periodontal indices and clinical examination.

The three groups with 15 patients each are classified as follows: Group I (n = 15) included patients with a healthy periodontium, Group II (n = 15) included patients with chronic periodontitis without OSMF, and Group III (n = 15) included patients with chronic periodontitis and OSMF.

The inclusion criteria for patients with chronic periodontitis were probing pocket depth (PPD) ≥3 mm, clinical attachment level (CAL) ≥3 mm, and habit of chewing kharra for at least 3 years ≥5 times per day. Patients with any systemic disease, allergies or drug usage, smokers, history of periodontal treatment in the past 6 months, or pregnant and lactating women were excluded from the study.

Periodontal indices such as gingival index (GI)[5] and plaque index (PI)[6] PPD, and CAL were measured with a graduated periodontal probe (PCP-UNC15®, Hu-Friedy, Chicago, IL, USA) for each tooth on all the six sites. On the basis of the region of quid placement, regional PPD and regional CAL scores were also calculated. OSMF was diagnosed on inspectory and palpatory findings adhering to the clinical classification by to the clinical classification by Khanna et al.[7]

Statistical analysis
Statistical analysis was performed using the IBM SPSS Statistics Software version 16. The two groups were compared using the unpaired t-test, while a comparison among the three groups was drawn using the ANOVA. Differences in the clinical parameters among the three groups were analyzed using one-way analysis of variance with the Tukey test. The level of significance was set at P < 0.05.

RESULTS

This cross-sectional study compared the clinical stages and periodontal findings in a total of 45 patients (mean age of 35 years). All clinical parameters were significantly higher in Group III and Group II compared to Group I (P < 0.05). Pair-wise analysis using Tukey’s post hoc test revealed statistically significant difference between Group III, Group II, and Group I. GI for Groups I, II, and III was 0.5 ± 0.4, 1.9 ± 0.5, 0.9 ± 0.5, and PI was 0.8 ± 0.4, 1.3 ± 0.7, and 2.1 ± 0.4 [Table 1], respectively. In Group III, PPD (overall) was 3.2 ± 0.6 mm and CAL (overall) was 4.8 ± 0.6 mm. CAL between Group II and Group III was not found to be statistically significant (P = 0.1). Group I showed a lower PPD and CAL. The frequency of kharra chewing in Group II and Group III was 6.10 ± 2.57 times per day and 6.55 ± 1.7 times per day, respectively. The duration of kharra consumption was 3.98 ± 2.5 years and 7.05 ± 2.70 years for Group II and Group III, respectively [Table 1].

DISCUSSION

Areca nut extracts in kharra have been shown to have a significant causative role in causing periodontal diseases along with the variables such as oral hygiene levels, dietary factors, and general dental health status. As the disease progresses, the chewers often have complaints of bleeding gums, halitosis, reduced mouth opening, pain during swallowing food, and ulceration and burning sensation in the soft tissues. The stiffness is characterized by formation of fine fibrillar dispersed collagen with marked edema in the initial stages and juxta-epithelial hyalinization later on. The signs and symptoms vary with the affected sites and stage of disease. Thick inelastic rope-like fibrous bands extending from the lamina propria through the entire submucosa to the muscle layer appear vertically in the buccal mucosa, along the contours of the faucial pillars and around the entire circle of lips narrowing the rima oris. This compromises oral hygiene and food intake by reducing mouth opening.[8,9] This study evaluated the effect of kharra chewing on the periodontal health status in patients with OSMF.

The mean values of PI were found to be significantly higher in Groups II and III as compared to Group I. Akhter et al.,[10] and Dodani et al.[11] reported that the plaque index of patients with compromised periodontium was higher than their healthy counterparts. In the presence of several confounding factors, the cholinergic effect of areca nut along with calcium salts in the saliva leads to increased heavy deposition of calculus which destroys the gingival tissue and periodontal attachment.[12]

The GI was found to be higher in Group II as compared to Group III. Since one of the biological effects of tobacco chewing is vasoconstriction of the gingival vasculature, the gingival blood flow is impaired. This suppresses the normal gingival inflammatory response to plaque infection and consequently conceals the actual levels of gingival inflammation.[10,14] Kharra chewers showed higher mean values of periodontal

| Parameter | Group I (control) | Group II (test) | Group III (test) | P |
|-----------|------------------|----------------|-----------------|---|
| GI        | 0.5±0.4          | 1.9±0.5        | 0.9±0.5         | 0.06 |
| PI        | 0.8±04           | 1.3±0.7        | 2.1±04          | 0.07 |
| PPDr (mm) | 1.5±0.3          | 4.3±0.4        | 3.4±0.7         | 0.005* |
| PPD0 (mm) | 1.2±0.3          | 4.0±0.4        | 3.2±0.6         | 0.03* |
| CALr (mm) | 00               | 4.5±0.6        | 5.1±0.8         | 0.02* |
| CALo (mm) | 00               | 4.2±0.4        | 4.8±0.6         | 0.03* |
| Frequency (times per day) | 0 | 6.10±2.57 | 6.55±1.7 | <0.0001* |
| Duration (years) | 0 | 3.98±2.54 | 7.05±2.70 | 0.0007* |

*Significance at P<0.05. PI – Plaque index; GI – Gingival index; PPDr – Probing pocket depth regional; PPD0 – Probing pocket depth overall; CALr – Clinical attachment level regional; CALo – Clinical attachment level overall; P – P-value
parameters including PPD and CAL. This could be attributed to the fact that, since arecoline inhibits cell attachment, spreading and migration and decreases collagen synthesis in human-cultured periodontal fibroblasts, the increased deposition of extracellular matrix unsettles the equilibrium between the matrix metalloproteinases and tissue inhibitors of matrix metalloproteinase, leading to inevitable periodontal destruction.[23]

The results of the present study were in accordance with those of Akhter et al. who reported that betel quid chewers exhibited higher mean PPD and CAL. In their study, mean PPD was approximately 3.8 ± 0.7 mm and CAL was 4.2 ± 1.2 mm in betel quid chewers.[10] Besides, Ling et al. had also found strong positive relation between habit of betel quid chewing and severity of periodontal destruction.[10] Dodani et al. had reported PPD in patients with OSMF and without OSMF as 1.88 ± 0.36 and 1.68 ± 0.16 mm, respectively.[11] Chu et al. had also reported PPD of 1.8 ± 0.38 mm and CAL of 0.52 ± 0.76 mm in betel quid chewers.[12]

These results have been consistent over decades. For every unit year of exposure to tobacco, loss of attachment would increase by 6.8 × 10⁻³ mm irrespective of oral hygiene, age, or other socioeconomic factors. This degree of loss of attachment is small when compared to that of tobacco users in Western countries where Martinez-Canut et al. observed loss of attachment of 5 × 10⁻³ mm for every unit year of exposure to tobacco. Hence, the duration and frequency of kharra chewing are equally important in the occurrence of periodontitis on OSMF patients.[16]

We observed a significant difference in the periodontal parameters of particular region of kharra placement and the entire or overall teeth of same patients. The intragroup comparison in Group III between PPD region was significantly higher than PPD overall, indicating that the severity of destruction was dependent on the placement of kharra in patients with OSMF. The hardness of kharra as well as its interaction with the ingredient in turn depresses the hosts’ resistance to local factors and causes greater calculus formation, accounting for the more periodontal destruction in its consumers.

**Limitations**

1. A small sample size
2. Unequal number of patients in different stages of OSMF.
3. No histologic analysis and biochemical analysis was carried out to deduce the clinical correlation of destruction
4. The diagnosis of OSMF was based on clinical findings while no histopathological evaluation was performed to confirm the findings.

**CONCLUSION**

Within the limitations of the study, it can be concluded that chewing kharra leads to periodontal destruction in patients with OSMF. A clear association between the poor periodontal health status and the adverse habit can be drawn even in the presence of the premalignant condition. Further multicentric studies, with larger population, should be carried out to correlate the histopathologic effect of kharra on oral and periodontal tissues.

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**Conflicts of interest**

There are no conflicts of interest.

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