FACTORS ASSOCIATED WITH HIGH FRENAL ATTACHMENT AND FRENECTOMY- A

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ABSTRACT

Frenum is a thin mucous membrane fold which is enclosed by muscle fibers that attach the lips to the alveolar mucosa and the underlying periosteum. The high frenal attachment leads to spacing (diastema), gingival recession,interference in prosthodontics treatment and speech difficulty. The treatment frenectomy is mainly done to correct high frenal attachment.The aim of the study was to find the common reasons for frenectomy and the other factors associated with high frenal attachment . This retrospective study included the patients who underwent frenectomy/ frenotomy for high frenal attachment in a dental hospital from June 2019 to March 2020. No gender or age restrictions were. 99 patients were included in the study. Digital case sheets were reviewed and the following data including the details like patients gender, age, site of high frenal attachment, reason for frenectomy were extracted, tabulated and analysed statistically with Chi square test using SPSS version 20. Among those 99 frenectomy cases. The males were (43.4%) and females were (56.6%). The prevalence of frenectomy was more in female gender as compared to male gender. The common reason behind frenectomy was spacing (61.6%) and the more common site of high frenal attachment was S2 (Maxillary anterior sextant) (55.5%) compared to S5 (Mandibular anterior sextant). There was a significant difference in the reasons for frenectomy between site($p < 0.05$)and sites underwent frenectomy and age of the patient($p < 0.05$).No significant difference in the reasons for frenectomy between males and females ($p > 0.05$). From the study it can be concluded that the common reason for frenectomy is diastema and the reasons for frenectomy is influenced by the site of high frenal attachment and the age of the patients.

KEY WORDS: Frenectomy , High frenal attachment , Prevalence , Recession , Spacing

INTRODUCTION

Frenum is a collagenous fibrous tissue fold of the mucous membrane which connects the lip to the alveolar process in the midline of both maxillary and mandible. If there is any change or difference in the both size and location of the frenum then this can lead to functional as well as aesthetic problems which require surgical excision (frenectomy/frenectomy) (Yadav *et al.,* 2019). The frenum basically originates embryologically as a central cell remnant of the vestibular laminar in the region of mid sagittal (Bali *et al.,* 2019). This mainly comprises connective tissue and epithelium and rarely comprises muscle fiber

(Priyanka *et al.*, 2013). The labial frenum function is to provide the upper lip stability and support in order to keep the lip in harmony with the growing bone of maxillary. This will help to regulate the facial growth. The frenal attachment too close to the margin of the gingiva can result in diastema (spacing), recession of the gingiva, loss of bone due to pull of muscles, poor lip mobility during speaking and at the time of smiling (Rajani, Biswas and Emmatty, 2018).

High frenal attachment is an important concern not only in restorative and aesthetic treatment of oral cavity but also in the management of periodontitis as it can influence the progression of periodontal pocket and gingival recession. Periodontitis is a chronic inflammatory disease caused by gram-negative organisms in the supporting structures of the tooth (Varghese *et al.*, 2015), (Mootha *et al.*, 2016), (Khalid *et al.*, 2016). Host mediated inflammatory response in periodontal disease may influence systemic health of the patient (Khalid, 2017), (Priyanka *et al.*, 2017),(Ramamurthy and Mg, 2018). Thus the management of periodontitis whether non surgical means, or surgical means important for overall well being of the patient (Ramesh, Sheeja S. Varghese, *et al.*, 2016), (Ramesh, Sheeja Saji Varghese, *et al.*, 2016), (Ramesh *et al.*, 2019), (Avinash, Malaippan and Dooraiswamy, 2017), (Ravi *et al.*, 2017), (Ramesh, Ravi and Kaarthikeyan, 2017).Thus management of frenal attachment, an anatomical variation, is having an important role in periodontitis treatment (Panda *et al.*, 2014).

Moreover one of the most common esthetic concerns which is related to the periodontal disease is the recession of gingiva and high frenal attachment can predispose to recession as well (Thamaraiselvan *et al.*, 2015). Yet another problem associated with high frenal attachment is diastema formation. Every time when the frenulum gets attached to the gingiva in a manner that allows the frenum to retract the margin of the gingiva that will lead to the development of diastema (spacing) or the movement of lip gets limited which is said to be an abnormal condition (Devishree, Gujjari and Shubhashini, 2012), (Abraham and Kamath, 2014).

The presence of diastema(spacing) between the central incisors that will result in maxillary diastema because of the presence of multifactorial etiology. There are well documented studies which support the concept of genetic predisposition for the maxillary midline diastema possibilities (Gkantidis, Kolokitha and Topouzelis, 2008). The midline diastema (spacing) of the teeth is a normal one during eruption as it can occur because of the the path of the eruption cuspids or due to increase in size of the premaxilla at the time of eruption of the maxillary permanent central incisors (L.n *et al.*, 2012).

Nevertheless it has been stated that midline diastema is a common reason for frenectomy due to concern on aesthetics (Muthu, Rathna and Koora, 2007). Since high frenal attachment is an anatomical variation it also has variability between individuals similar to other anatomical structures (Kavarthapu and Thamaraiselvan, 2018). Even though frenectomy/frenotomy are done as a surgical procedure for various functional and aesthetic reasons much research is not done to analyse the common reasons for advising the same and the various factors influencing it. So our present study is aimed to analyse the reasons behind the treatment of frenectomy and also to analyse the various factors associated with high frenal attachment

MATERIALS AND METHODS

This retrospective study included patients who were diagnosed with high frenal attachment and underwent frenectomy or frenotomy in a dental hospital.This study included patients treated in a single center which ensures that same diagnostic and treatment protocols were followed for all the patients and ensures

patients with the same ethnicity got included in the study. Ethical approval was obtained from the scientific review board of the university.

The study used a consecutive sampling method wherein case records of all the patients who were diagnosed with high frenal attachment and underwent frenectomy / frenotomy from June 2019 to March 2020 were retrieved from 86,000 patient records who got treated during the period. Inclusion criteria used was those patients who had high frenal attachment and were checked and approved by the concerned specialist. No age restrictions were made and both male and female patients were included in selection. Exclusion criteria were those patients with associated cleft lip or palate, patients whose case records were incomplete and patients where the good quality preoperative and postoperative photographs were not available in the digital system for cross verification .

The variables retrieved included patients age, gender, site of high frenum attachment and the reason for frenectomy. The site was recorded as sextant wise (S1 - S6) where (S2 for maxillary anterior sextant, and S5 for mandibular anterior sextant). The reason behind the frenectomy was identified from the case record after verifying the diagnosis and the treatment plan and cross verified with the photographs. All the records were manually verified and cross checked by 3 reviewers in order to avoid errors.

The extracted data was tabulated in an excel sheet and descriptive analysis was done using count and percentage. Age and gender as independent variables and site of high frenal attachment as the dependent variable were used to analyse whether there is any significant difference in the location of high frenal attachments with respect to age or gender. To analyse whether there is any significant difference between the site of high frenal attachment with respect to reasons behind frenectomy the site was the independent variable and reason behind frenectomy was the dependent variable. Statistical analysis was done by chi square test and p value 0.05 was set as the level of significance . All analysis was done using SPSS version 20.

RESULTS & DISCUSSION

The study included 99 frenectomy cases. Among that, males were 43(43.4%) and females were 56 (56.5%). The age of the patients ranged from 3-70 yrs. The most common age group reported for frenectomy for High frenal attachment was 21-30yrs (41.4%). Sites affected were only S2 (Maxillary anterior sextant) and S5 (Mandibular anterior sextant) and the most common site for frenectomy was S2 (55.5%) followed by S5 which was (44.4%).The most common age group who underwent frenectomy was 21-30 yrs(41.4%) followed by 11-20 (19.1) and 41-50(16.1%). Among 21-30 yrs of age group S2 was the common site whereas 41-50 yrs of age group S5 was mostly involved (Table 1 , Graph 1). On statistical analysis there was a significant difference in the site of frenectomy done between different age groups (p value 0.02) (Table 1).

On analysing the reasons for frenectomy the most common reason was spacing (61.6%) followed by gingival recession (21.2%).(Table 2 , Graph 2). While comparing the reasons behind frenectomy between different sites it is observed that for S2 sextant spacing was the predominant reason (45.5%) whereas for S5 sextant along with spacing (16.1%), gingival recession (17.1%) also equally prevalent(Table 2, Graph2). On statistical analysis there was a significant difference in the reasons for frenectomy between different sites (p value <0.05) (Table 2.).

In this study we also analysed whether there is any variation between the genders with respect to reasons behind frenectomy and found that females underwent frenectomy (56.5%) more than males (43.4%). Most

common reason for both the genders were spacing (Table 3, Graph 3). It is also noted that (14.1%) of females underwent frenectomy due to gingival recession whereas only (7%) of males had gingival recession as the reason behind frenectomy (Table 3, Graph 3). On statistical analysis the difference was not significant (p value >0.05) (Table 3).
In the present study on analysing the data of 99 frenectomy cases it was observed that S2 sextant was the most common site for frenectomy and the common age group affected was between 21-30 yrs. There was a significant difference in the percentage of sites affected with respect to the age of the patients. While analysing the reasons behind frenectomy the most common reason was spacing between upper anteriors and there was a significant difference in the reasons behind frenectomy between S2 and S5 sextants. On gender wise comparison of reasons behind frenectomy there was no significant difference between male and females even though females underwent more frenectomies than males .

According to the present study maxillary anterior sextant was the most common site underwent frenectomy. Supporting this finding Cabov et al has also reported that maxillary frenulum was the most common site which underwent frenectomy as compared with other frenal variants (Ćabov *et al.*, 2014).The most common reason for frenectomy was spacing followed by gingival recession. Other reasons such as prosthodontic treatment and tongue tie were the least common. It is interesting to note that for maxillary anterior sextant spacing was the major reason for advocating frenectomy whereas for mandibular anterior sextant gingival recession was also a common reason for frenectomy along with spacing. It has been reported that maxillary labial frenulum is a more thick fibrous penetrating type (Hammouri, Ghozlan and Alsmadi, 2017) compared to mandibular labial frenulum. A thick fibrous penetrating type frenulum can cause diastema formation. This might be the reason for observing spacing in S2 sextant in the present study. Gingival recession was more associated with S5 sextant(lower anterior). This could be due to thin gingival biotypes of lower gingiva which can predispose to more recession (Agarwal *et al.*, 2017). Moreover lower anterior teeth are more prone to periodontal disease as compared to upper anteriors (Anil, 2008).

It has been reported that prevalence of midline diastema was more in the papillary penetrating type of frenal attachment (62.5%) as compared to papillary (33.3%) and gingival attachment (1.40%)(Jindal *et al.*, 2016). Which is in line with our study where the common reason for frenectomy is spacing (diastema).

On analysing the age wise distribution, patients belonging to the 21- 30 age range were the common group who underwent frenectomy. On analysing site wise for S2 sextant the next common age group was 11- 20 years whereas for S5 sextant the next common age group was 41- 50 years followed by 31- 40years. This also explains the difference in the reason for frenectomy between S2 sextant and S5 sextant. Age group of 11-20 years and 21-30 years the correction of diastema for orthodontic purposes must be the common reason for frenectomy whereas as the age advances gingival recession also becomes a common reason for undergoing frenectomy especially in mandibular sextant. A weak but significant negative correlation between age of the patient and frenal attachment has also been reported (Hammouri, Ghozlan and Alsmadi, 2017). Supporting our finding, a study done in the Chennai population reported that age has an association with frenal attachment (Christabel and Linda Christabel, 2015).

Gender wise comparison revealed that females underwent frenectomy slightly more than males but on statistical comparison there was no significant difference between the reason behind frenectomy between males and females. In accordance with the present study results Jindal et al in their study reported that there is no significant difference between males and females with respect to type of frenal attachment (Jindal *et al.*, 2016). Similarly in Jordanian population there was no significant association reported

between gender and frenal attachment (Hammouri, Ghozlan and Alsmadi, 2017). No gender wise difference was reported with respect to high frenal attachment in a study where they have observed 931 children in the South Indian population (Christabel and Linda Christabel, 2015).

This retrospective study has inherent limitations as it was based on clinical case records even though at most care was taken in data extraction. And in this study we have included only those patients who underwent frenectomy which will not give true prevalence of high frenal attachment. Since the main aim was to analyse the reason behind frenectomy and associated factors, within the limitations it can be concluded that spacing is the common reason for frenectomy followed by gingival recession and age of the patient and the site of frenal attachment are associated factors for frenectomy. Future research is warranted to confirm the influence frenectomy on improving diastema closure and gingival recession management

CONCLUSION

Within the limitations of this study, it can be concluded that the common reason for frenectomy is diastema and the reasons for frenectomy is influenced by the site of high frenal attachment and the age of the patients.

AUTHOR CONTRIBUTIONS

Author 1(Thirumagal K), Carried out the retrospective study by collecting data and drafted the manuscript after performing the necessary statistical analysis. Author 2 (Dr. Sheeja Varghese) aided in conception of the topic, has participated in the study design, statistical analysis and has supervised in preparation of the manuscript. Author (Dr. Ravindra Kumar Jain) has participated in the study design, and has coordinated in developing the manuscript. All the authors have discussed the results among themselves and contributed to the final manuscript.

CONFLICT OF INTEREST

None Declared

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AGE AND SITE OF HIGH FRENAL ATTACHMENT				CHI SQUARE TEST		
AGE	S2 N (%)	S5 N(%)	TOTAL N(%)	PEARSON CHI SQUARE VALUE	df	ASYMPTOTIC SIGNIFICANCE (2-sided)
1-10	1(1.0%)	3(3.0%)	4(4.0%)	14.825	6	.022
11-20	14(14.1%)	5(5.0%)	19(19.1%)			
21-30	26(26.2%)	15(15.1%)	41(41.4%)			
31-40	8(8.0%)	7(7.0%)	15(15.1%)			
41-50	3(3.0%)	13(13.1%)	16(16.1%)			
51-60	2(2.0%)	1(1.0%)	3(3.0%)			

61-70	1(1.0%)	0	1(1.0%)			
TOTAL	55(55.5%)	44(44.4%)	99(100%)			

TABLE 1: Table represents frequency distribution and statistical analysis of high frenal attachment with respect to age and site; The most common age group reported for frenectomy for High frenal attachment was 21-30yrs (41.4%). Sites affected were S2 (Maxillary anterior sextant) and S5 (Mandibular anterior sextant) and the most common site for frenectomy was S2 (55.5%) followed by S5 which was (44.4%). Overall for younger patients the common site is S2 and as the age advances more patients are going for frenectomy for S5;sextant. Statistical comparison of association of age and site of high frenal attachment; Showing significant association with the site of frenectomy done and age of the patients(p value 0.022)

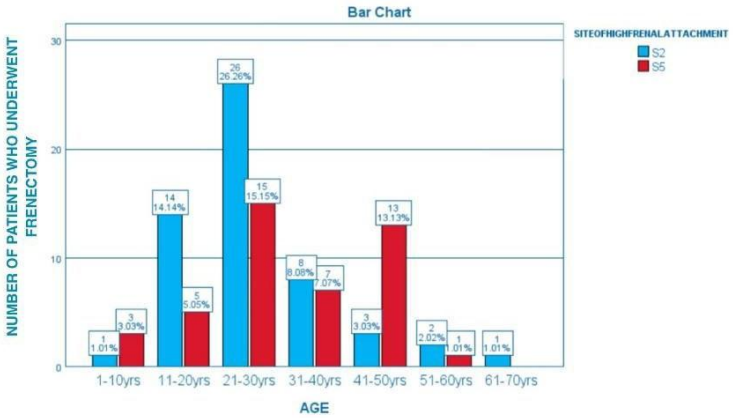

Figure 1: Bar graph depicting the age wise distribution of high frenal attachment at different sites. X Axis represents the age group and Y axis represents the number of patients underwent frenectomy for the respective age group. (Blue) represents S2(Maxillary anterior sextant)and (red) represents S5(Mandibular anterior sextant). In both sextants maximum patients were between 21-30 yrs and 41-50 age range S5 shows more cases than S2. Chi square test was done and association was found to be statistically significant. Pearson's Chi Square value:14.825, DF;6, p value: 0.022. There is a significant difference in the affected site with respect to different age groups (p value 0.022)

SITE OF HIGH FRENAL ATTACHMENT AND REASON FOR FRENECTOMY							CHI SQUARE TEST		
SITE OF HIGH FRENAL ATTACH M-ENT	SPACI N-G N(%)	RECES SI-ON N(%)	PROSTH-ODONTIC TREATME NT N(%)	TON-GUE TIE N(%)	SPAC I-NG & RECE S-SION N%)	TOT-AL N(%)	PEARS ON CHI - SQUAR E VALUE	d f	ASY-MPTOTIC SIGNIFICAN CE (2-sided)

S2	45 (45.5%)	4(4.0%)	4(4.0%)	0	2(2.0 %)	55(55.5 %)	26.607	4	.000
S5	16(16.1 %)	17(17.1 %)	2(2.0%)	3(3.0 %)	6(6.0 %)	44(44.4 %)			
TOTAL	61(61.6 %)	21(21.2 %)	6(6.0%)	3(3.0 %)	8(8.0 %)	99(100 %)			

TABLE 2: Comparison of reason behind frenectomy at different sites with statistical analysis; The most common reason is spacing (61.6%) followed by gingival recession (21.2%). In S2 (Maxillary anterior sextant) pacing is the predominant reason (45.5%) whereas for S5(Mandibular anterior sextant) along with spacing (16.1%), gingival recession (17.1%) is also equally prevalent. On statistical analysis there was a significant difference in the reasons for frenectomy between different sites (p value 0.000) with the spacing as the major reasons for S2 sextant and both gingival recession and spacing for S5 sextant.

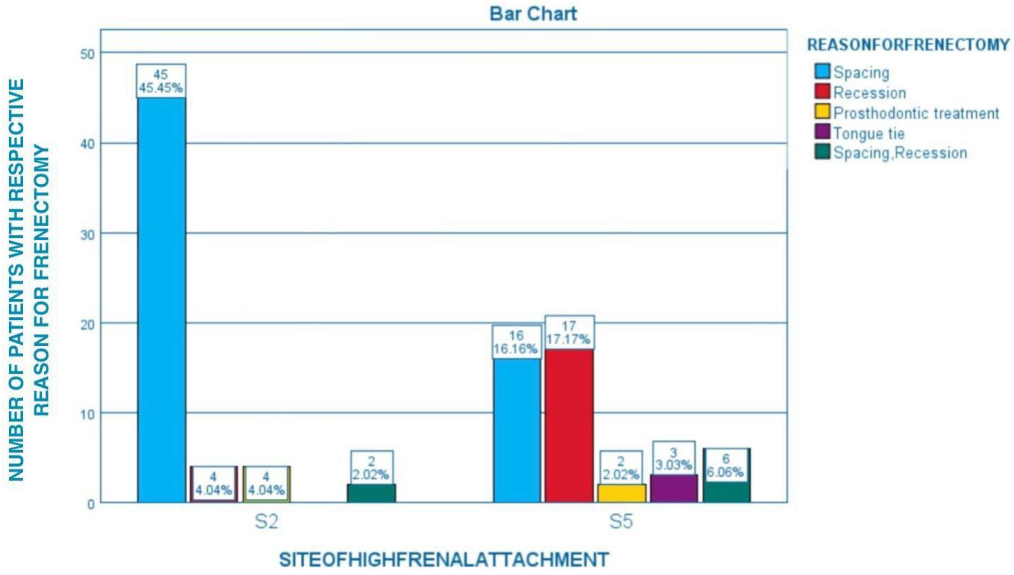

Figure 2: Bar graph shows comparison of reasons for frenectomy at different sites: X Axis represents the site of high frenal attachment and Y Axis represents the number cases with the respective reason for frenectomy. Spacing (blue), Recession (red), Prosthodontic treatment (yellow) , Tongue tie (purple) , Spacing & Recession (green). Chi square test was done and association was found to be statistically significant. Pearson's Chi Square value:26.607, DF;4, p value: 0.000. In S2(Maxillary anterior sextant)spacing is the predominant reason whereas for S5(Mandibular anterior sextant) long with spacing , gingival recession is also equally prevalent (p value <0. 001).

GENDER AND REASON FOR FRENECTOMY							CHI SQUARE TEST		
GENDER	SPACIN-G N(%)	RECESS-ION N(%)	PROSTH-ODONTIC TREATMENT N(%)	TONG-UE TIE N(%)	SPACIN-G & RECESSION N(%)	TOT-AL N(%)	PEARSON CHI SQUARE VALUE	df	ASYMP-TOTIC SIGNIF I-CANCE (2-sided)
MALE	28 (28.2%)	7 (7.0%)	4 (4.0%)	2 (2.0%)	2 (2.0%)	43 (43.4%)	4.107	4	0.392
FEMALE	33 (33.3%)	14 (14.1%)	2 (2.0%)	1 (1.0%)	6(6.0%)	56 (56.5%)			
TOTAL	61 (61.6%)	21 (21.2%)	6 (6.0%)	3 (3.0%)	8 (8.0%)	99 (100%)			

TABLE 3: Table represents frequency distribution of gender and reason for frenectomy with statistical analysis ; Females underwent frenectomy (56.5%) more than males (43.4%). Most common reason for both the genders are spacing. 14.1% of females underwent frenectomy due to gingival recession whereas only 7% of males had gingival recession as the reason behind frenectomy. On statistical analysis there is no significant difference in the reasons behind frenectomy between males and females p value: 0.392 (p value as 0.392)

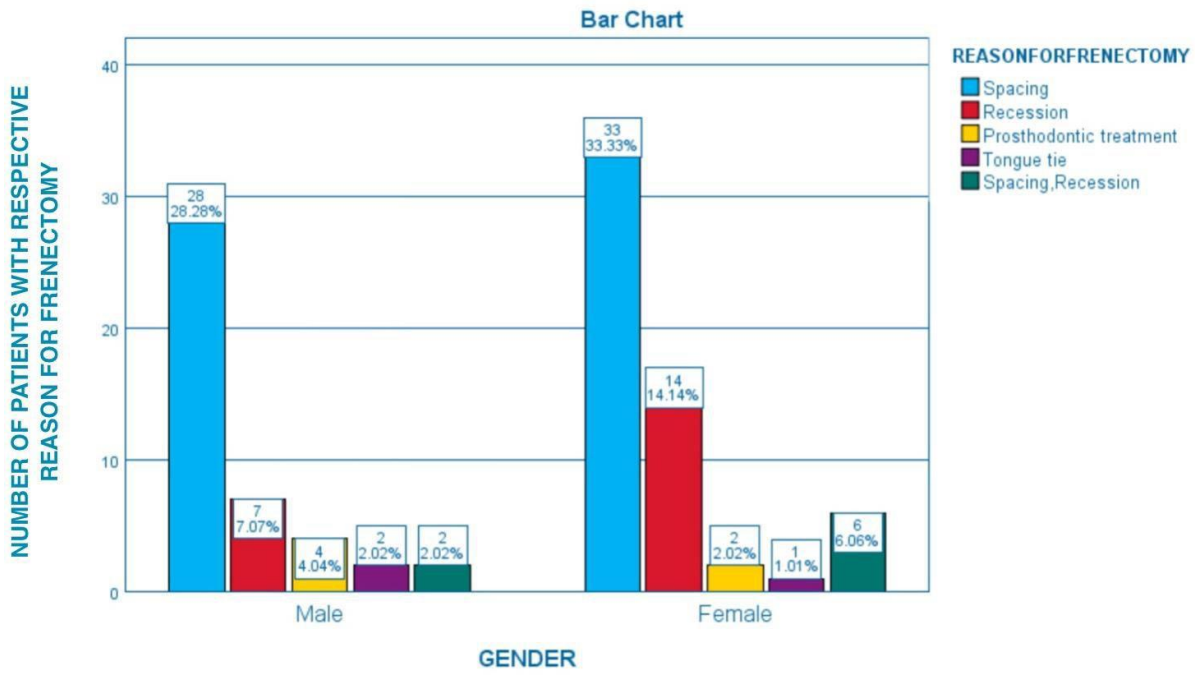

Figure 3: Bar graphs show gender wise comparison of various reasons for frenectomy: X Axis represents the gender and Y Axis represents count of patients with respective reasons for frenectomy. Spacing (blue), Recession (red), Prosthodontic treatment (yellow) , Tongue tie (purple) , Spacing & Recession (green). Chi square test was done and association was found to be statistically significant. Pearson's Chi Square value: 4.107, DF;4, p value: 0.392. In both genders spacing is the major reason behind frenectomy and more females show gingival recession as a reason for frenectomy. But the difference was not significant (p value as 0.392)