Journal Homepage: - www.journalijar.com

INTERNATIONAL JOURNAL OF ADVANCED RESEARCH (IJAR)

Article DOI: 10.21474/IJAR01/17144
DOI URL: http://dx.doi.org/10.21474/IJAR01/17144

RESEARCH ARTICLE

EVALUATION OF MAXILLARY ARCH ANALYSIS IN MODINAGAR ADULTS WITH NORMO-OCCLUSION; IN VIVO STUDY

Dr. Pravender[1], Dr. Leena Tomer[2], Dr. Sunita Choudhary[3], Dr. Vikas Sharma[1], Dr. Swati Tyagi[1], Dr. Puja Maity[1], Dr. Amruthasree V.[1] and Dr. Chandani[1]

1. Post Graduate Student, Department of Prosthodontics, Crown & Bridge and Implantology, Divya Jyoti College of Dental Science & Research.
2. HOD & Professor,Department of Prosthodontics, Crown & Bridge and Implantology, Divya Jyoti College of Dental Science & Research.
3. Professor, Department of Prosthodontics, Crown & Bridge and Implantology, Divya Jyoti College of Dental Science & Research.

Manuscript Info

Manuscript History
Received: 25 April 2023
Final Accepted: 28 May 2023
Published: June 2023

Key words:-
Maxillary Arch Analysis, 3M Template, Normo-Occlusion

Abstract

Purpose: The aim of this study is to evaluatemaxillary arch analysis in Modinagar adultswith normo-occlusion.

Materials and Methods: A total of 100 patients aged between 20 to 30 years with well-aligned arches up to second molar teeth were included in this study.Upper and lower alginate impression using properly fit dentulous metallic trays was taken for each arch. These impressions were transferred to the laboratory for pouring with Dental Stone to obtain dental arch. Each study model was signed by the coding number and either F or M letter (F=female, M=male).A digital calliper was used to measure the following parameters: Inter-molar distance, inter-canine distance, inter-molar depth and inter-canine depth.

Results: The inter canine width among the males (36.70±2.589) was found to be significantly higher as compared to females (33.66±1.343). The inter-molar width among the males (55.07±4.726) was found to be significantly higher as compared to females (50.50±3.378). the intergroup comparison of inter-canine depth between males and females using the independent t test with p value less than 0.05 considered to be statistically significant.The inter-canine depth among the males (9.098±1.754) was found to be higher as compared to females (8.854±1.051) with p value of 0.041 denoting a significant difference**.** Among the males 54% were having ovoid arch form, 26% were having Tapered arch form and 20% were having Square arch form. Among the females 40% were having Ovoid arch form, 32% were having Tapered arch form and 28% were having Square arch form .The intergroup comparison between males and females in terms of shape of arch was statistically significant with p value of 0.346.

Conclusion: This study shows that males showed larger arch size than females.The Ovoid arch form was the most prevalent, followed by the tapered and square arch form in the Modinagar population among both males and females.

Corresponding Author:- Dr. Pravender
Address**:-** Post Graduate Student, Department of Prosthodontics, Crown & Bridge and Implantology, Divya Jyoti College of Dental Science & Research.

……

Introduction:-

Natural dentition, which involves the balanced alignment of teeth and their relationship with surrounding muscles and the tongue, plays a crucial role in prosthodontic treatment for both edentulous and dentate patients. Criteria such as the position of the anterior tooth, ridge width, length, and height are important in achieving a natural profile and functional restoration. [1] Understanding the natural form of the dental arch, including its size and shape based on the alveolar ridge dimension, tooth eruption, and perioral muscles, is essential for successful prosthetic restoration. [1,2] Additionally, the size of deciduous dental arches is a critical factor in determining proper tooth alignment and the space necessary for correct eruption of permanent molars. Arch form, characterized by symmetry, roundness, elongation, and convexity, significantly influences diagnosis, treatment planning, space availability, prosthesis stability, and esthetics. [1] The selection and arrangement of teeth in prosthetics are greatly influenced by arch form, and the placement and number of implants depend on the biomechanics, which can vary between arches. The classification of dental arch forms initially proposed three main forms (narrowed, square, and oval), but clinical observations indicate a considerable diversity in maxillary arch forms among humans.[3,4] The arch shape consists of two areas: the anterior curvature and intercanine width, and the posterior curvature and intermolar width. Customization of a preformed archwire allows adjustments to be made to the anterior and posterior curvatures as needed. [4,5] The dental arch shape is also influenced by the Angle Class, with Class III patients showing the most noticeable arch form, while Class I patients exhibit the least noticeable arch shape.[6,7] On average, males have larger arch dimensions than females. Advancements in technology and computer programs have facilitated the digitization and accurate 3D construction of dental casts, enabling precise measurement of arch dimensions and determination of arch form. [7]

Material and Methods:-

This study was done for a period of 6 months. A total of 100 patients aged between 20 to 30 years with well-aligned arches up to second molar teeth were included in this study. Subjects with any prosthetic, orthodontic, or restorative treatment on maxillary anterior teeth, caries in maxillary anterior teeth, malposed or malformed anterior teeth, periodontal disease, congenital and acquire maxillary defect, or with anterior crowding were excluded from this study. The Institutional Review Board approved the protocol of the study. All participants were fully informed about all the methodologies used in the study, and consent was attained from all participants following their approval. A single operator performed all the procedures.

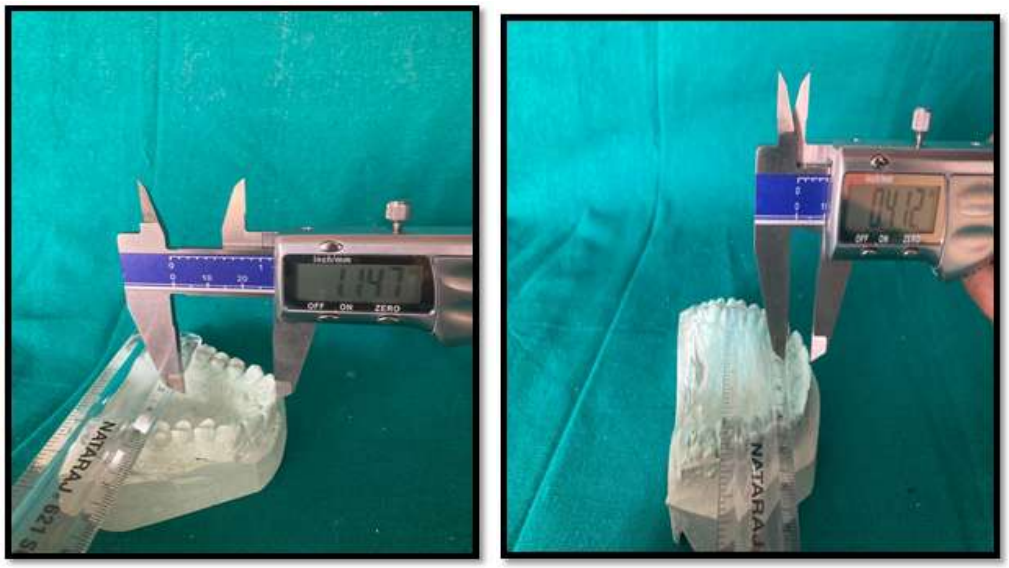
Procedure:-

Each participant was asked to sit in an upright position, looking forward on the dental chair, and examined clinically to ensure that each participant fulfilled all the inclusion criteria. Upper and lower alginate impression using properly fit dentulous metallic trays (SS White, Germany) was taken for each. These impressions were transferred to the laboratory for pouring with Dental Stone (Kalahari Ind Limited, India) to obtain dental arch models within a maximum of half an hour; to avoid dimensional changes in the material. Each study model was signed by the coding number and either F or M letter (F=female, M=male).

The arch form was determined for each subject depending on the maxillary arch. SYMGRID arch forms template was be used as a guide to determine the arch form for each subject. A digital caliper was used to measure the following parameters:

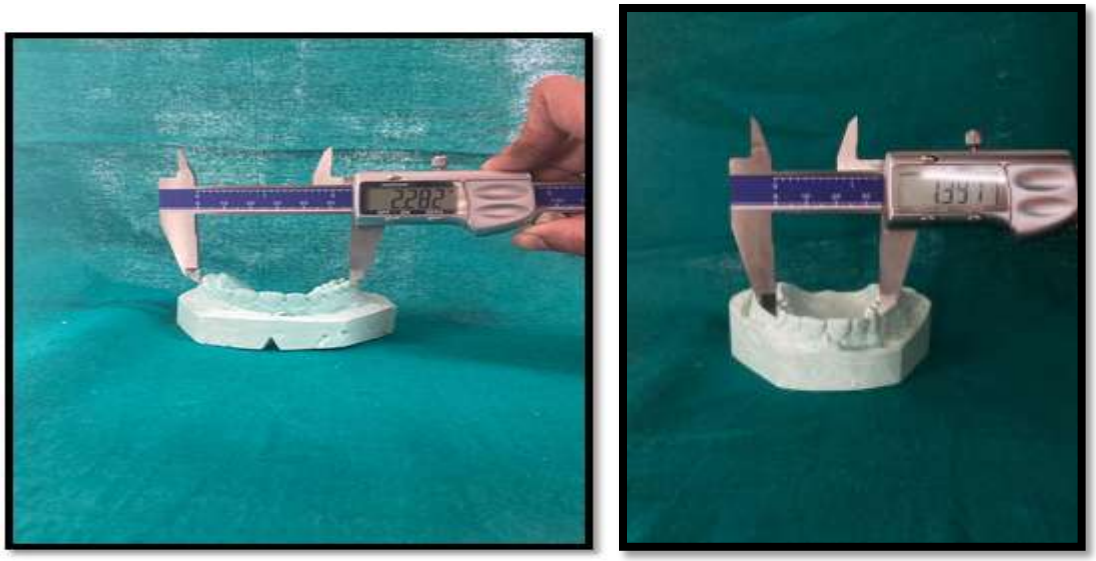
i) Inter-molar distance: the distance measured from the facial axis point of the first molar to the contralateral.
ii) Inter-canine distance: the distance measured from the facial axis point of the canine to the contralateral.
iii) Inter-molar depth: from the arch midline to the line drawn between the right and left first molars.
iv) Inter-canine depth: from the arch midline to the line between the right and left canine.

Picture:- Maxillary Cast.



Picture:- Measurement of intermolar depth and intercanine depth.

\



Picture:- Measurement of intermolar distance and intercanine distance.

Fig(A):- Points Marked On Study Model.

Fig (B):- Points On Study Model Is Connected And Formed A Line On A Glass Plate.

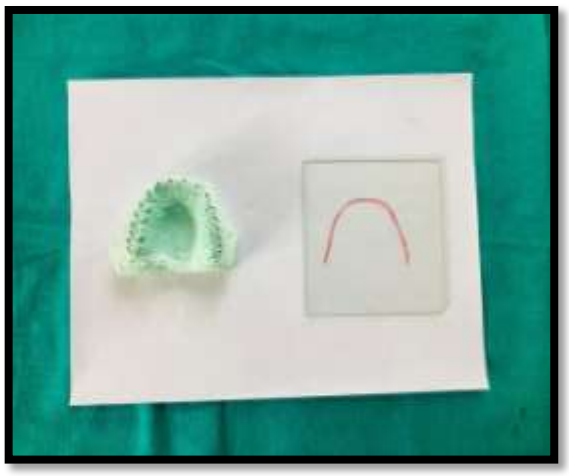


Fig (C):- Glass Plate Showing Arch Form

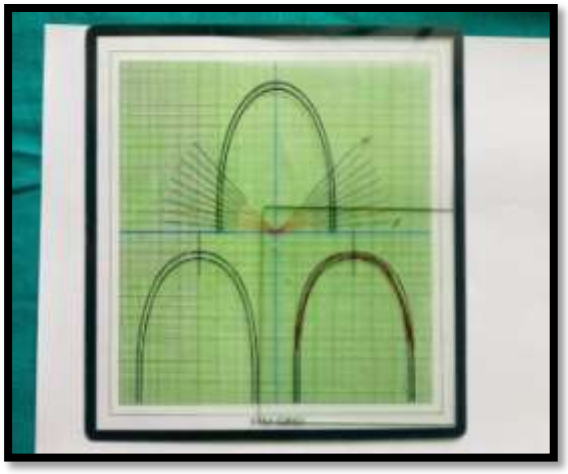


Fig (D):- Square Arch Form Using Symgrid™

Results:-

Table 2:- Intergroup Comparison Of Intercanine Width Between The Males And Females Compared Using Independent T Test.

	Mean	SD	T value	P value	Significance
Females	33.66	1.343	7.365	0.001	Non-Significant
Males	36.70	2.589			

Table -2 describes the intergroup comparison of inter-canine between males and females using the independent t test with p value less than 0.05 considered to be statistically significant. The inter canine width among the males (36.70±2.589) was found to be significantly higher as compared to females (33.66±1.343) with p value of 0.001 denoting a highly significant difference

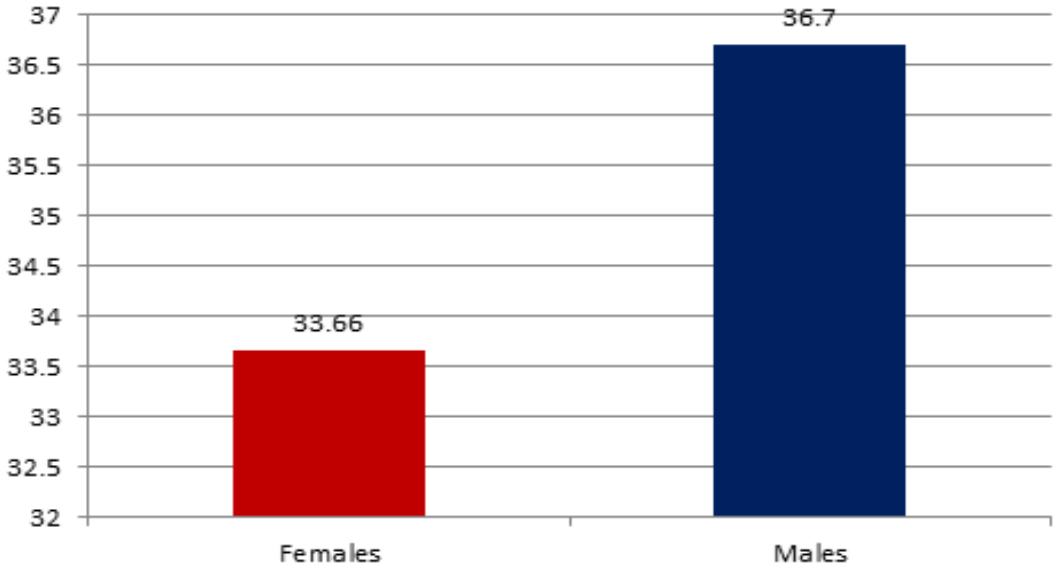


Table 4:- Integroup Comparison Of Intermolar Width Between The Males And Females Compared Using Independent T Test.

	Mean	SD	T value	P value	Significance
Females	50.509	3.378	5.650	0.001	Non-Significant
Males	55.070	4.726			

Table -4 describes the intergroup comparison of inter-molar between males and females using the independent t test with p value less than 0.05 considered to be statistically significant. The inter-molar width among the males (55.07±4.726) was found to be significantly higher as compared to females (50.50±3.378) with p value of 0.001 denoting a highly significant difference

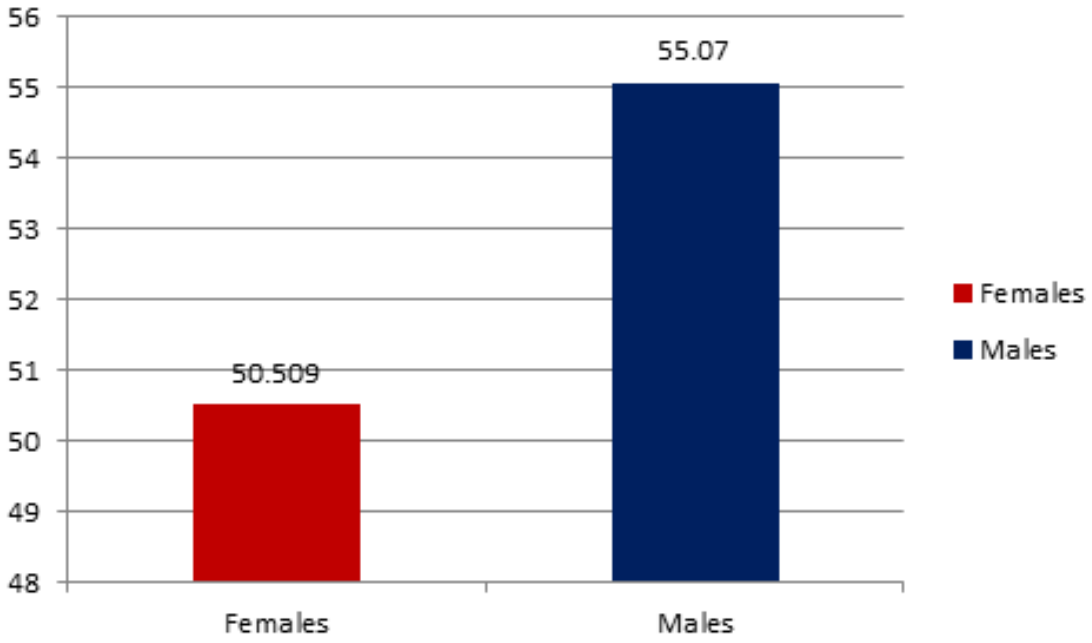


Table 6:- intergroup comparison of intercanine depth ..among the males and females using independent t test.

	Mean	SD	T value	P value	Significance
Females	8.854	1.051	1.845	0.401	Non-Significant
Males	9.098	1.754			

Table -6 describes the intergroup comparison of inter-canine depth between males and females using the independent t test with p value less than 0.05 considered to be statistically significant. The inter-canine depth among the males (9.098±1.754) was found to be higher as compared to females (8.854±1.051) with p value of 0.041 denoting a **significant difference.**

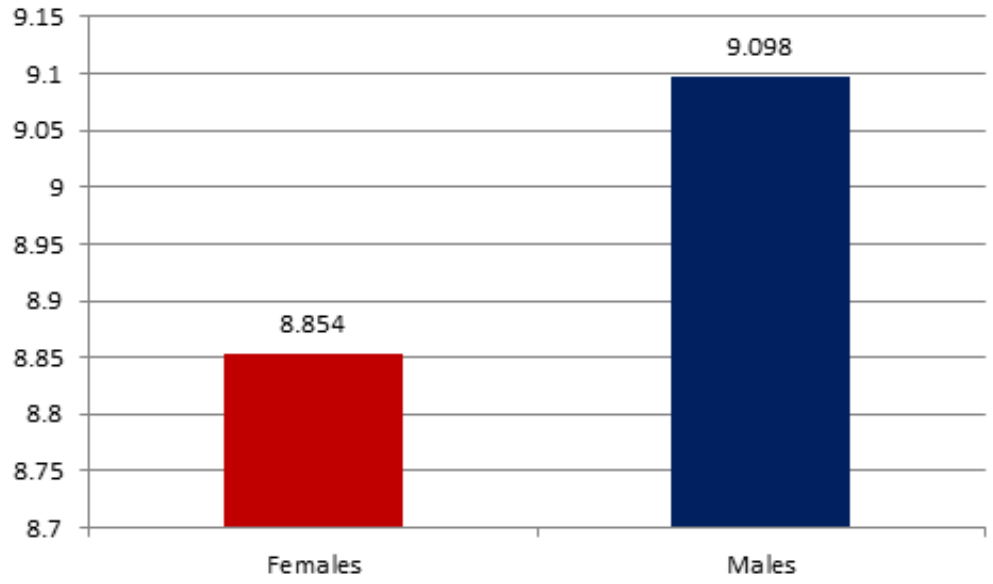


Table 8:- Intergroup Comparison Of Intermolar Depth Between The Males And Females Compared Using Independent T Test.

	Mean	SD	Std Error	P value	Significance
Females	26.930	1.896	2.357	0.001	Significant
Males	27.816	1.861			

Table -8 describes the intergroup comparison of inter-molar depth between males and females using the independent t test with p value less than 0.05 considered to be statistically significant. The inter-molar depth among the males (27.816±1.861) was found to be higher as compared to females (26.930±1.896) with p value of 0.020 denoting a **significant difference**

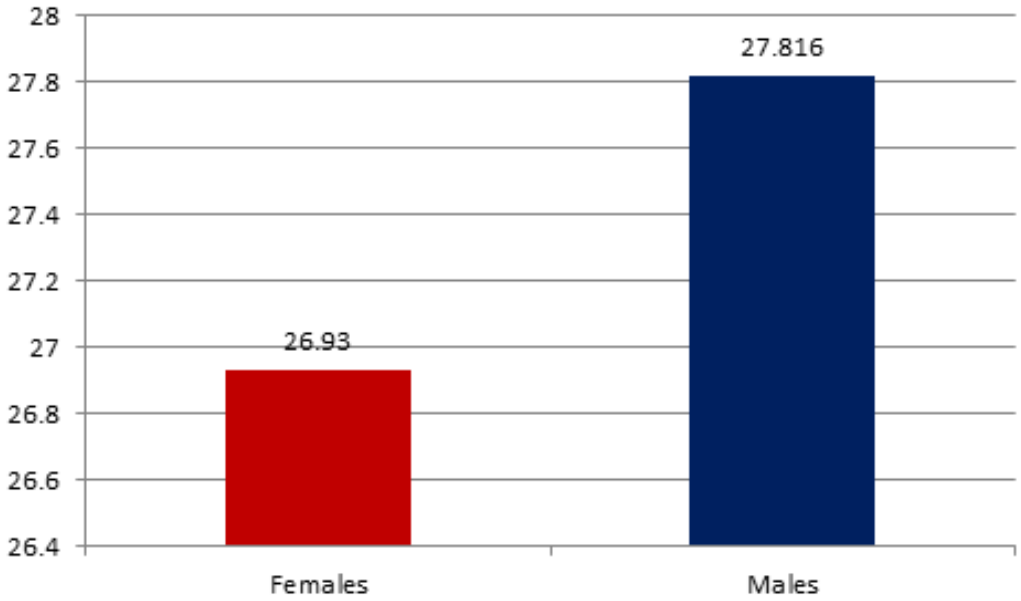
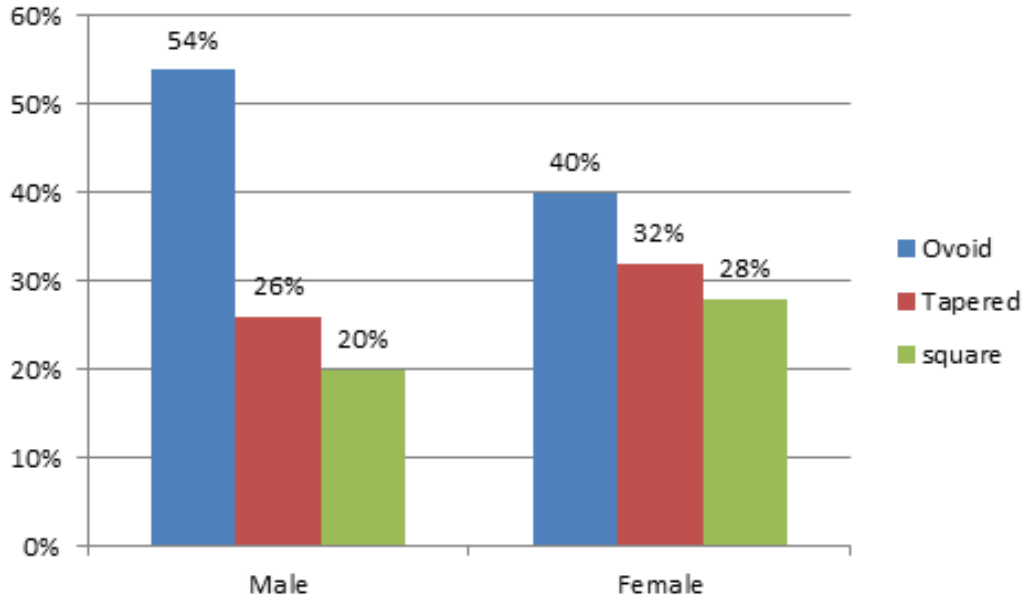


Table 10:- Intergroup Comparison Of Arch Form Among Males And Females Using Chi Square Test.

	Ovoid	Tapered	Square	P value
Male	27 (54%)	13 (26%)	10 (20%)	0.346 (Non-Sig)
Female	20 (40%)	16 (32%)	14 (28%)	

Table - Describes the intergroup comparison of arch form between males and females using the chi square test with p value less than 0.05 considered to be statistically significant. Among the males 54% were having ovoid arch form, 26% were having Tapered arch form and 20% were having Square arch form. Among the females 40% were having Ovoid arch form, 32% were having Tapered arch form and 28% were having Square arch form The intergroup comparison between males and females in terms of shape of arch was statistically significant with p value of 0.346



Discussion:-

Ethnicity is an important factor that influences the shape and dimension of dental arches. Different ethnic populations have various dental arch dimensions.[31]

The dental arch form should harmonize with the form of the residual ridge. For example, in square arch form, the distance between canines is wider, and posterior ridge arc is more parallel and the curvature of the anterior ridge is minimum. In the ovoid arch form, the distance between the canines is narrower and the curvature of the anterior ridge is more than the square arch. In tapering arch form, the distance of canines is narrower, and the curvature of the anterior arch is maximum than any other arches. Nelson concluded that the alignment form was a much more important factor than the outline form of the teeth as teeth of the same mould looked square in the square alignment, tapered in tapering alignment, and ovoid in ovoid aliment, as the alignment changes for different arch from the distance between the incisive papilla and central incisor would also change with different arch form. [32]

The arch form has many classifications, in this study, we used the first and most common classification, which was developed by Chuck et al., who classified the arch form into three categories tapered, ovoid, and square arch forms. Eventually, many clinicians and investigators used this classification over the years as well as the manufacturers construct archwires based on it. Different methods were used to describe dental arch form including simple subjective classification of arch form, objective analysis of arch width measurement, and the application of polynomial to describe arch form. Angle stated that the difference in arch forms can be attributed to many factors including race, type, and temperament. Many studies were done to describe the dental arch form across different populations[33]

Prasad et al. found that male arch widths were significantly larger than those of females in untreated adult South Indian populations, they compared their results with studies done on other populations and concluded that the dental arch width varies according to many factors including gender and race. Raberin et al. found that the size was related to the sex, which was smaller in females as compared to males, whereas the arch form was not related to the sex. Later many studies conform to Raberin et al. finding as the results of these studies showed that male arch widths were significantly larger than females' arch widths. In our study, the arch size of males showed a larger dimension than females, and the significance was noticed at an intermolar distance.[8]

In our study, ovoid arches were the most common in the Modinagar group, followed by tapered and square arches. These differences are attributable to genetic and environmental factors.

Previous studies show that the dental arch width changes rapidly with age. For that reason, the selected age group in our study was 18-30 years old, since the arch size reaches the maximum growth with minimal changes at the adolescence period.[12]

It is believed the maxillary arch shape is determined by the mandibular teeth due to the similarity between mandibular and maxillary arches morphology and their morphogenesis.[29]

In our study, the inter-canine width among the females was 33.66 with a standard deviation of 1.343. The mean inter-canine width among the males was 36.70 with a standard deviation of 2.589. The intergroup comparison of inter-canine between males and females using an independent t-test with p value less than 0.005 is considered to be statistically significantly higher as compared to females.

Inter-molar width among the females was 50.50 with a standard deviation of 3.378. The mean inter-molar width among the males was 55.07, with a standard deviation of 4.726. The intergroup comparison of inter-molar between males and females using the independent t-test with p value less than 0.05 is considered to be statistically significant. The inter-molar width among the males was found to be significantly higher as compared to females, with p-value of 0.001, denoting a highly significant difference.

The inter-canine depth in males and females. The mean inter-canine depth among the females was 8.854 with a standard deviation of 1.051 The mean inter-canine depth among the males was 9.098 with a standard deviation of 1.754. The intergroup comparison of inter-canine depth between males and females using the independent t-test with p value less than 0.05 is considered to be statistically significant. The inter-canine depth among the male was found to be higher as compared to females, with a p-value of 0.041 denoting a significant difference

The inter-molar depth in males and females. The mean inter-molar depth among the females (n=50) was 26.930 with a standard deviation of 1.896. The mean inter-molar depth among the males (n=50) was 27.816 with a standard deviation of 1.861.

The intergroup comparison of inter-molar depth between males and females using the independent t-test with p value less than 0.05 is considered to be statistically significant. The inter-molar depth among the male was found to be higher as compared to females, with p-value of 0.020 denoting a significant differencein the arch form among males and females. The arch form was predominantly oval in 47%of the study subjects, 29% of the study subjects were having tapered arch form, and 24%were having square arch form. Among the males, 54% were having ovoid arch form, 26%were having Tapered arch form and 20% were having Square arch form. Among thefemales 40% were having Ovoid arch form, 32% were having Tapered arch form and28% were having Square arch form.

The intergroup comparison of arch form between males and females using the chi-square test with p value less than 0.05 is considered to be statistically significant. Among the males, 54% were having ovoid arch form, 26% were having Tapered arch form, and 20% were having Square arch form. Among the females 40% were having Ovoid arch form, 32% were having Tapered arch form, and 28% were having Square arch form.The intergroup comparison between males and females in terms of the shape of the arch was statistically significant with p-value of 0.346.

Conclusion:-

On the basis of the results obtained and their analysis, the following conclusions were drawn from the present study:

1. Males showed larger arch size than females, which was a statistically significant at the intermolar and intercanine distance and depth among the selected population.
2. Ovoid form was the most prevalent arch form, followed by the tapered and square arch form in the Modinagar population among both males and females.

References:-

1. Park SJ, Leesungbok R, Song JW, Chang SH, Lee SW, Ahn SJ. Analysis of dimensions and shapes of maxillary and mandibular dental arch in Korean young adults. The Journal of Advanced Prosthodontics. 2017 Oct 1;9(5):321-7.
2. Ferro R, Pasini M, Fortini A, Arrighi A, Carli E, Giuca MR. Evaluation of maxillary and mandibular arch forms in an Italian adolescents sample with normocclusion. Euro J of Paediatric Dent. 2017 Mar;18(3):193-8.
3. Younes SA. Maxillary arch dimensions in Saudi and Egyptian population sample. American journal of orthodontics. 1984 Jan 1;85(1):83-8.
4. Arai K, Will LA. Subjective classification and objective analysis of the mandibular dental-arch form of orthodontic patients. American Journal of Orthodontics and Dentofacial Orthopedics. 2011 Apr 1;139(4):e315-21.
5. Nayar S, Manzoor W. Correlation between arch form and facial form: A cross sectional study. Journal of pharmacy &bioallied sciences. 2015 Apr;7(Suppl 1):S85.
6. Aznar T, Galan AF, Marin I, Domínguez A. Dental arch diameters and relationships to oral habits. The Angle Orthodontist. 2006 May;76(3):441-5.
7. Paranhos LR, Andrews WA, Jóias RP, Bérzin F, Júnior ED, Triviño T. Dental arch morphology in normal occlusions. Brazilian Journal of Oral Sciences. 2011;10(1):65-8.
8. Burdi AR. Morphogenesis of mandibular dental arch shape in human embryos. Journal of Dental Research. 1968 Jan;47(1):50-8.
9. Kadiyala SV, Chidambaranathan K. Prevalence of Primate and Anterior Spacing for Primary dentition in 3 to 6 year old children in Chennai. Research Journal of Pharmacy and Technology. 2018 Dec 31;11(12):5413-6.
10. Pound E. Lost—fine arts in the fallacy of the ridges. The Journal of Prosthetic Dentistry. 1954 Jan 1;4(1):6-16.
11. Oda S, Arai K, Nakahara R. Commercially available archwire forms compared with normal dental arch forms in a Japanese population. American Journal of Orthodontics and Dentofacial Orthopedics. 2010 Apr 1;137(4):520-7.
12. Aljayousi M, Al-Khateeb S, Badran S, Alhaija ES. Maxillary and mandibular dental arch forms in a Jordanian population with normal occlusion. BMC oral health. 2020 Dec;21(1):1-8.