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ORIGINAL ARTICLE

The Influence of Occlusal Trauma on Gingival Recession and Gingival Clefts

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Abstract The aim of this study was to investigate the centric occlusal contact pattern in maximum intercuspation and to study the nature of occlusal contacts during maximum intercuspation to protrusive, lateroprotrusive and lateral excursive movements. Fifty subjects having gingival recession and ten subjects having gingival clefts belonging to age group of 18–25 years were selected after obtaining informed consent from the student's population. The selected subjects were examined and the location and extent of gingival recession, gingival clefts and occlusal wear facets were recorded. The type of occlusion and the nature of occlusal contact in maximum intercuspation and eccentric mandibular movements were also recorded using articulating foil and shimstock. Chi square test, Fisher's exact test (F) and Z test were used to statistically analyse the data obtained. Among the three occlusal concepts, gingival recession was more commonly related to group function than to canine protected occlusion. Canine protected occlusion was associated with gingival recession on the labial surface while in group function occlusion; the recession was distributed equally on the facial surface of the anterior as well as posterior teeth. Nearly all subjects showed interferences in protrusive, lateroprotrusive and lateral excursive movements on teeth showing gingival recession and gingival clefts. Occlusal wear was seen on all teeth having gingival clefts and on most teeth having gingival recession. These results suggest that occlusal interferences in maximum intercuspation and eccentric movements in one form or the other and absence of mutually protected occlusion can contribute to gingival lesions such as gingival recession and clefts.

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Introduction

A harmonious relationship between occlusion and periodontium is today considered mandatory to maintain a healthy dentition. In a healthy occlusion, there are multiple pin point contacts between the maxillary and mandibular teeth in maximum intercuspation; and during protrusive, lateroprotrusive and lateral excursive movements there is immediate disclusion in the form of anterior guidance, canine guided occlusion or a mutually protected occlusion. In this manner, the teeth and the periodontium are protected from detrimental forces in centric and eccentric occlusions. When occlusion is unfavorable, this mechanism is disturbed and few cusps or a single cusp bear the occlusal forces initially during jaw closure. This affects the periodontal tolerance of the tooth or teeth which exhibit occlusal interferences.

Gingival recession and gingival clefts are two periodontal entities that can occur due to various factors. Stillman [1] in 1921 was the first to associate occlusal trauma in the development of gingival cleft and became known by his name as 'Stillman's cleft'. Surprisingly, the relationship between occlusal trauma and gingival cleft has remained unclear till the reports published by Solnit [2] which revealed that gingival clefts apparently underwent spontaneous repair following occlusal analysis and subsequent adjustment. According to Solnit, gingival clefts in the upper jaw are due to working side interferences and in the lower jaw due to the balancing side contacts. Contrary to this, Emslie [3] found no evidence to support the role of occlusal trauma in the formation of gingival clefts.

Parfit and Major [4] observed no occlusal contacts in more than half the mandibular incisors with recession and heavy occlusal contacts in only 15 % of the cases. Trot and Love [5] observed trauma from occlusion in only 10 % of the cases with recession while Gorman [6] found recession in 20 % of the cases.

Inspite of the voluminous nature of studies which relates occlusion to periodontal disease, the role of pathological occlusion to the incidence of gingival recession and gingival clefts has not been adequately investigated. It was thought desirable to find out the association of occlusal trauma in subjects having gingival recession who were otherwise free from the influence of calculus and other etiological factors which cause gingival recession and gingival clefts. Hence, this investigation was conducted on 50 subjects having gingival recession and 10 subjects having gingival clefts with the following objectives:

1. To study the maximum intercuspal contact pattern in teeth showing gingival recession and gingival clefts
2. To study the nature of occlusal contacts from maximum intercuspal position to protrusive, lateroprotrusive and lateral excursive movements in the same teeth showing gingival recession and gingival clefts

Materials and Methods

From the screening of 600 dental students comprising of males and females between 18 and 25 years of age group, 50 subjects showing gingival recession and 10 subjects showing gingival clefts were obtained. The following investigation was made for the tooth/teeth showing gingival recession and gingival clefts.

1. Recording the location and extent of gingival recession, gingival clefts and occlusal wear facets
2. Recording the type of occlusion
3. Recording the nature of occlusal contact in maximum intercuspation and eccentric mandibular movements.

Armamentarium

Arti-fol of 8 micron thickness (blue and red color)
Magnifying mirror
Shimstock of 8 micron thickness

Recording the Extent of Gingival Recession/Gingival Cleft and Occlusal Wear Facets

Gingival recession/gingival cleft were measured from the CEJ (deepest point) to the deepest point of the margin of the gingiva by using a graduated periodontal probe (Fig. 1).

Fig. 1 Grading the extent of gingival cleft using graduated periodontal probe

The following grade was given depending on the amount of recession.

Grade I-Mild (0–2 mm)
Grade II-Moderate (2–3 mm)
Grade III-Severe (3–6 mm)

The following scale was used for grading the severity of occlusal wear.

0-No visible facets in the enamel
1-Marked wear facets in the enamel
2-Wear into dentine
3-Extensive wear into dentine

Recording the Type of Occlusion

The subject was asked to move the mandible towards the side showing recession till the tip of the mandibular canine touches the tip of the maxillary canine. If the cuspids were the only teeth in contact and disclusion is seen in the posteriors then it is considered as "canine guided occlusion". Along with the canine if the other posterior teeth also made contacts with its antagonists then it was considered as "group function occlusion".

Recording the Nature of Occlusion in Maximum Intercuspation

The patient was instructed to "tap his/her back teeth together, both sides at the same time, slow and hard". After having the patient to repeat this process once or twice, the actual maximum intercuspation (MI) contacts were assessed by using Arti-Fol (blue) of 8 micron thickness which is cut into strips and placed over the teeth to be examined and the patient was asked to open and close the mouth again as before. The number of contacts was noted (Fig. 2). If there were interfering contacts, these were seen as 'darker marks' compared to others which were considered as 'heavy contacts' in maximum intercuspation.

Fig. 2 Contacts obtained by articulating film during maximum intercuspation

Fig. 3 Checking anterior disclusion during maximum intercuspation using shimstock

Fig. 4 Protrusive interferences identified during incisor edge-to-edge position

Fig. 5 Mediotrusive and laterotrusive interferences identified during eccentric movements of the mandible

The firmness of the contact can be detected by using the shimstock placed over the lower anteriors and the patient was asked to clench the teeth in MI. If there was resistance to removal, then it is suggested that there is no anterior disclusion (Fig. 3).

A "two color method" was followed for recording protrusive excursive contacts. The protrusive contacts were first marked after drying and isolating the teeth, by inserting red articulating foil and having the subject to produce several protrusive glides to edge-to-edge position (Fig. 4). The vertical stops are then marked with blue articulating foil by having the patient to tap his or her teeth together in MI. The number of protrusive interferences was noted.

Recording the Nature of Occlusion in Laterotrusive and Mediotrusive Movements

The patient was trained to move his mandible sideward till the tip of the mandibular canine aligns with the tip of the maxillary canine. The tooth was dried, isolated and red articulating foil was placed between the teeth and the patient was asked to close the mouth in MI and then the mandible is moved slowly, towards the predetermined position. Heavy occlusal contacts were observed as dark red marks on the surface of the affected tooth. A two color method was followed to distinguish the vertical stops. For recoding the mediotrusive contacts, the extent of mediotrusion was guided by the laterotrusion on the opposite side (Fig. 5).

In this manner, all the subjects were evaluated for the presence of occlusal interferences on the tooth exhibiting gingival recession and gingival clefts.

The data collected from 50 subjects showing gingival recession and 10 subjects showing gingival clefts was analysed statistically by applying Chi square test, Fisher's exact test and *Z* test.

Results

Among the three occlusal concepts, gingival recession was more commonly related to group function than to canine guided occlusion. Canine guided occlusion was associated with gingival recession on the labial surface while in group function occlusion; the recession was distributed equally on the facial surface of the anterior as well as posterior teeth (Table 1). Occlusal wear was seen on all teeth having gingival clefts and on most teeth having gingival recession (Table 2).Nearly all subjects showed interferences in protrusive, lateroprotrusive and lateral excursive movements on teeth showing gingival recession and gingival clefts (Tables 3 and 4).

Discussion

Among the three occlusal concepts, mutually protected, canine guided and group function; gingival recession was

Table 1 Type of occlusion, region wise distribution, location of gingival recession and gingival clefts

	Type of occlusion	Anterior region		Posterior region	
		Labial (%)	Lingual (%)	Labial (%)	Lingual (%)
Gingival recession	20 cases (40 %) canine protected 32 teeth, 7 cases mutually protected	75 [24]	–	18.8 [6]	6.2 [2]
	30 cases [60 %] group function 48 teeth, 5 cases mutually protected	39.6 [19]	10.4 [5]	45.8 [22]	4.2 [2]
Gingival clefts	2 cases, canine protected 2 teeth	100 [2]	–	–	–
	8 cases, group function 21 teeth	19 [4]	–	81 [17]	–

Table 2 Occlusal wear on teeth showing gingival recession and gingival clefts

	Type of occlusion	Anterior region (%)	Posterior region (%)
Gingival recession	Canine protected	34.4 [11]	–
	Group function	37.5 [18]	35 [12]
Gingival clefts	Canine protected	100 [2]	–
	Group function	19 [4]	81 [17]

Table 3 Number of teeth showing disclusion and interferences in maximum intercuspation, protrusive and laterotrusive movements in gingival recession

Gingival recession	Type of occlusion	Disclusion present (%)	No. of teeth with interferences/contacts	
			Anterior (%)	Posterior (%)
Canine protected	Centric	3.1 [1]	71.9 [23]	25 [8]
	Protrusive	31.3 [29]	62.5 [20]	6.2 [2]
	Mediotrusive	90.7 [6]	6.3 [2]	3 [1]
	Laterotrusive	71.9 [23]	28.1 [9]	–
Group function	Centric	12.5 [6]	37.5 [18]	50 [24]
	Protrusive	60.4 [29]	35.5 [17]	4.1 [2]
	Mediotrusive	79.2 [38]	12.6 [6]	8.4 [4]
	Laterotrusive	35.4 [17]	33.4 [6]	31.2 [15]

Table 4 Number of teeth showing disclusion and interferences in maximum intercuspation, protrusive and laterotrusive movements in gingival clefts

Gingival clefts	Type of occlusion	Disclusion present (%)	No.of teeth with interferences/ contacts	
			Anterior (%)	Posterior (%)
Canine protected	Centric	–	100 [2]	–
	Protrusive	50 [1]	50 [1]	–
	Mediotrusive	100 [2]	–	–
	Laterotrusive	50 [1]	50 [1]	–
Group function	Centric	4.8 [1]	14.3 [3]	80.9 [17]
	Protrusive	76.2 [16]	4.8 [1]	19.1 [4]
	Mediotrusive	85.7 [16]	–	14.3 [3]
	Laterotrusive	47.6 [10]	14.3 [3]	38.1 [8]

more commonly related to group function than to canine guided occlusion. This can be explained by the fact that in canine guided occlusion there was total disclusion of posterior teeth while in group function this was not the case. There is general predilection for the lesions to appear on the facial surface [7–9].

Absence of anterior disclusion in maximum intercuspation can have deleterious influence [10]. This may be the reason for the gingival recession seen in 85 % of the subjects where there was no anterior disclusion in maximum intercuspation.

Gingival clefts were generally seen on the maxillary teeth and they had a tendency to be located in the posterior region [11]. The same occlusal interferences which were related to gingival recession were also common to gingival clefts (Fig. 6).

Nearly all the subjects showed interference either in protrusive or in mediotrusive or laterotrusive movement on the teeth showing gingival recession and gingival clefts (Figs. 7, 8 and 9).

Arti-foil of 8 microns thickness is used in the study whose thickness is less than patient's perception [12, 13].

One of the striking observations of the study was the relation between mutually protected occlusion and the incidence of gingival recession and gingival clefts. When there was no mutually protected occlusion there was no disclusion in the anterior teeth during maximum intercuspation, and during protrusion there was no posterior disclusion [10, 14]. All these situations constituted pathological malocclusion which adversely affects the occlusal surface of

Fig. 6 Gingival recession seen on the buccal surface of lower molar with cross tooth balance preventing group function occlusion

Fig. 7 Gingival cleft seen on the buccal surface of upper first premolar

Fig. 8 Protrusive interference seen

Fig. 9 Laterotrusive interference seen as red marks

the teeth, periodontium, neuromuscular system and the temporomandibular joint [11, 15, 16]. This study relates this form of pathological malocclusion also to gingival recession and gingival clefts.

It is a well known fact that pathological malocclusion in the form of various interferences and prematurities can give rise to occlusal wear facets [17]. To complement this theory, this study showed that occlusal wear was seen on all the teeth having gingival clefts and on most of the teeth having gingival recession. Further it is presumed that occlusal wear was a result of heavy contacts during functional and non-functional movements [17–20]. This perhaps may also have a relation to the incidence of these lesions.

To sum up, this study has been significant to show that occlusal interferences in maximum intercuspation and eccentric movement in one form or the other and the absence of mutually protected occlusion can contribute to these gingival lesions. A longitudinal study with proper occlusal analysis and correction of interferences is necessary to further highlight the importance of occlusion to these lesions.

Conclusion

From the results of the foregoing investigation the following conclusions were drawn. Gingival recession was more commonly related to group function occlusion (60 %) as compared with canine guided occlusion (40 %). In subjects having canine guided occlusion, gingival recession was seen on the labial surface of the anteriors (75 %) whereas in group function occlusion, recession was distributed equally on the facial surfaces of the anterior and posterior teeth. Gingival recession was seen on the labial surface of the mandibular anterior teeth in 85 % when there was an absence of anterior disclusion in maximum intercuspation. Interferences in the form of protrusive, mediotrusive and laterotrusive contacts were associated with gingival recession. Gingival clefts were more commonly seen on the maxillary teeth and the posterior region. Interferences in laterotrusion, mediotrusion or protrusion were observed in the teeth showing gingival clefts. Occlusal wear was observed on the teeth having gingival clefts. There was significance between mutually protected occlusion and the incidence of gingival recession and gingival clefts. In 80 % of the subjects, there was no mutually protected occlusion.

Summary

An investigation was done on a selective sample of 50 subjects having gingival recession and 10 subjects having gingival clefts comprising of both the genders with a mean age of 22 years. The influence of occlusal trauma on gingival recession and gingival clefts in these subjects in protrusive, mediotrusive and laterotrusive movements of the mandible were studied. The interfering contacts in

these positions were observed and related to gingival recession and gingival clefts. The method consisted of recording occlusal contacts in these positions by obtaining markings on the interferences with an 8 micron thickness articulating foil.

Further anterior disclusion in maximum intercuspation and the nature of occlusion in excursive movements such as posterior disclusion in the form of canine guidance and mutually protected occlusion and group function were recorded in these patients to find out their influence on gingival recession and gingival clefts.

References

1. Harrel SK (2004) The effect of occlusal discrepancies on gingival width. J Periodontol 75(1):98–105
2. Solnit A, Stambaugh RV (1983) Treatment of gingival clefts by occlusal therapy. Int J Periodontics Restor Dent 3(3):38–55
3. Bernimoulin J-P, Curilovic Z (1977) Gingival recession and tooth mobility. J Clin Periodontol 4(2):107–114
4. Wennström JL (1996) Mucogingival therapy. Ann Periodontol 1:671–701
5. Trott JR, Love B (1966) An analysis of localized gingival recession in 766 Winnipeg High School students. Dent Pract Dent Rec 16(6):209–213
6. Gorman WJ (1967) Prevalence and etiology of gingival recession. J Periodontal 38:316–322
7. Ingerval B, Meyer D, Stettler B (1992) Tooth contacts in eccentric mandibular positions and facial morphology. J Prosthet Dent 67:317–322
8. Patur B (1969) The role of occlusion and the periodontium in restorative procedures. J Prosthet Dent 21(4):371
9. Bhaskar SN (1967) Occlusion and periodontal disease. Int Dent J 17(2):251–266
10. Franklins Ira (1974) Occlusal contacts of the natural teeth. J Prosthet Dent 32:660–667
11. Stallard RE (1969) Occlusion: a factor in periodontal disease. Dent Clin of North Am 13(3):599–605
12. Schelf E (1985) Thickness and marking characteristics of occlusal registration strips. J Prosthet Dent 54(1):122
13. Halperin GC (1982) Thickness, strength and plastic deformation of occlusal registration strips. J Prosthet Dent 48(5):575
14. Goldstein GR (1979) The relationship of canine protected occlusion to a periodontal index. J Prosthet Dent 41(3):277–283
15. Broderson SP (1978) Anterior guidance: the key to successful occlusal treatment. J. Prosthet Dent 39:396–400
16. O'Leary TJ, Shanley DB, Drake RB (1972) Tooth mobility in cuspid–protection and group function occlusions. J Prosthet Dent 27:21–25
17. Reynolds JM (1970) Occlusal wear facets. J Prosthet Dent 24(4):367–372
18. Jin KJ (1992) Clinical diagnosis of trauma from occlusion and its relation with severity of periodontitis. J Clin Periodontal (Denmark) 19(2):92–97
19. Morris ML (1958) The position of the margin of the gingival. Oral Surgery 11:969–984
20. Novaes AB, Ruben MP, Ken S, Goldman HM, Novaes AB Jr (1975) The development of the periodontal cleft: a clinical and histopathologic study. J Periodontol 46:701–709