

INFLUENCE OF FIXED ORTHODONTIC TREATMENT DURATION ON THE PREVALENCE AND SEVERITY OF GINGIVAL ENLARGEMENT

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ABSTRACT

In patients undergoing fixed orthodontic therapy, favorable conditions for plaque stagnation as well as difficulty in performing usual oral hygiene measures have been associated with poorer periodontal health among orthodontic patients. So this study aims to assess the effect of the duration of fixed orthodontic treatment on presence of gingival enlargement in adolescents and young adults. This cross sectional descriptive study was conducted in the dental hospital of Nepal Medical College Teaching Hospital. Patients under fixed orthodontic therapy for at least 3 months were examined for the presence of gingival enlargement (GE). Demographic variables and the details of duration of the fixed orthodontic therapy was recorded along with presence of gingival enlargement and its grading. The oral hygiene habits like frequency of brushing, use of interdental cleaning aids were recorded along with plaque index. Gingival enlargement was present in 204 (63.7%) out of total 320 patients taken, among which 124 patients (38.8%) had gingival enlargement of score 1 and 80 (25.0%) patients had gingival enlargement of score 2. Gingival enlargement was observed in 101 (73.2%) in 20-30 years old patients which was more prevalent in this age group. Oral hygiene habits like frequency of brushing and use of interdental aids also seem to affect the occurrence of gingival enlargement in patients. Among those who were undergoing orthodontic therapy for more than 2 years, 48 (82.8%) had presence of gingival enlargement. Mean of plaque index was seen to be statistically associated with presence of gingival enlargement. Thus, this study showed that the duration of orthodontic treatment duration significantly influenced the occurrence of GE. Therefore, oral hygiene instructions and motivations should be reinforced for patients undergoing orthodontic treatment.

KEYWORDS

Fixed orthodontics, gingival enlargement, gingival hyperplasia, orthodontic appliances, Nepal

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INTRODUCTION

It is well-established that orthodontic appliances can impair plaque control leading to gingivitis.¹ Plaque retention is increased with fixed appliances and plaque composition may also be altered. There is an increase in anaerobic organisms and reduction in facultative anaerobes around bands, which are periopathogenic.²

There are few reasons for gingival enlargement in orthodontic patients like mechanical irritation by orthodontic bands which are more likely to be in contact with the gingival margin posteriorly, chemical irritation by the exposed cement at the gingival margin and greater likelihood of food impaction posteriorly between arch wire and soft tissue.³

Placement of bands supragingivally may allow easier cleaning and reduce the risk of possible damage to gingival health but, unfortunately, most supragingival margins of bands soon become subgingival because of the gingival enlargement. It is generally accepted that gingival health is compromised when orthodontic bands are worn. The extent of gingivitis around banded teeth compared with the rest of the mouth is often noticed during treatment and during debond. Since evidence exists that specific bacteria may be responsible for producing certain diseases, it seems reasonable to suggest that, as orthodontic bands evoke a gingival reaction, they may in some way influence the subgingival microfloral population, shifting it to a more disease-inducing population. This may be one explanation for the inflammation seen around bands in patients with excellent supragingival plaque control.⁴ Orthodontic bands may allow accumulation of plaque similar to that caused by overhanging subgingival restorations. There is a change in the resident subgingival flora to a population resembling that of chronic periodontitis with increase in gram-negative anaerobic bacteria, despite good supragingival plaque control.⁵ Therefore, the rationale of the present study was to evaluate the influence of fixed orthodontic treatment duration on the prevalence and severity of inflammatory gingival enlargement.

MATERIALS AND METHODS

This cross sectional descriptive study was conducted in the dental hospital of Nepal Medical College Teaching Hospital (NMCTH). Duration of the study was from May 2023 to July 2023. Patients or their legal guardians were informed about the study and authorized

their participation. Demographic variables and the details of duration of the fixed orthodontic therapy was recorded along with the presence of gingival enlargement and its grading. Ethical approval was obtained prior to the conduction of study from the Institutional Review Committee (IRC) of NMC (Ref. No: 62-079/080). Patients under fixed orthodontic therapy for at least 3 months were examined for the presence of gingival enlargement using Miranda and Brunet Index⁶ given in 2001 in which horizontal measurement of the enlargement is possible. This index is also called as nodullary papilla index. According to this:

Score 0 – papilla thickness <1mm

Score 1 – papilla thickness 1-2 mm

Score 2 – papilla thickness >2 mm

The oral hygiene habits like frequency of brushing, use of interdental cleaning aids were recorded. Plaque index was evaluated using Sillness and Loe plaque index.⁷

Inclusion criteria included patients using fixed orthodontic appliances for at least 3 months and who were 10 to 30 years of age. Exclusion criteria were patients in need of traction of impacted teeth, patients suffering from congenital abnormality, systemic illness, cysts, or with special needs or using systemic medication for the treatment of chronic diseases that might interfere with gingival overgrowth. Patients known to have systemic diseases like diabetes, leukemia, granulomatous diseases like wegeners and sarcoidosis were excluded. Smokers were also excluded.

Sample size was calculated using the Cochran statistical formula ($N = Z^2pq/d^2$), where the minimum sample size for the study was taken as 314 where $Z = 1.96$ at 95.0% confidence interval, p (the prevalence of gingival enlargement in orthodontic patients)⁸ was set at 48.0%, q was equal to $1 - p$, and d is minimum acceptable degree of error which is set at 5.0%. Statistical analysis was done using SPSS version 22. Means and standard deviation was calculated for the variables. The difference in proportions was calculated using Chi-square test. For all tests, values of $P < 0.05$ were considered to be statistically significant.

RESULTS

There were 142 (44.4%) males and 178 (55.6%) females in our study. Gingival enlargement was present in 204 (63.7%) out of total 320 patients taken (Fig. 1). In regard to the grades of gingival enlargement, 124 patients (38.8%) had

gingival enlargement of score 1 and 80 (25.0%) patients had gingival enlargement of score 2. (Table 1) Prevalence of gingival enlargement

Table 1: Grades of gingival hypertrophy in study population.		
Grades of hypertrophy	n	%
Score 0	116	36.3
Score 1	124	38.8
Score 2	80	25.0

Table 2: Prevalence of gingival enlargement in different age groups.		
Age group	Gingival enlargement (n)	%
10-15 years	20	39.2
15-20 years	102	64.6
20-30 years	81	73.6

P- <0.001

Table 3: Prevalence of gingival enlargement according to frequency of brushing		
Frequency of brushing	Presence of gingival enlargement (n)	%
Once a day	70	84.3
Twice a day	131	57.2
More than two times a day	3	37.5

P- <0.001

Table 4: Prevalence of gingival enlargement according to use of interdental cleaning aids		
Use of interdental cleaning aids	Presence of gingival enlargement (n)	%
No	71	88.8
Yes	133	55.4

P- <0.001

Table 5: Association of duration of treatment and gingival enlargement		
Duration of orthodontic therapy	Gingival enlargement present	%
<12 months	54	50.5
1-2 years	102	65.8
>2 years	48	82.8

P- <0.001

Table 6: Periodontal Variables			
Gingival enlargement	n	Plaque index mean	Std. deviation
Absent	116	.2331	.3151
Present	204	.8653	.7931

P- <0.001

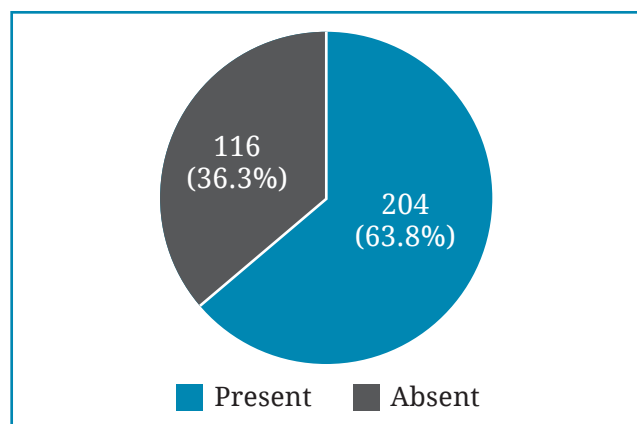


Fig. 1: Prevalence of gingival enlargement

was observed in 101 (73.2%) in 20-30 years old patients which was more prevalent in this age group as compared to other age groups (Table 2).

Oral hygiene habits like brushing and use of interdental aids also seem to affect the presence of gingival enlargement in patients. In this study, those who brushed once a day had gingival enlargement seen in 70 (84.3%) as compared to other groups. Only 3 (37.5%) of those who brushed more than three times a day had gingival enlargement. This was statistically significant ($p = <0.001$) (Table 3). Among those who used interdental cleaning aids, 71 (88.8%) did not have any gingival enlargement (Table 4). In regard to the duration of the orthodontic therapy, those who were undergoing orthodontic therapy for more than 2 years, 48 (82.8%) had presence of gingival enlargement (Table 5). When the mean of plaque index was compared, those without gingival enlargement had 0.2331 of mean gingival index as compared to gingival index of 0.8653 who were presented with gingival enlargement which was also found to be statistically significant (Table 6).

DISCUSSION

Gingival enlargement (GE) is excessive growth of the gums where the inflammatory tissue may be in a limited region, or it may be generalized. It is well-established that orthodontic appliances can impair plaque control leading to gingivitis.⁹ Fixed appliances make oral hygiene difficult even for the most motivated patients, and almost all patients experience some gingival inflammation. Resolution of inflammation usually occurs a few weeks after debond, bands cause more gingival inflammation than bonds, as bands are often seated subgingivally. Plaque retention is increased with fixed appliances and plaque composition may also be altered. There

is an increase in anaerobic organisms and a reduction in facultative anaerobes around bands, which are therefore periopathogenic.¹⁰

In our study gingival enlargement was seen in 204 (63.8%) of the total patients examined. This is in accordance to other studies which had prevalence of 74%,¹¹ 76%,¹² 67.7%¹³ gingival enlargement seen among those undergoing fixed orthodontic therapy. According to the Miranda and Brunet Index⁶ for the gingival enlargement, score of 1 was more prevalent in our study which indicated papillary thickness of 1-2mm. This was seen in 124 (38.8%) as compared to 80 (25.0%) of patients which had enlargement of score 2. In a study done by Soliz *et al*,¹⁴ similar findings were observed, as the most prevalent gingiva enlargement was Grade I.

In regard to the prevalence of gingival enlargement according to the different age groups, the highest of 101 (73.2%) was seen in 20-30 years old patients followed by 15-20 years who had prevalence of 89 (62.7%) least was seen in 10-15 years old in which only 14 (35.0%) had gingival enlargement. In a study done by Vincent-Bugnas *et al*¹⁵ gingival enlargement was more prevalent in 13-19 years (49.2%) followed by more than 20 years (43.5%) and least was seen in 9-13 year olds which only had prevalence of 7.3%.¹⁵

This could be attributed to the fact that as the age progress the duration of treatment increased and hence this could be an attributable factor for gingival enlargement. WHO identifies the period of adolescence as being between 10 and 19 years old.¹⁶ Orthodontists consider adolescence as a favorable period for treatment commencement due to the fact that by this age, permanent tooth eruption is complete even as craniofacial growth is still progressing. This offers advantages in terms of tooth movement and correction of malocclusion while maintaining favorable facial growth.¹⁷ However, these advantages can be outweighed by complications arising due to lack of patient cooperation and less compliance. Adolescents tend to have higher levels of supra-gingival plaque accumulations and higher rates of gingivitis and GE.¹⁸ In one study the highest frequency (48.0%) of GE was observed among the Group 1 age group.⁸ (10-19 years) Another study showed the increase in age showed a reduction in the prevalence of gingival enlargement from 68.5% in the group from 16 to 25 years to 46.1% in the group over 25 years.¹⁹

Good practice of oral hygiene was positively associated with the decreased occurrence of gingival enlargement as in a total of 83 patients who brushed their teeth once a day had gingival enlargement seen in 70 (84.3%) as compared to those who brushed twice a day. Patients who brushed twice a day were seen to be 229 in total and among them 131 (57.2%) had some degree of gingival enlargement.

Similarly, in regard to use of interproximal aids like interdental brush, 71 (88.8%) of those who did not use any interdental aids were seen to have gingiva enlargement as compared to 133 (55.4%) who used interproximal aids and still presented with gingival enlargement. A consolidated relationship with the patient could determine the treatment success, as stated by Huang *et al*²⁰ additional efforts by orthodontists and hygienists could effectively motivate orthodontic patients to improve their oral hygiene.²⁰

One study also showed that patients who practiced oral hygiene measures more than three times daily did not have any GE. On the other hand, those who brushed and flossed only once daily had the highest percentage of grade 2 GE.⁸ In regard to the duration of the orthodontic therapy, only 54 (50.5%) of those patients with treatment duration of less than 12 months were found to have some form of gingival enlargement as compared to 48 (82.8%) of those who were undergoing orthodontic treatment for more than 2 years. There were studies in literature which showed significant increase in gingival enlargement with respect to the treatment duration.¹¹⁻¹³ The average PI was higher in people with a treatment duration of more than 2 years. This difference might be attributed to patients decreased cooperation with increased treatment duration and elongated dental plaque exposure time.

In conclusion, this study showed an increasing occurrence of GE as the duration of orthodontic treatment increased. Oral hygiene instructions and motivational activities should target adolescents and young adults undergoing orthodontic treatment. Further longitudinal studies may elucidate the association between the use of fixed orthodontic appliances and GE.

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REFERENCES

1. Naranjo AA, Triviño ML, Jaramillo A, Betancourth M, Botero JE. Changes in the subgingival microbiota and periodontal parameters before and 3 months after bracket placement. *Am J Orthod Dentofacial Orthop* 2006; 130: 275.e17-275.e22.
2. Diamanti-Kipiotti A, Gusberti FA, Lang NP. Clinical microbiological effects of fixed orthodontic appliances. *J Clin Perio* 1987; 14: 326-33.
3. Kouraki E, Bissada NF, Palomo JM, Ficara AJ. Gingival enlargement and resolution during and after orthodontic treatment. *NY State Dent J* 2005; 71: 34-7.
4. de Oliveira Guaré R, Costa SC, Baeder F, de Souza Merli LA, Dos Santos MT. Drug-induced gingival enlargement: biofilm control and surgical therapy with Gallium-Aluminum-Arsenide (GaAlAs) Diode Laser—a 2-year follow-up. *Spec Care Dentist* 2010; 30: 46-52. DOI: <https://doi.org/10.1111/j.1754-4505.2009.00126.x>
5. Atack NE, Sandy JR, Addy M. Periodontal and microbiological changes associated with the placement of orthodontic appliances. A review. *J Periodontol* 1996; 67: 78-85.
6. Miranda J, Brunet L, Roset P, Farré M, Mendieta C. Reliability of two measurement indices for gingival enlargement. *J Periodontal Res* 2012; 47: 776-82.
7. Silness J, Loe H. Periodontal disease in pregnancy II. Correlation between oral hygiene and periodontal condition. *Acta Odontol Scand* 1964; 22: 121-35.
8. Eid HA, Assiri HA, Kandyala R, Togoo RA, Turakhia VS. Gingival enlargement in different age groups during fixed Orthodontic treatment. *J Int'l Oral Health* 2014; 6: 1-4.
9. Naranjo AA, Triviño ML, Jaramillo A, Betancourth M, Botero JE. Changes in the subgingival microbiota and periodontal parameters before and 3 months after bracket placement. *Am J Orthod Dentofacial Orthop* 2006; 130: 275.e17-275.e22.
10. Diamanti-Kipiotti A, Gusberti FA, Lang NP. Clinical microbiological effects of fixed orthodontic appliances. *J Clin Perio* 1987; 14: 326-33.
11. Zanatta FB, Ardenghi TM, Antoniazzi RP, Pinto TMP, Rösing CK. Association between gingivitis and anterior gingival enlargement in subjects undergoing fixed orthodontic treatment. *Dental Press J Orthod* 2014; 19: 59-66.
12. Alzahrani M, Joman M, Zahrani A. Prevalence of Gingival Hyperplasia in Orthodontic patients. *Pac J Med Sci* 2020; 14: 1514-16.
13. Gopaldasamy K, Ramamurthy J, Pradeep D. Prevalence of Gingivitis in Patients Undergoing Orthodontic Treatment of Ages 18-25 Years- A Retrospective Study. *Int'l J Dentistry Oral Sci* 2020; 7: 1231-35.
14. Soliz MA, Ortiz MJ, Carvajal AS. Prevalence of gingival enlargement in patients with fixed orthodontic apparatus: A cross-sectional observational study. *Na J Adv Res Rev* 2021; 9: 45-55.
15. Vincent-Bugnas S, Borsa L, Gruss A et al. Prioritization of predisposing factors of gingival hyperplasia during orthodontic treatment: the role of amount of biofilm. *BMC Oral Health* 2021; 21: 84. DOI: <https://doi.org/10.1186/s12903-021-01433-2>.
16. WHO. World Health Organization (WHO) approach to adolescents. Available from: URL: <http://www.un.org.in/jinit/who.pdf> 1998 (Accessed on: July 2023).
17. JE Albino, SD Lawrence, CE Lopes, LB Nash, LA Tedesco. Cooperation of adolescents in orthodontic treatment. *J Behav Med* 1991; 14: 53-70.
18. RL Boyd, PJ Leggott, RS Quinn, WS Eakle, D Chambers. Periodontal implications of orthodontic treatment in adults with reduced or normal periodontal tissues versus those of adolescents. *Am J Orthod Dentofacial Orthop* 1989; 96: 191-8.
19. Lucchese A, Bondemark L, Marcolina M, Manuelli M. Changes in oral microbiota due to orthodontic appliances: a systematic review. *J Oral Microbiol* 2018; 10: 1476645. DOI: 10.1080/20002297.2018.1476645.
20. Huang J, Yao Y, Jiang J, Li C. Effects of motivational methods on oral hygiene of orthodontic patients. *Medicine (Baltimore)*. 2018; 97: 1-8.
21. Hosadurga R, Nabeel Althaf MS, Hegde S, Rajesh KS, Arun Kumar MS. Influence of sex hormone levels on gingival enlargement in adolescent patients undergoing fixed orthodontic therapy: A pilot study. *Contemp Clin Dent* 2016; 7: 506-11.
22. Zanatta FB, Ardenghi TM, Antoniazzi RP, Pinto TMP, Rosing CK. Association between gingival bleeding and gingival enlargement and oral health-related quality of life (OHRQoL) of subjects under fixed orthodontic treatment: a cross-sectional study. *BMC Oral Health* 2012; 12: 53. DOI: <https://doi.org/10.1186/1472-6831-12-53>.
23. Almansob YA, Alhammadi MS, Luo XJ et al. Comprehensive evaluation of factors that induce gingival enlargement during orthodontic treatment: A cross-sectional comparative study. *Niger J Clin Pract* 2021; 24: 1649-55.
24. Pinto AS, Alves LS, Zenkner JEDA, Zanatta FB, Maltz M. Gingival enlargement in orthodontic patients: Effect of treatment duration. *Am J Orthod Dentofacial Orthop* 2017; 152: 477- 82.
25. Karacaoglu F, Gazioglu C, Akkaya S et al. Are the effects of fixed orthodontic treatment on gingival health similar in adolescents and young adults? *J Biomedical Sci* 2016; 6: 1-6.