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Original Article

# Influence of Betelnut Chewing and its Correlation with Pulp stone among Adult Rural Population of Sullia Taluk, Dakshina Kannada District: A Retrospective Study

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## Abstract

**Background:** Globally approximately 600 million people practice the habit of betel nut chewing. In Dakshina Kannada, betel nut is consumed as a major constituent mixed with or without various tobacco products. Its use is acceptable among all sections of society, including women and children. Pulp stones are discrete calcified stones or foci of calcification in the dental pulp. The exact causes of pulp stones are unclear, but they are often found in patients consuming these products. To date, there is no literature, which determines the association between betelnut chewing and pulp stones in the Dakshina Kannada population.

**Aim:** The aim of the study was to determine the correlation between betelnut chewing and pulp stones in comparison with those of healthy subjects without any betel quid chewing in rural population of Dakshina Kannada district, Karnataka, India.

**Materials and Methods:** A total of 100 patient records were examined, comprising of patients with betel nut chewing and control group. The teeth were examined under ×2 magnification on orthopantomography. The presence or absence of pulp stones was recorded.

**Statistical Analysis:** All statistical analyses were performed using the SPSS software. For each variable, the mean and standard deviation were calculated. Analysis of the data between groups was carried out by paired and unpaired *t*-tests.

**Results:** The study sample included 2798 teeth identified in full mouth series of orthopantomography of patients aged between 20 and 55 years. Pulp stones were found in 13.35% of the total teeth examined. When compared to teeth type and pulp stones, first molar showed increased prevalence of pulp stones.

**Conclusion:** A positive correlation was found between patients with betel nut chewing and pulp stones. The findings suggest that the constant masticatory forces by the virtue of chewing betel quid leads to the formation of pulp stones.

**Key words:** Betel quid, Endodontic treatment, Occlusal forces, Pulp stone, Rural population

## INTRODUCTION

Approximately 600 million people practice the habit of betel nut chewing (Gupta and Warnakulasuriya 2002). The areca nut is the seed of the areca palm, commonly referred to as betel nut.[1] Usually, betel is consumed as betel quid; a small package containing pieces of betel nut and slaked lime (calcium hydroxide) wrapped in a betel leaf. Betel quid chewing results in overall reddish staining of the teeth due to the tannin present in the arecanut. Due to its mild stimulating effects, it is most often used as a recreational drug, but it is also part of rituals and traditional medicine (Zumbroich 2008).[2] The origin of betel nut chewing in Southeast Asia can be traced back for more than 2000 years by historical, linguistic, and ethnographic sources.

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Biochemically, the active tetrahydropyridine alkaloids of the betel nut (arecoline, arecaidine, guvacoline, and guvacine) can be detected in high concentrations in saliva (Franke *et al.* 2015).[3] During mastication with slaked lime, the ester bonds of arecoline and guvacoline are cleaved, yielding arecaidine, and guvacine, respectively. Habitual use can lead to permanent staining of all enamel surfaces. The hard fibrous nature of the betel nut can lead to fractured teeth and extensive attrition of the occlusal tooth surface among regular users. The loss of enamel may also expose the underlying dentine which may result in dentinal sensitivity. Due to a lack of awareness, chewing betel nuts is one of the most common addictions in India which can result in compromised oral hygiene and esthetics. These are available in the form of several chewing products such as paan, gutka, khaini, and paan masala. Its use is acceptable among all sections of society, including women and quite often in children.[4,5]

Pulp stones are discrete calcified stones or foci of calcification in the dental pulp. Although pulp stones rarely cause pain, they must be evaluated because a tooth undergoing endodontic treatment may be affected clinically by the presence of large pulp stones. Large pulp stones in the pulp chamber blocks the access to the orifices and also deflect or engage the tip of hand or rotary instruments, thereby, preventing its easy passage. The exact causes of pulp stones are unclear, but they are often found in patients consuming these products.[6] Another factor indicated in the literature that contributes to stone formation may be high masticatory forces, manifested through dental wear or through constant chewing habits as quid chewing. Moreover, it could result from ageing, pulp degeneration, circulatory disturbances in pulp, high masticatory forces due to behavioral activities, operative procedures, or orthodontic movements.

The prevalence of pulp stones in teeth, based on radiographic examination, has been reported to be around 20–25% depending on the study type, design, and radiographic technique employed while histological examinations reveal higher percentages.[7] da Silva *et al.* had found that CBCT provides accurate anatomical details in three dimensions, offering the possibility to view an individual tooth in axial, sagittal, and coronal views.[8]

Bernick and Nedelman found with age, pulp chamber size decreases due to the deposition of secondary dentin in the root.[8] As a result of dental caries, pulp inflammation triggers secondary (reparative) dentin formation and calcification. To date, there is no literature, which determines the association between betelnut chewing and pulp stones in the Dakshina Kannada population.

## MATERIALS AND METHODS

A total of 3092 teeth were evaluated from 100 panoramic radiographs obtained from the Department of Oral Medicine and Radiology, KVG Dental College, Sullia, Dakshina Kannada, Karnataka.

50 Records with history of betelnut chewing and 50 records of healthy subjects were randomly selected for the study.

### Inclusion Criteria

The following criteria were included in the study:

- Fully erupted, minimally restored, non-carious teeth, free from radiographically observable pulpal sclerosis
- Individuals with betel nut chewing habits for more than 3 years duration
- Age group-between 20 and 55 years.

### Exclusion Criteria

The following criteria were excluded from the study:

- Teeth with crown or bridge
- Carious lesions and deep restorations
- Patients with syndromes that are more prone to pulp stones.

### Evaluation of Panoramic Radiograph

Definite radiopaque body which is found inside the pulp chamber was considered as pulp stones and a score of presence or absence was given after the confirmation by two different examiners [Figure 1].

### Statistical Analysis

All statistical analysis was performed using the SPSS software 22. For each variable, a mean and standard deviation was calculated. Analysis of the data between groups was carried out by paired and unpaired *t*-tests.

## RESULTS

Tables 1 and 2 show intergroup comparison of patients with betel quid chewing compared to healthy subjects. It is seen that subjects with betel quid chewing had more pulp stone compared to that of healthy subjects. The prevalence of pulp stone based on the tooth type was in the order first molar > second premolar > second molar > first premolar [Figure 2]. Pulp stones appear more frequently in molars than in premolars. A statistically significant difference was seen between the tested groups ($P < 0.05$).

Table 3 shows the prevalence of pulp stones in maxilla and mandible. The result of the present study showed that maxilla had more occurrences of pulp stone compared to mandible. Pulp stones are rarely found in healthy subjects [Figure 3].

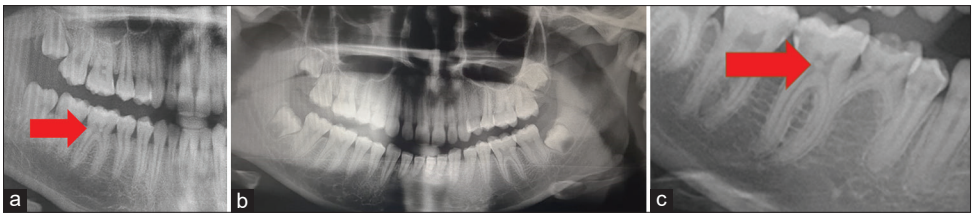


**Figure 1: (a-c) The orthopentomograph depicting definite radiopaque body which is found inside the pulp chamber was considered as pulp stones. Scoring was given based on the occurrence of pulp stones**

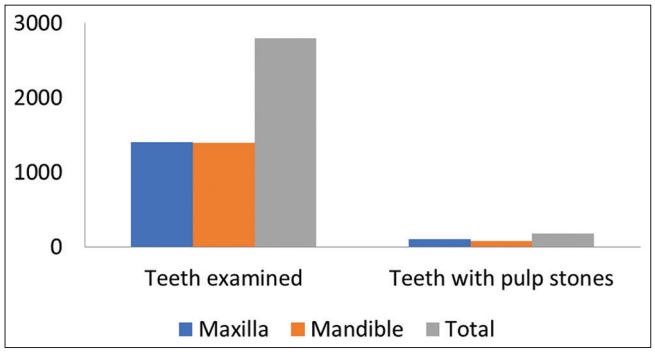


**Figure 2: Prevalence of pulp stone in maxilla and mandible**

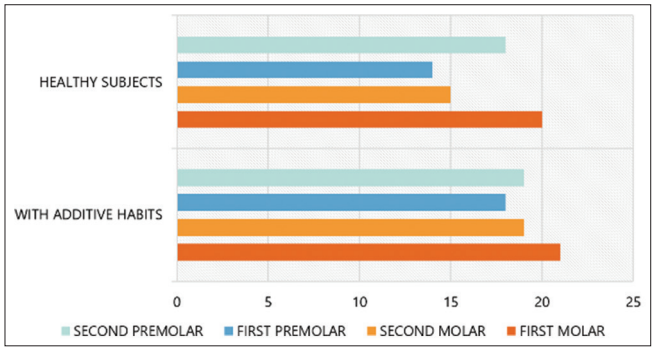


**Figure 3: Prevalence of pulp stone based on tooth type**

| PREVALENCE OF PULPSTONES IN PATIENTS WITH BETEL QUID CHEWING | | |
|---|---|---|
| | Teeth examined | Teeth with pulp stones |
| Maxilla | 781 | 53 |
| Mandible | 741 | 42 |
| Total | 3092 | 244 |

**Table 1: Prevalence of pulpstones in patients with betal quid chewing**

| PREVALENCE OF PULPSTONES IN HEALTHY SUBJECTS | | |
|---|---|---|
| | Teeth examined | Teeth with pulp stones |
| Maxilla | 706 | 49 |
| Mandible | 704 | 33 |
| Total | 1410 | 82 |

**Table 2: Prevalence of pulpstones in healthy subjects**

| PREVALENCE OF PULPSTONES | | | |
|---|---|---|---|
| | Teeth examined | Teeth with pulp stones | P Value |
| Maxilla | 1403 | 102 | 0.06 |
| Mandible | 1395 | 75 | |
| Total | 2798 | 177 | |

**Table 3: Prevalence of pulpstones**

## DISCUSSION

In India, betelnut chewing being one of the most common addictions that can be due to a lack of knowledge and awareness leading to compromised oral hygiene.[9] The hard fibrous nature of the betel nut can lead to fractured teeth and extensive attrition of the occlusal tooth surface among regular users.[4,5] The loss of enamel may also expose the underlying dentine which may result in dentinal sensitivity. The correlation to pulp stones has been plethoric as opposed to aging, behavioral activities, habits, metabolic imbalance or dysfunction, orthodontic treatment, and traumatic occlusion.[6] Various conditions may cause generalized pulp stones to form in the dentition. These include type I osteogenesis imperfecta, type II dentin dysplasia, Elhers-Danlos syndrome, tumoral calcinosis, Elfin facies syndrome, familial expansile osteolysis, and otodental syndrome.[7] In forensic odontology, radiographic matching of pulp stone configurations, along with other features recorded in dental records, may provide valuable information in the identification of deceased person.[10] The highest numbers of pulp stones, among all the examined groups were evident in patients with betel quid chewing.

Exact etiology for the formation of pulp stone is not known.[6] Another factor indicated in the literature that contributes to stone formation may be high masticatory

forces, manifested through dental wear or through constant chewing habits as quid chewing. Numerous researchers have proven the existence of different rates of dental wear in such conditions (Özdemir, Yavuz, and Erol).[11-15] Stronger dental wear and occurrence of pulp stone may be due to "behavioral activities," such as daily tasks including betel quid chewing.[16-19] Moreover, mechanical defects around the functional active surfaces detected on many teeth could be explained by the behavioral habits of biting or holding hard objects. Studies of Hillmann and Geurtsen, Fatemi *et al.*, and Chen and Huang reported higher rate pulpal calcifications in elderly patients with periodontal disease.[20-23] These authors also suggested that the frequency, duration and intensity of chronic irritations being causative factors for such calcifications.[24]

According to study type, design, and radiographic technique, pulp stone prevalence ranges from 8% to 90%. Pulpal calcifications have been investigated by radiographs[9-13] or histological sections.[8] Dental pulp stones, which are bigger than 200 mm can be observed by dental radiographs. The radiographic prevalence is less than histologic studies.[11] Radiographs are the only noninvasive way of evaluating dental pulp stones in clinical researches. But these studies tend to underreport the occurrence of pulpal calcifications. Histological observations are also incomplete in this respect because of a limited number of researches.

Although pulp stones rarely cause pain, they must be evaluated because a tooth undergoing endodontic treatment may be affected clinically by the presence of large pulp stones.[13] It is possible for large pulp stones in the pulp chamber to block access to the canal orifices and to deflect or engage the tip of the exploring instrument, preventing its easy passage down the canal. The use of piezoelectric, ultrasonic, and nickel-titanium rotary instruments permits the removal of pulp calcifications and the negotiation of root canal orifices.[13] In the current study, pulp stones were seen more in molar than premolar. This could be due to increase in the occlusal loading at the molar area.[14,15]

In general, bitewing and periapical radiographs can easily demonstrate the calcifications of the pulp as individual tooth can be clearly identified. Baghdady *et al.*[15] used bitewing radiographs to investigate the prevalence of pulp stones. Hamasha *et al.*, Darwazeh *et al.*[25,26] and Tamse *et al.*[28] used both periapical and bitewing radiographs for the identification of pulpstones. They compared the two radiographic techniques and concluded that no significant difference was found between the projections. The present study evaluates the occurrence of pulp stone with digital panoramic radiograph so that teeth involved with calcification in both maxilla and mandible can be ruled out.

A wide variety of pulp stone sizes were found in this study, consisting of small particles up to large calcified bodies that occluded a majority of the pulp chamber. However, the true prevalence is likely to be higher than the figure from this radiographic study, because radiographs are not likely to detect pulp stones <200 μm in diameter.[13] However, radiographs are the only means of evaluating pulp stones non-invasively in clinical studies.[10-14] Radiographic differentiation between pulp stone and pulpal sclerosis (which proceeds later to pulpstones) was demonstrated by "white." He explained that early pulpal sclerosis cannot be demonstrated radiographically. In diffuse pulpal sclerosis, there is generalized calcification which is seen throughout the large area of pulp chamber or canal. However, pulp stones may be seen as a definite single or multiple radiopaque structures within the pulp chamber or root canals.[15] In the present study, panoramic radiograph was used because of its main advantage as it shows both jaws on a single radiographic image. It helps evaluate the entire dentition in a panoramic radiograph for pulp stones retrospectively without exposing the patient again for bitewing. This would be ideal for screening pulpal calcifications. The present study sample included 2798 teeth identified in full mouth series of orthopantomagraph of patients aged between 20 and 55 years. Pulp stones were found in 13.35% of the total teeth examined different studies report varying incidences of pulp stones. According to James *et al.*, 56% of permanent teeth have pulp stones. In contrast, Ranjitkar *et al.*[16-19] found pulp stones in 10.1% of teeth examined and Tamse *et al.* showed that 20.7% of the teeth had pulp stones based on radiographic examination

In the present study, pulp stones were more prevalent in molar teeth, especially in the maxillary arch.[8,11,14] This is in accordance with the findings reported by Turkal *et al.*, Yosuf *et al.*, Sisman *et al.,* and Ranjitkar *et al.* In contrast with the observations of the present study, Hamasha *et al.*[18] reported occurrence of pulp stones frequently in the mandibular first molar. Being the first tooth to erupt in the oral cavity, molars bear more occlusal forces leading to early degenerative changes. Rich blood supply in molar can also cause increased calcification is yet another proposed factor. Ranjitkar *et al.*[27] calculated the prevalence of pulp stones in young Australian adults using radiographs and reported that occurrences were rare in premolars (0.4%) but significantly higher in molars (19.7%) and more common in first molars than in second molars and in maxillary first molars than in mandibular first molars. These results are attributed to the fact that molars provide better blood flow, which may contribute to calcification. Higher frequency of pulp stones was reported in maxillary arch compared to mandibular arch, but similar frequency in both arches[20,21] or higher occurrence in mandibular arch have also been reported.[29-34]

## CONCLUSION

A positive correlation was found between patients with betel quid chewing habit and pulp stones. The findings suggest that the constant masticatory forces by the virtue of chewing betel quid leads to the formation of pulp stones.

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