MANDIBULAR ARCH FORMS IN CLASS II DIVISION 1 MALOCCLUSION

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ABSTRACT

The dental arch form is defined as the shape formed by the configuration of the bony ridge of the jaw. Arch form dimension and variations have been studied by several authors. Consideration of the arch form is of utmost importance, because it is crucial that the arch form should be examined before starting upon the treatment as this gives valuable information about the position into which teeth can be moved if they are to be stable following treatment. Different methods have been developed to describe the dental arch morphology ranging from simple classification of arch shape through combinations of linear dimensions to complex mathematical equations.This study is a cross sectional retrospective study which has been undertaken in a university setting. Case records of 300 class II division 1 malocclusion patients in the age group of 12- 40years were included for the study and an analysis was done on different dental arch forms prevalent in class II division 1 malocclusion. Descriptive statistical analysis was performed for association of arch form with gender, age group of the included records in SPSS software by IBM. Chi-square test was performed,frequency distribution was performed. No significant statistical association between gender and arch form , age group and arch form in class II div 1 malocclusion was seen.

KEYWORDS: Arch form;Dental arch;Esthetics;Ethnicity;malocclusion;population

INTRODUCTION

"Dental arch form is the arch,formed by the buccal and facial surfaces of the teeth when viewed from their occlusal surfaces"-Indian Dental Academy.Dental arch dimensions, including dental arch width, length, and form, are important for the diagnosis, treatment, planning, and treatment outcomes of patients who are seeking orthodontic treatment in all age groups.('Thesis AbstractLongitudinal dental arch changes in adultsGary A. Carter, DDS, MS', 1997) Different ethnic groups and populations display variable dental arch measurements and characteristics.(Camporesi *et al.*, 2009; Mintenko *et al.*, 2020)(Viswanath *et al.*, 2015)(Felicita, 2017b)(Dinesh *et al.*, 2013) It is well-known that dental arch dimensions continue changing throughout growth and development, but during adulthood, the changes decrease('Thesis AbstractLongitudinal dental arch changes in adultsGary A. Carter, DDS, MS', 1997)(Kamisetty *et al.*, 2015). This explains why many researchers were interested in investigating the changes in dental arch dimensions during each stage of growth and development.('Thesis AbstractLongitudinal dental arch changes in adultsGary A. Carter, DDS, MS', 1997)(Camporesi *et al.*, 2009; Jain, Kumar and Manjula, 2014)(Mintenko *et al.*, 2020)(Bishara *et al.*, 1997)('Changes in crowding and spacing of the teeth with age', 1970)(Snyder, 1959)(Sillman, 1964)(Samantha, 2017) It is well documented in the literature that using preformed arch wires for orthodontic patients, regardless of their arch form, will lead to post-treatment instabilities in the form of relapse, so it is pertinent to analyse the pretreatment arch form and use customized arch forms.

Several researchers have classified the dental arch forms(Samantha, 2017) .It is accepted that the dental arch is shaped and confined by the supporting bone configurations, and it is affected by the eruption of teeth and the surrounding muscular forces.(Snyder, 1959) Chuck,(Ackerman, Ackerman and Kean, 2007) in 1934, made the first classification for the dental arch in 3 forms, namely: ovoid, tapered, and square shape. Several arch forms were documented in the literature. The most popular were the Ricketts penta morphic arch forms, which considered factors such as arch correlation, size, and length .He classified them into 5 forms to fit most facial forms and patients. Growth and development of the dental arches differ between males and females.(Bishara *et al.*, 1997) The 6 keys of occlusion by Andrew(Andrews, 1972) describe the feature of normal occlusion; any significant deviation from the normal occlusion will cause malocclusion. (Dinesh *et al.*, 2013) .Much research has been carried out to document dental arch dimensions, arch forms, and tooth size discrepancy in several populations (Felicita, 2017b). Archforms play an important role in orthodontic diagnosis and treatment plan (Samantha, 2017). Limitations for tooth movement, especially for incisor retractions, arise from the basal bone where teeth are rooted(Kamisetty *et al.*, 2015) (Jain, Kumar and Manjula, 2014; Krishnan, Pandian and Kumar S, 2015). If teeth move excessively over alveolar bone, periodontal complications and unstable treatment effects, even the tooth exfoliation may occur (Felicita, Chandrasekar and Shanthasundari, 2012; Rubika, Sumathi Felicita and Sivambiga, 2015).

The maxillary and mandibular dental arches are the key components of dental orofacial complex.(Felicita, Chandrasekar and Shanthasundari, 2012) Therefore, the alignment of the dental arches is very important for various functions like chewing, talking and respiration. Because this is so important throughout life, any dis-alignment in the upper or lower dental arch relationships, which is otherwise known as malocclusion, are of great importance both biologically and clinically. A large body of literature on class II malocclusion, serves as a guide for study and understanding the wide range of variation seen within the dental arches (Felicita, Chandrasekar and Shanthasundari, 2012)(Samantha, 2017; Felicita, 2018). Class II malocclusion is characterized by increased anteroposterior overlap of upper incisors and a convex facial profile. (Felicita, 2017a) there are mostly predominantly three Types of dental arch forms - Average, broad and constricted (Ramesh Kumar *et al.*, 2011)

Most studies visualised the dimensions of the dental arches and found the differences between the different arch forms.some studies, however did not find differences in maxillary or mandibular arch width in subject with or without malocclusion. In this present study ,descriptive statistical analysis was performed for association of arch form with gender, age group of the included records in SPSS software by   IBM.

MATERIALS AND METHODS

This study was a cross sectional retrospective study which has been undertaken in a university setting. The benefits of undertaking a study in a university setting are easy retrieval of records and the demerits being limited to the number of patients, same ethnicity, same geographical location. Ethical committee approval was taken for this study(ethical approval number: SDC/SIHEC/2020/DIASDATA/0619-0320); totally 988 cases reported to Saveetha dental college to department of orthodontics for their orthodontic treatment, from which we selected total 300 cases who are having class II division 1 malocclusion.The inclusion criteria is patients having class II division 1 malocclusion and patients having other malocclusions and who already undergone orthodontic treatment were excluded from this study.Cross verification of data for errors was done via photographic verification.data was tabulated in excel and was then imported to the SPSS software and the variables were defined.In SPSS, chi-square test was performed, descriptive statistics, frequency distribution was performed. A p value of 0.05 was considered as the threshold to

detect statistically significant differences.In this present study ,descriptive statistical analysis was performed for association of arch form with gender, age group of the included records in SPSS software.

RESULTS & DISCUSSIONS:

After statistical analysis done in SPSS, the results of this study are - frequency distribution of average arch form was 80%, constricted arch form was 14% and broad arch form is 6%. There was no significant association between gender and arch forms (since, p value >0.05) and there was a significant statistical association between age group and arch forms(since, p value <0.05) .

Figure 1:Pie chart shows distribution of study subjects based on the different age groups.In this pie red colour denotes children(8-14 years) -18.67%,blue colour denotes adolescence(15-18 years)-14.67% and green colour denotes adult(>18 years)-66.67%.Figure 2:Pie chart shows distribution of study subjects based on gender.In our study , we had 45.67% females denoted by blue and 54.33% males denoted by green. Figure 3: Bar graph represents the association between age group and arch form. X-axis represents the age group and Y-axis represents the mandibular arch form where blue colour denotes average arch form,green colour denotes broad arch form and red colour denotes constricted arch form.Chi-square test was done and association was found to be statistically significant(p value:0.028). Pearson's Chi Square value:10.874, DF:4, p value:0.028(<0.05) hence statistically significant,proving there is statistical association between age and the arch form.Figure 4: Bar graph represents the association between gender and arch form.X-axis represents the gender and Y-axis represents the mandibular arch form where blue colour denotes average arch form,green colour denotes broad arch form and red colour denotes constricted arch form.Chi-square test was done and association was found to be statistically insignificant(p value:0.683). Pearson's Chi Square value:0.764, DF:2, p value:0.683(>0.05) hence statistically not significant,proving there is no association between gender and the arch form.

  Angle pointed out the arch form in his classification as the line of occlusion, which he considered as an important criterion for ideal occlusion. Since then, researchers had emphasized the importance of determining the prevalence of the different arch forms among populations.The size and shape of the dental arches have considerable implications for orthodontic diagnosis and treatment planning. These have an effect on the space availability, stability of dentition, esthetics and health of the periodontium (Bulyalert and Pimkhaokham, 2018)(Sivamurthy and Sundari, 2016)(Samantha, 2017). determining arch forms before orthodontic treatment are essential steps for proper diagnosis, treatment planning, treatment strategy, and post-treatment stability (Engel, 1979; Al-Khateeb et al., 2013; Kamisetty et al., 2015). Angle pointed out the arch form in his classification as the line of occlusion, which he considered as an important criterion for ideal occlusion (Vikram et al., 2017). Since then, researchers had emphasized the importance of determining the prevalence of the different arch forms among populations. In this study, we observed that the frequency distribution of average arch from was 80 %, constricted arch from was 14 % and broad arch from was 6 %. There was no significant association between gender and arch forms (since, P value > 0.05) so in both the genders the three arch forms were equally prevalent.Average arch form is prevalent in all the age groups (childrens, adolescence, adult), followed by constricted, then broad arch form. There is no significant statistical association between age group and arch forms (since, P value > 0.05). The studies done by (Buschang, Stroud and Alexander, 1994) reported that the mandibular arch form is relatively larger in younger age groups, Garg A , et al.(Garg et al., 2014) In their study they found that the average arch form was the most prevalent arch form in Class II Div 1 malocclusion.

The limitations of this study is small sample size and same ethnicity. The future scope in this topic is to use digital models and study the prevalent arch forms.

CONCLUSION:

Measuring arch dimensions and determining arch forms before orthodontic treatment are essential steps for proper diagnosis, treatment planning, treatment strategy, and post-treatment stability. Within the limitations of the study the conclusion can be summarized as follows:

1. No significant statistical association between gender and arch form in class II div 1 malocclusion.
2. Significant statistical association between age group and arch form in class II div 1 malocclusion

AUTHOR CONTRIBUTIONS: Author 1(Anubhav Das), carried out the retrospective study by collecting data and drafted the manuscript after performing the necessary statistical analysis.Author 2(Ravindra Kumar Jain) aided in conception of the topic , has participated in the study design, statistical analysis and has supervised in preparation of the manuscript.All of the authors have discussed the results among themselves and contribute to the final manuscript.

CONFLICT OF INTEREST: No conflict of interest.

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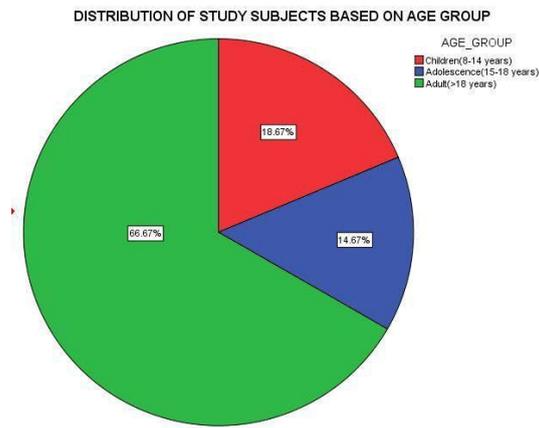
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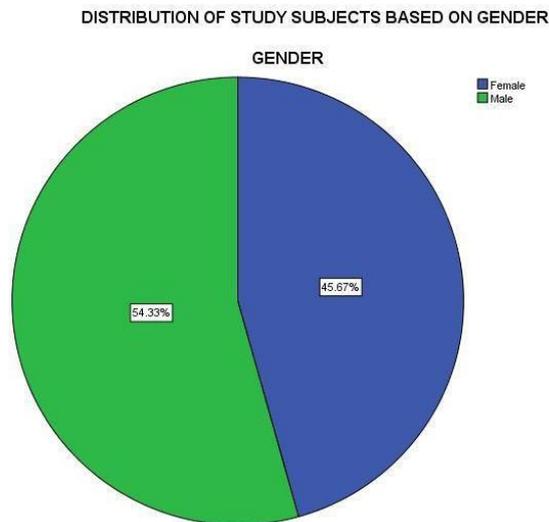

Figure 2: This pie chart shows distribution of study subjects based on gender.In our study , we had 45.67% females denoted by blue and 54.33% males denoted by green in the above pie chart.
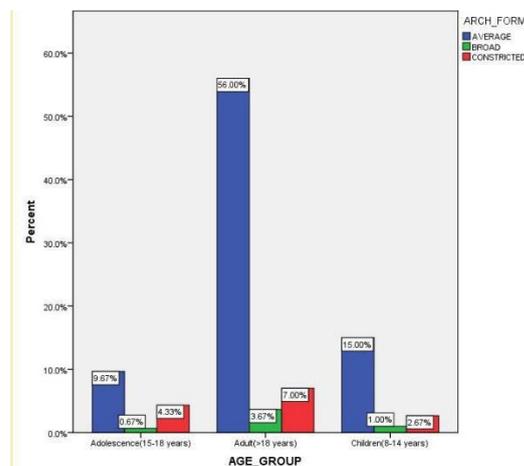

Figure 3: Bar graph represents the association between age group and arch form.X-axis represents the age group and Y-axis represents the number of patients with various mandibular arch form where blue colour denotes average arch form,green colour denotes broad arch form and red colour denotes constricted arch

form.Chi-square test was done and association was found to be statistically significant(p value:0.028).hence statistically significant,proving that average(ovoid) arch forms were the most common arch forms in adults with class II malocclusion.
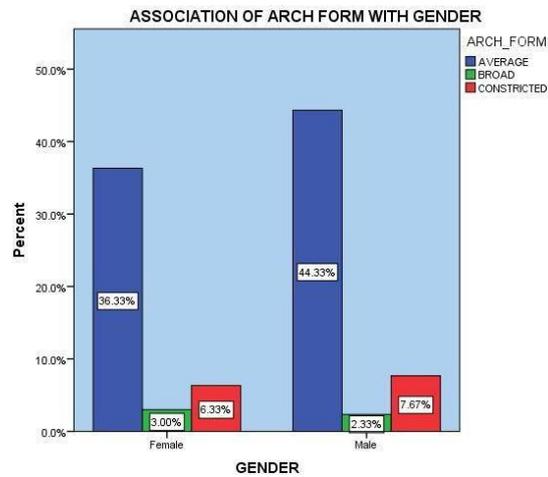

Figure 4: Bar graph represents the association between gender and arch form.X-axis represents the gender and Y-axis represents the mandibular arch form where blue colour denotes average arch form,green colour denotes broad arch form and red colour denotes constricted arch form.Chi-square test was done and association was found to be statistically insignificant(p value:0.683). Hence statistically not significant, proving that there are no gender differences in arch forms among class II malocclusion subjects.