

Relationship of Root Proximity with Periodontal Disease - A Clinico-Radiographic Retrospective Study

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ABSTRACT

Aim: The present study was conducted with the aim to examine whether root proximity is a risk marker for periodontal disease. Introduction-Root proximity is one of the key factors that the clinician should evaluate to determine the individual tooth prognosis before periodontal treatment. Root proximity was determined as favourable when there was more than 1mm of bone between the roots and unfavourable when less than 1mm was recorded.

Methodology: Total 300 individuals were included in the study. 150 patients with advanced periodontal disease with at least one mandibular molar with bone loss greater than one third of the root length and 150 controls without periodontal disease each were included. Interproximal space was assessed on the IOPA (paralleling angle) between 1st molar and 2nd molar and a score was assigned according to severity and location. Consequently, relative risk for periodontal disease was calculated with DIOGRA™ software. A two-digit classification was obtained dividing the root into three locations [apical (A), between (B) and coronal (C)]

Results: In patients with advanced periodontal disease, there is more interradicular distance at apical area and less at CEJ which implies that there is more root proximity at CEJ. However, in healthy patients, there is more interradicular distance at CEJ implying lesser root proximity at CEJ. Hence root proximity can be considered as a risk marker for periodontitis.

Conclusion: Root proximity can be a predisposing factor for the progression of

periodontal disease. However, we should not forget about the impact of other significant factors, such as oral hygiene and the presence of plaque.

Keywords: Root Proximity, Periodontal Diseases, Oral Hygiene, Plaque, CEJ

INTRODUCTION

The phenomenon root proximity is well known among clinicians, yet very little research concerning root proximity has been performed. Root proximity is one of the key factors that the clinician should evaluate to determine the individual tooth prognosis before periodontal treatment. The health of the hard and soft tissues of the periodontium which approximate the interproximal embrasure space has been thought to be dependent in part on the dimensions of the space itself (Wheeler, 1958).¹

Trossello & Gianelly (1979)² introduced the term “root proximity” to describe those situations where roots of adjacent teeth are 1.0mm or less apart, as measured radiographically. Root proximity was determined as favourable when there was more than 1mm of bone between the roots and unfavourable when less than 1mm was recorded.

Artun *et al.* (1986)³ used a different cut-off point and suggested that Root Proximity should be diagnosed when the distance between the roots of adjacent teeth was <0.8 mm, as assessed on periapical radiographs.

Kramer (1987)⁴ describes 1mm as a minimum to achieve adequate septal space between the roots. Today, Root Proximity is interpreted as an interradicular distance of < 0.8 mm (Vermlyen et al^{5,6}, 2005a; 2005b; Avila et al⁷, 2009). In sites with interradicular distance < 0.5 mm there was no cancellous bone and there was only lamina dura. In sites with interradicular

distance < 0.3 mm there was no alveolar bone at all.

The aim of the study is to examine whether root proximity, a risk marker for periodontal disease. A risk marker is defined as an attribute or an exposure that is associated with increased probability of disease, but is not necessarily a causal factor. (According to LAST 2001)⁸

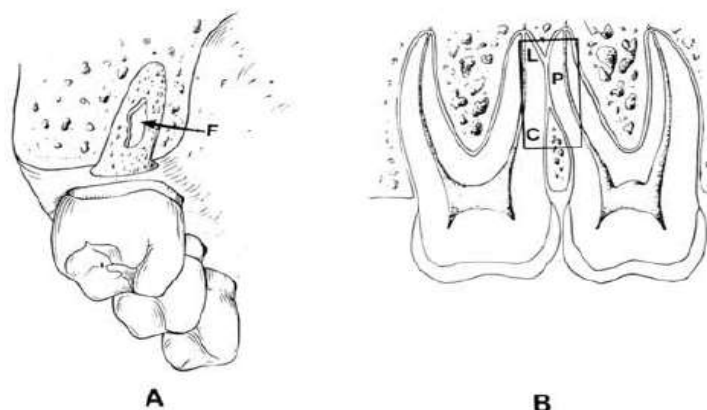


Fig.1 - A fenestration in the septal bone (F) is depicted between the roots of adjacent maxillary molars (A). The sagittal view (B) displays the variable anatomy between adjacent roots which are separated by periodontal ligament only at (P), by lamina dura at (L), and by cancellous bone and lamina dura at (C). Lamina dura and cancellous bone were observed between adjacent roots at sites that were greater than 0.5 mm apart. Bone was not observed between adjacent teeth at sites where roots were closer than 0.3 mm

MATERIALS & METHODS

Subjects- 300 patients reported to the department of periodontics, ITS Dental college, Greater Noida, were selected for the study. All subjects fulfilling the inclusion criteria, were included in the study

Inclusion criteria:

1. Patients with age group 20-65 years were required to have all (28) teeth, third molars could be present but were not examined in the study.
2. Presence of full mouth periapical radiographs (long cone paralleling technique)
3. Patients were required to have advanced periodontal disease with bone loss more than one third of the root length at least at one site

Exclusion criteria

1. Orthodontic treatment
2. Periodontal surgery
3. Presence of supernumerary or impacted teeth
4. Medical condition or medication affecting the periodontium

METHODOLOGY

300 individuals were divided into 2 groups. OPG for every patient was taken and the full mouth clinical examination was done to assess the periodontal disease and grouping the individuals in to study group and the control group. The study group consisted of 150 periodontal patients with advanced periodontal disease and control group of 150 individuals without periodontal disease .187 were men and 113 were women . A total of

192 mandible IOPA and 108 maxillary IOPA were taken.

Radiographic measurement

Interradicular spaces between the roots of 2 adjacent teeth of every patient was assessed on IOPA (long cone paralleling technique) and a score was assigned according to severity and location which was classified according to Vermlyen et al (2005)⁶

A two-digit classification was obtained dividing the root into three locations, with each location having the possibility of three different severities of root proximity.

Division: to indicate location

Coronal

Between

Apical

The division of the root surface, bordering the inter-proximal area, into three equal

parts was accomplished by using a digora software. Root surfaces were divided into three equal parts: the coronal third (c), the middle third (b) and the apical third (a). When present, root proximity was scored as being in the coronal, middle or apical portions of the roots or a combination of the locations.

Subdivision: to indicate severity

Severity 1: >0.5 and ≤ 0.8 mm: small amount of cancellous bone is present between the adjacent roots.

Severity 2: >0.3 and ≤ 0.5 mm: only cortical bone and connective tissue attachment is present between the adjacent roots.

Severity 3: ≤ 0.3 mm: only connective tissue attachment is present between the adjacent roots.



Fig – 2 – Measurement of the interradicular distances between the roots of 2 adjacent teeth at CEJ, at middle and at Apex

STATISTICAL ANALYSIS

Levene's test is used to assess the equality of variances for a variable calculated for the two groups. For comparing the difference of the interradicular spaces between the roots

of 2 adjacent teeth at CEJ, at Middle, at Apex in both healthy group and the individuals who have periodontal disease, an independent t-test was performed.

RESULT

Table 1- Represents the mean of Interradicular distance at the different levels ie. at CEJ,at Apex and at the middle of the root length

TABLE 1					
	Status	N	Mean	Std. Deviation	Std. Error Mean
at CEJ	Healthy	150	1.567	.2008	.0164
	Disease	150	.641	.1018	.0083
at Apex	Healthy	150	1.231	.1635	.0133
	Disease	150	.867	.0910	.0074
at Middle	Healthy	150	1.417	.1751	.0143
	Disease	150	.762	.0917	.0075

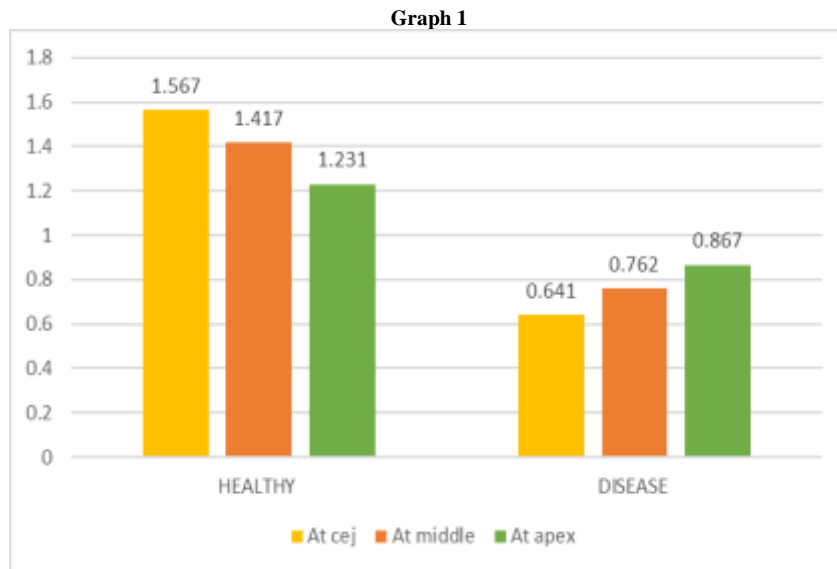


Table 2-Represents the interradicular distance at CEJ, middle and apical area between premolars and molars in maxillary and mandibular arches

Table 2					
	arch	N	Mean	Std. Deviation	Std. Error Mean
at CEJ	Maxillary	114	1.195	.4472	.0419
	Mandibular	186	1.049	.5081	.0373
at Apex	Maxillary	114	1.085	.2215	.0207
	Mandibular	186	1.027	.2255	.0165
in Middle	Maxillary	114	1.150	.3295	.0309
	Mandibular	186	1.052	.3678	.0270

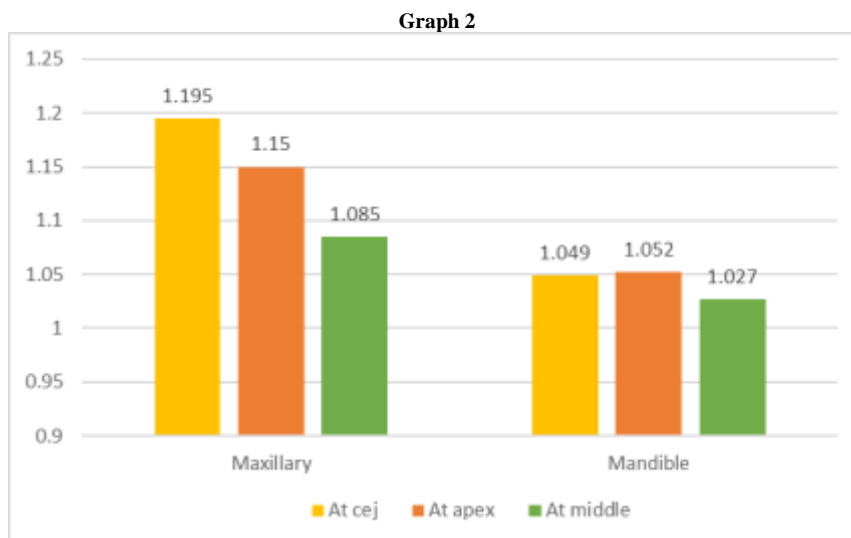


Table 3- Represents the interradicular distance at CEJ, Middle and Apical area between the roots of the 2 adjacent teeth (premolar and molar) in males and females.

TABLE -3					
	Sex	N	Mean	Std. Deviation	Std. Error Mean
at cej	Male	209	1.134	.5157	.0357
	Female	91	1.035	.4207	.0441
at apex	Male	209	1.089	.2338	.0162
	Female	91	.958	.1745	.0183
in middle	Male	209	1.118	.3757	.0260
	Female	91	1.024	.2990	.0313

GRAPH - 3



In the present study, it has been proved that the root proximity leads to inflammation and act as a risk marker for the periodontal disease.

Table 1- represents the, mean of interradicular distance at the different levels ie. at CEJ, at Apex and at the middle of the root length in healthy and individuals with periodontal diseases. In Healthy sample, the mean distance between the roots of the 2 adjacent teeth at CEJ is 1.567 mm, at apex 1.231mm and at the middle 1.417 mm. In the case of periodontal disease, the interradicular distance between the 2 adjacent roots is less as compared to the healthy patients. In periodontal disease cases, the mean interradicular distance between the 2 adjacent teeth at CEJ is 0.641, and at the apex 0.910, and at the middle 0.917. The mean interradicular distance at the CEJ is less than the mean interradicular distance at the apex in the periodontal disease cases. whereas the interradicular distance between the 2 teeth is more in cases of healthy patients. (p value < 0.005)

Table 2- Represents the interradicular distance at CEJ, middle and apical area between premolars and molars in maxillary and mandibular arches. In Maxillary arches, the mean interradicular distance between the roots of the 2 teeth at CEJ is 1.195mm, at apex is 1.085mm, at middle is 1.150mm. In mandibular arches the mean interradicular

distance between the roots of the 2 teeth at CEJ is 1.049 mm, at apex 1.027mm, and at middle is 1.052mm. Among 300 individuals, it has been observed that the interradicular distance at the CEJ, at apical and at middle is higher in maxillary as compared to the mandibular arch. In maxillary arch, the interradicular distance at CEJ is more than the apical area, this implies that the root proximity is less at the CEJ. In the mandibular arch, the root proximity is more at the CEJ. (p value <0.005)

Table 3 represents the interradicular distance at CEJ, Middle and Apical area between the roots of the 2 adjacent teeth (premolar and molar) in males and females. On comparison, it is observed that the interradicular distance between the roots of the 2 adjacent teeth is higher in Males at different levels i.e. at CEJ, at Middle and at Apical area. Though the mean value of the interradicular spaces between the roots of 2 adjacent teeth in males and females is greater than 1mm hence the root proximity is not correlated with gender. (p value >0.005)

DISCUSSION

Determining a tooth's prognosis is a critical step in patient care that is established after a diagnosis has been made, but before treatment has been planned and presented. Because periodontal disease is a

multifactorial condition. Further complicating matters, periodontal prognostic outcomes also depend on the individual's risk factors

The practice of risk assessment involves dental care providers identifying patients and populations at increased risk of developing periodontal disease. Assessing patients' risk of developing periodontal disease can have a significant impact on clinical decision making.

Root proximity can occur in the presence of crowded teeth, "kissing roots" of adjacent teeth, and narrow (close) or fused roots. The importance of the degree of root proximity as a contributory factor in the progression of periodontal disease has been the subject of several studies published throughout the last decades.⁷

A lack of interproximal space has been viewed as a negative clinical finding, particularly when treatment needs for that area may require restorative, orthodontic, or periodontic procedures (Pritchard¹⁹⁷⁵⁹; Pennel and Keagle 1977¹⁰; Schluger et al.1977¹¹; Goldman and Cohen1980¹²), yet recent studies have reported a positive correlation between interproximal width and the incidence of intrabony defects (Silbey and Pritchard1963¹³; Nielson et al.1980¹⁴; Tal 1984¹⁵).

In an early article by Heins and Wieder¹⁶ who analyzed 116 posterior interproximal sites, they reported that when the interradicular distance was <0.5mm, no cancellous bone was observed histologically, but a lamina dura. Moreover, if that distance was <0.3 mm, alveolar bone was not present. It was speculated that the absence of adequate bone support facilitates periodontal disease progression

Study published by Kim et al¹⁷, root distances <0.8mm are a risk factor for alveolar bone loss. In a prospective study of 400 subjects who underwent orthodontic treatment, Artun et al.³ observed that root proximity (diagnosed radiographically as interradicular distance <0.8 mm) did not predispose to a more rapid periodontal attachment loss, mainly in anterior teeth.

It was the goal of this article to address and discuss most of the important factors that might influence the health of the periodontium. Although associations have been claimed between gingival inflammation, trauma from occlusion and the morphology of bone loss, predictions of the ultimate pathoses resulting from such combined periodontal insults is limited also, in a longitudinal study of Laurell et al¹⁸ in 2003 it was shown that maxillary molars and lower incisors were the sites that were most prone-to-bone loss. It also cannot be denied that there is a striking similarity with root proximity patterns. Therefore, root proximity might be used as a risk in a way that its presence can downhill the prognosis of teeth (Mc Guire 1991)¹⁹

CONCLUSION

Root proximity can be a predisposing factor for the progression of periodontal disease. It has been speculated that an adequate space between the teeth at the level of crestal bone is necessary for maintenance of gingival health' and that malposed or rotated teeth may be predisposed to more rapid breakdown of the periodontium when roots are in close proximity, resulting in a thin interproximal septum. Improper angulation of teeth during orthodontic treatment decreases the interalveolar space between adjacent roots and may, depending upon the shape of the crown and the configuration of the Cementoenamel Junction, reduce the width of the interdental alveolar bone.

Declaration by Authors

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Conflict of Interest: The authors declare no conflict of interest.

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