International Journal of Dentistry and Oral Science (IJDOS)
ISSN: 2377-8075

Relationship Between Arch Form And Periodontal Diseases – A Retrospective Study

Research Article

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Abstract

Objectives: This study was done to assess the relationship between arch forms and periodontal diseases.
Materials and Methods: A retrospective study was conducted in a dental hospital with a sample size of 3022 subjects of age from 6-84 years old. The data variables including socio-demographic, type of arch forms and periodontal disease present were retrieved from our record. Results were analyzed using SPSS Statistical software Version 20.
Results: Overall, there were 50.3% of U shaped, 32.5% of square-shaped and 17.2% of V-shaped arch. The V-shaped arch form was predisposed to periodontal disease followed by U shaped arch and square-shaped arch ($p<0.05$) which was statistically significant. In association with gender, there was a statistically significant difference between gender and periodontal diseases where males were more prevalent compared to females ($p<0.05$). There was found to be no statistically significant difference between dental arch forms with gender in which V-shaped and U-shaped were more common in females and square-shaped was more common in males ($p>0.05$).
Conclusion: Within the limitations of the study, it can be concluded that the V-shaped arch and males were prone to periodontal diseases. The study on the relationship of arch form and periodontal diseases helps in proper diagnosis and treatment planning among orthodontists and periodontists.

Keywords: Arch Dimension; Arch Form; Crowding; Malalignment; Periodontal Disease.

Introduction

Dental arch dimensions including dental arch width, arch length and arch form play an important role in diagnosis, treatment planning and outcomes in orthodontic treatments [1]. There are several factors that may be affected by dental arch forms such as available space, smile aesthetics and potentially long term occlusal stability [2, 3]. During orthodontic treatment, maintaining the pre-treatment dental arch form may help to reduce crowding relapse and periodontal damage [4]. Dental arch forms may be varied based on ethnic groups and populations [5]. Several researchers had been trying to classify the dental arch forms. One of them was Chuck in 1934 had classified dental arch form in three forms, namely ovoid, tapered and squared shaped [6].

Dental arch continuity and integrity are a result of harmony between tooth size and arch dimensions [7]. The presence of any discrepancies between these elements may predispose to dental crowding or spacing [8]. Dental irregularity and crowding may lead to periodontal diseases which are greater in the anterior teeth region [8]. Several studies reported that there was a correlation between arch dimensions and crowding [1, 10] and there was a correlation between malposition of teeth with periodontal diseases [11, 12].

Periodontitis is an advanced form of periodontal disease which causes destruction to the soft and hard tissue component of the tooth-supporting structures leading to tooth mobility [13-19]. Ag-

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Received: February 25, 2021
Accepted: March 04, 2021
Published: March 08, 2021

Citation: Nor Syakirah binti Shahroom, Sheeja S. Varghese, Iffat Nasim. Relationship Between Arch Form And Periodontal Diseases – A Retrospective Study. *Int J Dentistry Oral Sci.* 2021;08(03):1906-1910. **doi:** http://dx.doi.org/10.19070/2377-8075-21000378

gressive periodontitis commonly affected younger age individuals [20]. Moreover, any type of tooth malposition such as crowding, rotated teeth, incisor proclination and mandibular molar tipping may result in early tooth loss due to the formation of periodontal pockets on the mesial surface of the tooth involved [21]. This condition should be treated by aligning the teeth which help to redirect the occlusal force and reduce the effect of occlusal trauma on periodontium [21]. Besides that, plaque accumulation due to difficulty in oral hygiene maintenance is one of the causative factors of periodontal diseases. Due to tooth malposition such as crowding, individuals may have difficult access to clean the interdental areas which leads to plaque accumulation and calculus formation. This will initially cause gingival inflammation or worsen it may trigger the adaptive immune mechanism causing the release of inflammatory mediators and cytokines causing destruction of the periodontal tissues [22-26].

Materials and Methods

A retrospective study was conducted involving patients visiting the dental hospital from June 2019 till February 2020. Ethical approval was granted by the Institutional Ethics Committee of Saveetha Dental College with an ethical approval number SDC/SIHEC/2020/DIASDATA/0619-0320.

All available case sheets were reviewed and analyzed. A total of 3022 patients were selected in the study using consecutive sampling methods. Those who satisfy the inclusion and exclusion criteria were included. The inclusion criteria were patients with the arch form written in the orthodontic diagnosis section and a complete periodontal chart and the periodontal diagnosis were made approved by the respective specialists. The exclusion criteria were completely edentulous patients, incomplete diagnosis and patients with cleft lip or palate. All the data was included and cross-verified using photographs to minimize bias. The data were verified by the second reviewer.

Sociodemographic data (age and gender), type or arch form and presence of periodontal diseases were retrieved from our record. The type of arch form was observed and classified into: i) U-shaped, ii) V-shaped and iii) square shaped. The periodontal status of the patients was evaluated and diagnosed based on The American Academy of Periodontology Classification 1999. The periodontal diagnosis was divided into five: i) clinically healthy gingiva - 0-3mm probing depth and no bleeding on probing ii) localised chronic gingivitis - 0-3mm probing depth and bleeding on probing with less than 30% of sites are involved iii) generalised chronic gingivitis - 0-3mm probing depth and bleeding on probing with more than 30% of sites are involved iv) localised chronic periodontitis - >3mm probing depth with loss of attachment, mobility or furcation involvement less than 30% of sites are involved v) generalised chronic periodontitis - >3mm probing depth with loss of attachment, mobility or furcation involvement more than 30% of sites are involved.

Data were analyzed using IBM SPSS version 20 (IBM Corporation, New York USA). To analyze the association between gender and arch form, gender was the independent variable and arch form was the dependent variable. To analyze the association between gender and arch form with periodontal diseases, gender and arch form were the independent variables and periodontal diseases were the dependent variables. A Chi-square test was used to establish the association of the categorical variables.

Results

A total of 3022 patients with 1717 (57%) males and 1305 (43%) of females aged 6-84 years old were involved in this study. In the present study, we observed that there was a statistically significant association between arch form and periodontal status ($p<0.05$) as shown in Table 1. Periodontal disease was prevalent in patients with a narrow or V-shaped arch as shown in Figure 1. 115 (22.1%) of patients with V-shaped arch were diagnosed with generalised chronic periodontitis followed by U shaped arch with 245 (16.1%) and square-shaped arch with 150 (15.3%). Meanwhile, localised chronic periodontitis was commonly seen in patients with a square-shaped arch 154 (15.7%), V-shaped arch 200 (14.8%) and U shaped 77 (13.2%). Generalised chronic gingivitis and clinically healthy gingiva were higher among patients with U shaped arch with 866 (57%) and 117 (7.7%) respectively. Localised chronic gingivitis was higher among square-shaped arch 124 (12.6%) followed by V-shaped arch 31 (6%) and U shaped arch 91 (6%).

According to gender, periodontal diseases were prevalent in males compared to females and found to be statistically significant ($p<0.05$) as shown in Table 2. In this present study, males were prone to develop generalised chronic periodontitis with 336 (19.6%) compared to females 174 (13.3%) as shown in Figure 2. Meanwhile, females were commonly diagnosed with clinically healthy gingiva 105 (8%), generalised chronic gingivitis 719 (55.1%), localised chronic periodontitis 190 (14.6%) and localised chronic gingivitis 117 (9.0%) compared to males.

In this present study, females were more common with V-shaped 238 (18.2%) followed by U shaped 661 (50.7%) compared to males with 282 (16.4%) and 858 (50%) respectively as shown in Figure 3. In males, the square shape was more common with 577 (33.6%) compared to females with 406 (31.1%). There was no statistically significant association between gender and arch form ($p>0.05$) as shown in Table 3.

Discussion

The overall objective of the present study was to evaluate the possible relationship between different types of arch forms and periodontal diseases. No previous study has associated arch forms with periodontal diseases.

The present study found that there was a statistically significant association between arch form and periodontal diseases ($p<0.05$). Patients with narrow or V-shaped arch form were predisposed to periodontitis. There was no previous study related to the arch form with periodontal diseases. However, a previous study reported that there was an association between arch dimension including arch width and crowding [27-29]. Mimoza Selmani et al reported that narrow arch forms are predisposed to crowding which results in difficulty in oral hygiene maintenance [30]. Thus, tooth malposition and malocclusion can be considered as a local predisposing factor of periodontal diseases that can initiate the accumulation of plaque. Crowding of the teeth causes difficult accessibility to tooth brushing and laborious cleaning of teeth is very much needed [31]. Plaque and calculus formation due to im-

Figure 1. Image representing the association of arch form with periodontal status. X-axis represents the arch form and Y-axis represents the percentage of patients with respective periodontal status. The blue color for clinically healthy gingiva, green for localised chronic gingivitis, beige for generalised chronic gingivitis, purple for generalised chronic gingivitis with localised chronic periodontitis and yellow for generalised chronic periodontitis. The V-shaped arch forms are having a higher prevalence of generalised chronic periodontitis. (Chi-Square test, p<0.05).

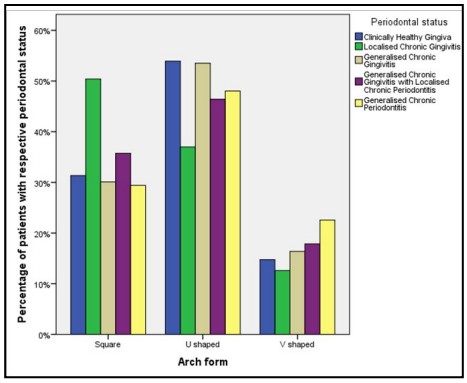


Figure 2. Image representing the association of gender with periodontal status. X-axis represents gender and Y-axis represents the number of people with respective periodontal status. The blue color for clinically healthy gingiva, green for localised chronic gingivitis, beige for generalised chronic gingivitis, purple for generalised chronic gingivitis with localised chronic periodontitis and yellow for generalised chronic periodontitis. There is a significant increase in generalised chronic periodontitis in males compared to females. (Chi-Square test, p<0.05).

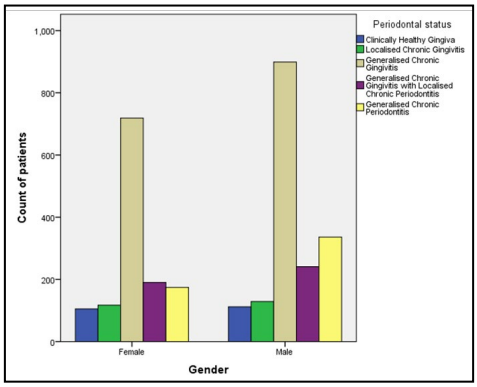
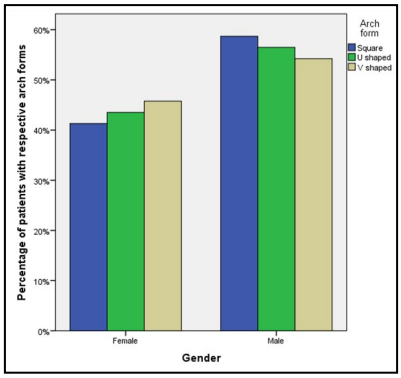


Figure 3. Image representing the association of gender with arch form. X-axis represents gender and Y-axis represents the percentage of patients with respective arch forms. The blue bar represents square arch, green bar represents U- shaped arch and light brown represents V-shaped arch. V-shaped arch form is common in females and a square-shaped arch form is common in males. But the difference was not significant (Chi-Square test, p>0.05).



proper oral hygiene will cause initiation of gingival inflammation which may worsen and cause periodontal tissue destruction [22, 23]. Moreover, the present study also found that patients with clinically healthy gingiva and gingivitis were higher among patients with U shaped arch. This may be the fact that it was easy to maintain good oral hygiene with proper brushing techniques due to easy accessibility within interdental spaces.

In the present study, there was a statistically significant difference between gender and periodontal diseases (p<0.05). Periodontal diseases were common among males compared to females. Previous studies reported that males had a high risk of developing periodontitis [32, 35]. Eke et al., reported that recent evidence on periodontal risk assessment has revealed that gender plays a critical role in periodontal risk in which men are at higher risk for severe periodontitis compared to women [36]. Furthermore, smoking and diabetes also play a role in the disease process [36]. Studies also revealed that oral hygiene behaviors in males were poor compared to females [37-39]. This can be seen in the present study where females were prevalent in clinically healthy gingiva and gingivitis due to good oral hygiene maintenance. However, Merchant et al., reported that there was no association between oral hygiene practices and periodontitis in males [40].

The predominant arch form for females in the present study was V-shaped arch form (18.2%) and U shaped (50.7%). Previous studies reported that the square arch form was predominant in females followed by ovoid or U shaped arch form and tapering or V-shaped arch form [41, 42]. Meanwhile, Owais AI et al., reported that a square arch form was more common in females followed by

Table 1. Shows the descriptive statistic of periodontal status based on arch forms. V-shaped arch form is showing a higher number of periodontitis patients than the other arch forms.

Type of Arch forms	Periodontal status					Chi-Square test		
	Clinically healthy gingiva	Localised chronic gingivitis	Generalised chronic gingivitis	Generalised chronic gingivitis gingivitis with localised chronic periodontitis	Generalised chronic periodontitis	Chi-square value	df	p-value
Square	68 (6.9%)	124 (12.6%)	487 (49.5%)	154 (15.7%)	150 (15.3%)			
U shaped	117 (7.7%)	91 (6%)	866 (57%)	200 (13.2%)	245 (16.1%)	57.489	8	0
V shaped	32 (6.2%)	91 (6%)	265 (51%)	77 (14.8%)	115 (22.1%)			

Table 2. Shows the descriptive statistic of periodontal status based on gender. Males are having significantly higher prevalence of periodontitis than females.

Gender	Periodontal status					Chi-Square test		
	Clinically healthy gingiva	Localised chronic gingivitis	Generalised chronic gingivitis	Generalised chronic gingivitis with localised chronic periodontitis	Generalised chronic periodontitis	Chi-square value	df	p-value
Female	105 (8%)	117 (9%)	719 (55.1%)	190 (14.5%)	174 (13.3%)			
Male	112 (6.5%)	129 (7.5%)	899 (52.4%)	241 (14%)	336 (19.6%)	22.58	4	0

Table 3. Shows the descriptive statistics of arch forms based on gender. U shape arch was slightly more prevalent in males and V shape was slightly more in females. But the difference was not statistically significant.

Gender	Arch forms			Chi-Square test		
	Square	U shaped	V-shaped	Chi-square value	df	p-value
Female	406 (31.1%)	661 (50.7%)	238 (18.2%)	2.903	2	0.234
Male	577 (33.6%)	858 (50%)	282 (16.4%)			

V-shaped arch form and U shaped arch form [43]. Another study reported that the V-shaped arch form was more predominant in females which were similar to the present study [44].

The predominant arch form for males in the present study was square arch form with 33.6%. Similarly, a previous study reported that predominant arch form for males was square arch form 35.33%, followed by ovoid 34.67% and tapering 30% in which the value was greater than the present study [42]. Other studies reported contrary results with the present study in which the ovoid arch was predominant in males followed by tapering and square arch forms [41, 44, 45]. However, the present study revealed that there was no statistically significant association between gender and arch form which was contrary to the study done by Mohammad A et al., [41].

The study on the relationship between arch form and periodontal diseases revealed that a V-shaped/narrow/tapering arch form may lead to periodontitis due to tooth and arch form discrepancies which cause tooth malposition or crowding. Thus, the need for periodontics treatment to improve the periodontal health status should be done first followed by orthodontic treatment to maintain proper alignment of teeth for normal occlusion. There are various periodontal therapies aimed to eliminate the diseases and maintenance of periodontium [46-50].

Firstly, the limitation of this study was the presence of observer bias. Secondly, the etiological factors such as smoking habits, systemic diseases, genetics, medications and nutrition intake were not included in the study which can influence periodontal disease. However, due to the large sample size, the limitations did not affect the results much. Further study can be done to associate the relationship of arch forms with periodontal diseases along with other etiological factors and the association between orthodontics and periodontics in the treatment planning of periodontal diseases.

Conclusion

Within the limitations of this study, it can be concluded that there was a statistically significant association between arch form and periodontal disease. Periodontitis was prevalent in patients with a V-shaped arch form and clinically healthy gingiva and gingivitis were prevalent in patients with U-shaped arch form. Besides, periodontal diseases were prevalent in males compared to females. The study on the relationship of arch form and periodontal diseases helps in proper diagnosis and treatment planning among orthodontists and periodontists.

Acknowledgement

We thank Saveetha Dental College and Hospitals, Saveetha Institute of Medical and Technical Sciences, Saveetha University, Chennai for the research support.

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