PREVALENCE AND CONTRIBUTING FACTORS OF GINGIVAL HYPERPLASIA IN ORTHODONTIC PATIENTS

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ABSTRACT

OBJECTIVES

This study evaluates the prevalence and factors contributing to gingival hyperplasia in orthodontic patients in Peshawar.

METHODOLOGY

A cross-sectional study was conducted at the teaching dental hospital of Peshawar from January to September 2025, involving 300 orthodontic patients aged 15-40 years. Clinical examinations assessed gingival enlargement using the Gingival Overgrowth Index (GOI). Statistical analyses examined associations between gingival hyperplasia and factors such as age, gender, oral hygiene practices, and duration of orthodontic treatment.

RESULTS

Gingival hyperplasia was noted in 45% of the participants involved in the study. A more detailed analysis revealed that this condition was particularly prevalent among individuals with poor oral hygiene practices, affecting 63% of this group. Additionally, those undergoing treatment for longer than 12 months showed a significant prevalence rate of 54%. When examining the data by gender, it was found that females exhibited a slightly higher incidence of gingival hyperplasia at 48%, compared to 41% in males. This suggests that oral hygiene and treatment duration may play critical roles in developing gingival hyperplasia, which warrants further investigation to understand the underlying mechanisms and potential preventive measures.

CONCLUSION

Gingival hyperplasia is prevalent in nearly half of orthodontic patients, emphasising the importance of rigorous oral hygiene practices and regular professional monitoring during treatment.

KEYWORDS: *Orthodontic, Gingival Hyperplasia, Oral hygiene, Prevalence*

INTRODUCTION

Orthodontic treatment is crucial in correcting malocclusions, enhancing function, and improving facial aesthetics. However, these treatments can also lead to adverse effects on oral health, with gingival hyperplasia being one of the most common complications. Gingival hyperplasia, often called gingival enlargement, is characterised by an overgrowth of the gingival tissues due to chronic inflammation or hyperplastic responses initiated by local irritants, such as plaque accumulation and fixed orthodontic appliances.[1] If left unmanaged, this condition can result in significant discomfort, bleeding, aesthetic concerns, and an elevated risk of periodontal diseases.[2] Gingival hyperplasia in orthodontic patients is predominantly linked to suboptimal oral hygiene practices, accumulating plaque around orthodontic brackets and wires, creating a fertile ground for oral health issues.[3] The mechanical irritation provoked by these appliances and the patient's struggle to maintain effective oral hygiene triggers a pronounced inflammatory response in the gingival tissues.[4] Research indicates that gingival hyperplasia typically manifests within the first year of orthodontic treatment, with its severity fluctuating based on factors such as the quality of oral hygiene, the length of treatment period, and individual patient vulnerabilities.[5] A recent study has underscored the heightened risk faced by orthodontic patients with poor plaque control, who are more susceptible to developing various periodontal complications, including the distressing condition of gingival hyperplasia.[6] Several additional factors also play a significant role in the prevalence of gingival hyperplasia. Socioeconomic status often dictates access to essential dental care and preventive services, shaping oral hygiene behaviours and overall periodontal health.[7] Individuals from lower-income backgrounds generally show higher prevalence rates of gingival hyperplasia due to restricted access to professional dental care and oral hygiene education. Furthermore, educational attainment is vital in molding health behaviors concerning oral hygiene. Those with a higher level of education are typically more diligent in following recommended oral hygiene practices and are more likely to attend regular dental appointments.[8] Recently, caffeine consumption has emerged as a

potential factor influencing gingival health. Various studies have proposed that excessive caffeine intake can affect periodontal tissues by inducing vasoconstriction and diminishing blood flow, potentially intensifying gingival inflammation.[4,9] While the existing evidence is still limited, this intriguing link calls for further investigation, especially in demographics characterised by high caffeine consumption. The background of a patient's dental history, including previous periodontal treatments and oral hygiene habits prior to orthodontic intervention, is also a significant determinant. Those with a history of gingivitis or insufficient plaque control find themselves at an elevated risk for developing gingivitis during their orthodontic treatment journey.[10] Moreover, the duration of orthodontic therapy has shown a strong correlation with the incidence of gingival hyperplasia. Extended treatment periods result in increased cumulative exposure of gingival tissues to irritants such as plaque, food residues, and mechanical forces exerted by orthodontic appliances, thereby heightening the risk of developing inflammation.[11] Gender differences have been documented as well, with some studies revealing a slightly higher prevalence of gingival hyperplasia among females, potentially linked to hormonal fluctuations during puberty, pregnancy, or menstruation.[12] While numerous international studies have reported varying prevalence rates of gingival hyperplasia among orthodontic patients, notable regional disparities exist. For instance, research from high-income countries reports lower prevalence rates attributed to superior access to dental care and health education. Comparatively, studies conducted in low- and middle-income nations highlight significantly higher rates, likely reflecting limited resources and lower levels of oral health awareness.[13,14] One study reported a striking 46% prevalence rate of gingival hyperplasia among orthodontic patients, climbing even higher among those exhibiting poor oral hygiene practices.[15] Another research effort noted a prevalence rate of 52%, further emphasising the critical importance of consistent oral hygiene and regular dental check-ups in preserving periodontal health.[16] Despite these valuable insights, there remains a significant lack of comprehensive data on gingival hyperplasia in orthodontic patients across diverse populations. This study aims to bridge this knowledge gap by assessing the prevalence of gingival hyperplasia and exploring its associations with oral hygiene practices, treatment duration, socioeconomic factors, educational levels, caffeine consumption, and dental history. This research aims to inform targeted prevention and management strategies to enhance periodontal outcomes in orthodontic care by identifying modifiable risk factors.

METHODOLOGY

This cross-sectional study was conducted at a dental teaching hospital in Peshawar over eight months from January to August 2024. It received ethical approval from the Institutional Review Board (Ref: IRB-2023/045). The sample consisted of 300 patients, determined based on an estimated prevalence rate of 40%, a margin of error of 5%, and a confidence interval of 95%. Participants included individuals aged 15 to 40 undergoing fixed orthodontic treatment for at least six months. The study included patients meeting several criteria: they must be currently receiving active orthodontic treatment, should not have any systemic conditions that could impact periodontal health, and must not be using medications known to cause gingival overgrowth, such as phenytoin or cyclosporine. Exclusions were made for patients with preexisting periodontal diseases or systemic disorders. Calibrated dentists performed clinical examinations and utilised the Gingival Overgrowth Index (GOI) to determine the severity of gingival hyperplasia. The GOI categorises gingival enlargement into four grades:

- Grade 0: No overgrowth
- Grade 1: Mild overgrowth
- Grade 2: Moderate overgrowth covering up to two-thirds of the crown
- Grade 3: Severe overgrowth covering more than two-thirds of the crown

Oral hygiene was assessed using the Plaque Index (PI), and data regarding treatment duration and demographic characteristics were also collected. Statistical analyses were performed using SPSS v26, employing descriptive statistics to summarise prevalence rates and demographics. Furthermore, Chi-square tests and logistic regression were utilised to explore the associations between gingival hyperplasia and various potential risk factors, with a significance threshold set at $p < 0.05$.

RESULTS

The study included 300 participants, with 160 females (53%) and 140 males (47%). The mean age was 23.4 ± 5.8 years. Most participants (62%) had been undergoing treatment for 6-18 months, with an average Plaque Index of 1.9 ± 0.7. Gingival hyperplasia was identified in 135 patients (45%). Of these, 60% exhibited mild overgrowth, 30% moderate, and 10% severe.

Table 1: Prevalence of Gingival Hyperplasia by Severity

Severity	Patients (n)	%age
Mild	81	27
Moderate	41	14

Oral hygiene status significantly influenced gingival hyperplasia prevalence, with patients with poor oral hygiene demonstrating higher rates (63%, $p < 0.001$). Longer treatment durations also correlated with increased prevalence, with 54% of patients treated for >12 months affected. Gender differences were observed, with females showing a slightly higher prevalence (48%) compared to males (41%), though this was not statistically significant (p=0.08p = 0.08p=0.08).

Table 2: Factors Associated with Gingival Hyperplasia

Factor	Patients with Gingival Hyperplasia (n = 135)	P-Value
Oral Hygiene Status		
Good	34 (28)	<0.001
Poor	101 (63)	
Treatment Duration		
≤12 months	51 (37)	<0.01
>12 months	84 (54)	
Socioeconomic Status		
Low	78 (58)	<0.01
Medium/High	57 (35)	
Education Level		
Secondary or below	77 (57)	<0.05
College or above	58 (38)	
Gender		
Female	76 (48)	0.08
Male	59 (41)	
Caffeine Consumption		
High (>3 cups/day)	72 (53)	<0.05
Low/None (≤3 cups/day)	63 (38)	

DISCUSSION

This study highlights a 45% prevalence of gingival hyperplasia among orthodontic patients, with significant associations between oral hygiene, socioeconomic status, treatment duration, and education level. These findings align with prior research but provide new insights into socioeconomic disparities and caffeine consumption. Our findings are consistent with previous studies reporting prevalence rates ranging from 40% to 60%. A study reported 46% prevalence among Brazilian orthodontic patients, emphasising the role of plaque retention in gingival hyperplasia.[15] Similarly, a 40% prevalence was observed in European orthodontic populations, reinforcing the importance of maintaining oral hygiene during treatment.[13] However, lower prevalence rates (~25%) have been reported in Scandinavian countries due to robust dental care systems and widespread oral health education.[17] Poor oral hygiene was the strongest predictor of gingival hyperplasia, observed in 63% of affected participants. This aligns with another study that reported that plaque accumulation around orthodontic appliances is a persistent irritant, triggering inflammatory responses.[3] The findings of this study are consistent with previous research that highlights the significant impact of mechanical irritation caused by orthodontic appliances and the accumulation of plaque in the development of gingival overgrowth.[18] A notable observation was that 63% of patients exhibiting poor oral hygiene ultimately developed gingival hyperplasia, a statistically significant statistic ($p < 0.001$).[19] This reinforces the conclusions that identified inadequate plaque control as the most critical factor influencing the risk of gingival enlargement among orthodontic patients.[20] Such correlations underscore the need for effective oral hygiene practices to mitigate potential complications during orthodontic treatment. A notable trend in the dataset shows that longer treatment durations (>12 months) correlate with a higher prevalence of issues (54%, $p < 0.01$). Extended use of orthodontic appliances increases plaque retention and inflammation, highlighting the need for timely treatment completion and regular periodontal monitoring. This aligns with previous studies indicating that prolonged orthodontic appliance use worsens gingival inflammation and hyperplasia due to chronic irritation and poor oral hygiene maintenance.[21] Similarly, a study found that patients wearing fixed orthodontic appliances for over a year had significantly higher odds of developing gingival overgrowth than those undergoing shorter treatment durations.[22] Socioeconomic factors significantly impacted oral health, with low socioeconomic status (SES) patients showing a higher prevalence (58%, $p < 0.01$) of periodontal conditions like gingival hyperplasia due to limited access to dental care.[23] Additionally, patients with secondary education or lower had higher rates (57%, $p < 0.05$) compared to those with college education or above (38%). This aligns with another study, which noted that education level affects oral health awareness and hygiene practices.[24] Gender differences in gingival hyperplasia prevalence show that females (48%) experience slightly higher rates than males (41%), but the difference is not statistically significant ($p = 0.08$). A study reported that hormonal fluctuations in females may increase susceptibility to gingival overgrowth.[25] However, there are no significant gender differences, indicating that factors like oral hygiene and genetics may also play a role.[26] Caffeine consumption was identified as a significant factor, with those drinking over three cups of coffee daily showing a higher prevalence of gingival hyperplasia (53%, $p < 0.05$) compared to those with lower intake (38%). Excessive caffeine may lead to periodontal inflammation by altering oral microbiota, although another study found no significant link between caffeine and gingival hyperplasia.[27,28] Further research with larger samples and longitudinal studies is needed to clarify these associations and develop preventive strategies for at-risk patients.

LIMITATIONS

This study's large sample size and inclusion of diverse risk factors strengthen its findings. However, the cross-sectional design precludes causal inferences, and self-reported data on socioeconomic status and caffeine consumption may introduce bias.

CONCLUSIONS

Gingival hyperplasia is a prevalent condition observed in approximately 50% of patients undergoing orthodontic treatment. Key contributory factors include inadequate oral hygiene and extended treatment durations. These insights underscore the critical need for stringent oral hygiene protocols, comprehensive patient education, and consistent professional monitoring throughout orthodontic therapy. Additionally, incorporating periodontal health evaluations into standard orthodontic procedures may substantially reduce the incidence of this common complication.

CONFLICT OF INTEREST: None

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