Gingival Biotypes in Relation to Incisors Inclination, Position and Altered Passive Eruption- A Clinico- Radiographical Study

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Abstract

The study aimed to examine the relation among gingival biotype, inclination, position of maxillary and mandibular incisors and altered passive eruption (APE). 80 patients aged between 20-40 years were recruited. Gingival biotype and APE was assessed by periodontal probe. The inclination and position of incisor were evaluated with help of cephalometric analysis. Data reported that there were no significant relation between maxillary inclination, position and gingival biotype. The inclination and position of incisor in mandible were found to be substantially higher in thin gingival biotype. Altered Passive Eruption was significantly greater in thick biotype.

Keywords: Gingival biotype, gingival recession, incisor inclination and position and Altered passive eruption.

1. Introduction

When organizing orthodontic tooth movement, the incisor teeth inclination and positioning are a crucial consideration. In recent years, the extent of proclination of incisors in the dental arch have been the subject of discussion. Gingival recession may result from proclination's influence. An aesthetic impairment may result from gingival recession, which can be generalized or localized, damage one or more tooth surfaces.[1]

Since the gingival biotype describes the hard and soft tissues that surround teeth, determining it is crucial. There are two types of biotypes of gingiva: thick and thin. The thin biotype of gingiva has the following physical characteristics: a) soft with significant scalloping; b) pellucid; and c) limited width of attached gingiva. It frequently displays thin labial bone with potential fenestrations and dehiscence while being assessed surgically. A healthy periodontium is known to have thick gingival tissue, which is characterised by dense, fibrotic tissues as well as a relatively broad band of keratinized tissue.[2] The substantial underlying bone architecture is depicted by the flat topography of the gingival tissues.

Reduction in thickness of gingiva might be a predisposing factor contributing to periodontal tissue breakdown.[3] The incisor's Inclination and position may be considerably associated

with the biotype of gingiva when teeth are positioned more labially, which may impact the width of the alveolar bone and gingival covering the root.[4,5]

Gottlieb and Orban reported that tooth eruption is accomplished by two phases. The active eruption phase led to the emergence of tooth in the oral cavity. This phase ends when tooth comes in contact with its opposing teeth but continues with occlusal wear or loss of opposing teeth. The soft tissue that surrounds the tooth shifts apically during passive eruption.[7]

Goldman and Cohen (1968) explained Altered Passive Eruption (APE) as a condition in which "the gingiva in the adult is located incisal to the cervical convexity of the crown and removed from the cementoenamel junction (CEJ) of the tooth".[6]Formerly, it was also termed as 'retarded passive eruption' or 'delayed passive eruption'. The clinical significance of APE might be its esthetic consequences as when it affects maxillary anterior teeth it leads to alteration of dentofacial harmony and often leads to square appearing clinical crowns.[6]

A couple of studies have enumerated the probable causes of interruptions during passive phase, namely interocclusal interruptions of soft tissues while eruption of teeth, evidence of familial hereditary tendencies, and the existence of dense and fibrous gingival tissues.[8]

However, the goal of the present study was to interpret the association among altered passive eruption and biotypes of gingiva, incisor inclination, and positions of the incisors of maxillary and mandibular arch.

2. Methodology

Participants:

Between January 2015 and March 2015, 73 subjects (42 females and 31 males) aged between 17-40 years with presence of all maxillary anterior teeth were randomly chosen from the institution with written informed consent. This cross sectional study was performed according to the terms with the Helsinki Declaration of 1975, as per revision in 2000. The criteria included for selection of participants were healthy gingiva with Plaque and gingival index score[9, 10] of 0 and 1. Exclusion criteria includes systemic compromised conditions like pregnancy or medications which enhance the risk of hyperplasia of gingiva, presence of incisal restoration, crown or extensive fillings in anterior teeth, a history of gum surgery and orthodontic correction treatment in anterior teeth region. Smokers were also excluded.

Data collection and clinical measurements:

Subjects were interviewed to acquire demographic features of the study population (age and sex). Furthermore, history regarding and periodontal treatment and orthodontic treatment were interrogated.

Clinical parameters (gingival biotype and Altered passive eruption) were scrutinized by single calibrated investigator at the anterior teeth's mid- facial aspect.

A periodontal probe (Michigan-O probe with William's color-coded markings, Hu-Friedy, Chicago, IL, USA) was used to assess the biotype of gingiva by peeking through the margins of gingiva and probing the sulcus of gingiva at the mid-facial region of the anterior teeth in maxillary and mandibular arch (TRAN method). The periodontal probe was deemed thin when it could be seen through the gingiva, and thick when it couldn't. (Figure 1 and 2).

Figure 1and 2: Illustrating thin and thick gingival biotype respectively.

Periodontal probe was used to identify the absence or presence of APE of maxillary anteriors to the nearest 0.5 mm. Altered passive eruption diagnosis was absent when the measurement from margins of gingiva to the Cemento-enamel junction is 0.5-2 mm and was considered present when it is more than 2 mm, in at least two anterior teeth in maxilla (Figure 3).

Figure 3: Case presenting altered passive eruption

By taking lateral cephalometric radiographs with a digital and cephalometric system, it was possible to determine the maxillary and mandibular incisor teeth's inclination and location. The cephalostat machine's ear rods were placed in the external auditory meatus of each subject, the Frankfort plane should be parallel to the horizon, the saggital plane should be directed at an right angle to the path of X ray, the teeth should be placed in centric occlusion, and the lips were kept closed in a relaxing way. The cephalogram was afterwards imported into the vistadent OC software (dentsply, Birmingham, USA) and digitally traced by the same investigator; the landmarks employed are depicted in figure 4. The inclination and location of the maxillary and mandibular incisors were evaluated using these markers.

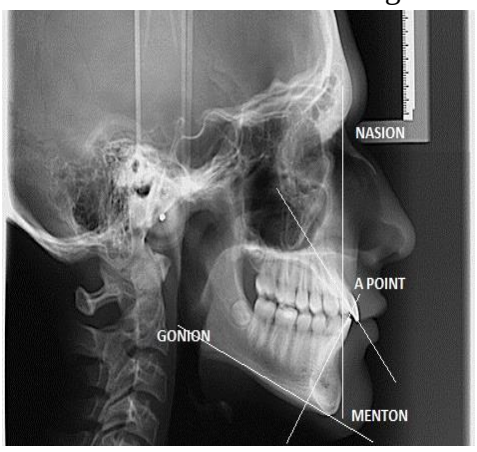

Figure 4

FIG 4: The measurement of inclination and position of Maxillary and mandibular incisors are done using cephalometric landmarks and planes. Nasion: In the midsagittal plane, the fronto-nasal suture's anteriormost point. A Point: The furthest-reaching point of the midline in the concavity between the anterior nasal spine and the lowest point on the alveolar bone underneath the maxillary central incisors termed as Prosthion. Between the topmost point on the alveolar bone that covers the central incisors of mandible (Infradentale) and Pogonion, B Point is the most posterior point of midline in the concavity of jaw.

Incisor inclination of maxilla. The angle made by intersecting a line from nasion to point A (NA) with a line drawn along the long axis of maxillary central incisor.

Incisor position of Maxilla. The measurement of distance from the most labial point on maxillary central incisor to NA line.

Incisor inclination of mandible. The angle between intersecting line drawn along the plane pf mandible (Gonion-Menton) and line drawn along the long axis of central incisor of mandible.

Incisor position of mandible. The distance measured between the most labial point on incisor of mandible to NB line.

3. Statistical Analysis

The Statistical Package for Social Sciences Version 20.0 (IBM SPSS Statistics for Mac, Armonk, NY: IBM Corp, USA) was used to tabulate and analyse data. The means and frequency distributions for the continuous and categorical variables were determined. The Chi-square [x2] was used for interpreting the categorical data and to establish the relation between continuous variables Student's t-test was used, the bivariate connection between biotype of gingiva, inclination, gender and location of the incisors of maxilla or mandible was evaluated. The logistic regression models were used in multivariate analysis to interpret the connection among gingival biotypes and the other research variables. Statistical significance was explained as a p-value of less than 0.05.

4. Results

Table 1 displays maxillary and mandibular gingival biotypes' gender distribution. In both incisors of maxilla and mandible, women were substantially had more chances to have thin gingival biotype than men. (p= 0.035 and 0.005 respectively).

TABLE 1: Maxillary and mandibular arches distribution of gingival biotype as per gender among 73 subjects.

GINGIVAL BIOTYPE	THIN n(%)	THICK (n%)	P value*
MAXILLARY INCISORS			
MALES (n=31)	10(32.2%)	21(67.74)	0.035
FEMALES (n=42)	24(57.1)	18(42.85)	
TOTAL (n=73)	34(47.57)	39(53.4)	
MANDIBULAR INCISORS			0.005
MALES (n= 31)	13(41.9)	18(58.1)	
FEMALES (n=42)	31(73.8)	11(26.2)	
TOTAL (n=73)	44(60.2)	29(39.72)	

The bivariate comparisons of incisor inclination and location for the teeth of maxillary and mandibular arch for thick and thin gingival biotypes are shown in Table 2. Between thin and thick gingival biotypes, there were found no statistically significant variations in the means inclination and position of maxillary incisors. In comparison to the thick gingival biotype, the inclination and location of mandibular incisors were substantially higher in the thin biotype of gingiva.

TABLE 2: Thin and thick biotypes of gingiva in subjects in relation to incisor inclination and location

VARIABLE	GINGIVAL BIOTYPE				
	THIN		THICK		P value
	MEAN	SD	MEAN	SD	
Maxillary arch					
Incisor inclination	32.970	7.250	34.717	7.587	0.318
Incisor position	8.382	3.861	9.307	3.784	0.306
Mandibular arch					
Incisor inclination	36.613	8.621	30.931	7.201	0.004
Incisor position	8.318	3.226	5.931	2.711	0.001

Results from the bivariate analysis (Table3) showed that Altered Passive Eruption was significantly greater in thicker gingival biotype when compared to thin gingival biotype. (P value <0.001)

TABLE3: Gingiva Biotype Comparison (n [%]) in subjects Without and with Altered passive eruption

GINGIVAL BIOTYPE	THICK	THIN	P value*
ALTERED PASSIVE ERUPTION	20	1	<0.001
NON ALTERED PASSIVE ERUPTION	19	33	
TOTAL	39	34	

Taking into account age, maxillary incisor inclination, and location, regression analysis for the incisors of maxilla (Table 4) revealed that women had 2.8 times more commonly associated with thin gingiva than men. Other factors had no statistically significant relationship with gingival biotypes. Regression analysis revealed that women has been 3.9 times more commonly associated with thin gingival biotype than men in the mandibular arch. The higher mandibular incisor inclination (p=0.004) and location (p=0.001) were also significantly related with thin gingival biotype.

TABLE4: Multivariable relation between biotype of gingiva in the maxilla and mandible with studied factors.

VARIABLES	Odds ratio	95 % CI		P value*
MAXILLA		lower	upper	
Gender(Female versus male)	4.133	0.0174	0.480	0.035
Age(Years)	1.017	-0.0765	0.0282	0.722
Maxillary incisor inclination(degree)	1.032	-0.0079	0.0238	0.319
Maxillary incisor position(mm)	1.068	-0.0148	0.0468	0.305
Altered passive eruption(thin versus thick)	0.028	0.366	0.807	0.028
MANDIBLE				
Gender(female versus male)	3.902	0.096	0.540	0.005
Age(years)	0.956	-0.033	0.0133	0.395
Mandibular incisor inclination(degree)	0.916	-0.031	-0.0061	0.004
Mandibular incisor position(mm)	0.765	-0.089	-0.021	0.001

5. Discussion

The study's findings showed that the protrusion and proclination of the incisors of mandible were substantially correlated with gingival biotype of thin type, however there was no correlation among biotypes of gingiva and the inclination and positioning of the incisors of maxilla.

According to Cook et al., a thin biotype of gingiva is frequently correlated with a thin underlying labial bone, whereas a thick biotype of gingiva is correlated with a thicker underlying labial bone.[11] One element that might contribute to the thinning of the gingiva is periodontal tissue.[3] According to one study, there is a higher chance of gingival recession and alveolar dehiscence when the teeth roots are dislodged from the centre of the alveolar bone.[1] Additionally, the thickness of the bone and the gingiva that encircles the root may be impacted when teeth are pushed more labially.[4,5]

In the current study, women had a 2.8-fold higher likelihood than men of having thin gingival biotype in their maxillary incisors and a 3.9-fold higher likelihood in their mandibular incisors. In this study, 28.77% (21/73) subjects were diagnosed with Altered Passive Eruption (APE). Among them 95.24% patients had thick gingival biotype whereas only 4.8% subjects with thin gingival biotype had APE. **Batista et al.** (2012) examined the anatomic features of hard and soft tissues of APE diagnosed teeth by CBCT and established that thick gingival biotype with flat architecture was common gingival feature in all the cases. The mean soft tissue thickness of ≥1mm was found in all cases assessed.[12] The concept behind this assumption might be relatively slow migration of thick and fibrotic gingiva during passive phase of eruption as compared to thin gingival biotype.[6]

The gingival biotypes of the maxilla and mandible were not distinguished in earlier investigations. The uniqueness of gingival biotype, however, was called into doubt by a recent research by Houchmand et al. (2013) since it could vary across the maxillary and mandibular arches.[3]The prevalence of the thin biotype of gingiva was separately analysed for the incisors of maxilla and mandible in the current study, and the findings revealed a frequency of 47.6% in maxilla and 53.4% in the mandible incisors.

Because of its accuracy and simplicity, the TRAN technique was used in the current investigation to determine the biotype of gingiva based on the transparency of the periodontal probe through the gingival edge (Houchmand et al. 2013).

The limitation of the present study was that it was cross-sectional, which prevented it from showing the order of events. Because the sample was selected from a single center's patient pool, the results might be biased. Another drawback was the periodontal probe's inability to accurately identify CEJ.

6. Conclusion

Thin gingival biotype is related with proclination and protrusion of incisors of mandible, but not with maxillary proclination and protrusion. In individuals with thin biotype of gingiva, labial movement of these teeth may enhance the risk of developing dehiscence of bone and recession of gingiva. For orthodontic patients, understanding the frequency of thin or thick biotype of gingiva may be helpful during evaluation of patients and assessment of risk. For instance, augmentation of gingiva before orthodontic treatment may assist certain individuals with thin gingival biotype. Therefore, further research is necessary to assess this idea. Altered Passive Eruption is more common in thick gingival biotype.

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