ROLE OF INTER-CONDYLAR DISTANCE AND INTER-CANINE DISTANCE IN POSTERIOR TEETH ARRANGEMENT: AN INVIVO STUDY

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ABSTRACT:

Objective: The purpose of this study was to determine the relationship of intercondylar distance and intercanine distance with maxillary intermolar distance. It was cross-sectional comparative study and the study was carried out at the Department of Prosthodontics, AMC Dental College and Hospital, Ahmedabad.

Method: Following the inclusion criteria, a total of 120 dentate subjects were selected. The impression of the maxillary arch was obtained using irreversible hydrocolloid impression material. The vernier caliper was used to measure the distance between the mesiobuccal cusp tips of maxillary first molars and between the tips of maxillary canines. With the help of an arbitrary fascia-type facebow the intercondylar distance was recorded. The distance obtained between the two condylar rods was measured using the vernier caliper. Every distance was measured three times to ensure the accuracy and the mean was taken. The data were recorded and was stastically analysized.

Result: Pearson correlation coefficients (r) for the intercondylar distance and maxillary intermolar distance was significant and showed positive correlation (r=0.39, p=0.001) and also was significant and positive for maxillary intercanine and intermolar distance (r=0.44, p=0.0005).

Conclusion: In edentulous patients, the intercondylar distance and intercanine distance can be used for the arrangement of posterior teeth.

Key words: Teeth arrangement, Inter condylar distance, Inter canine distance, Intermolar distance.

INTRODUCTION:

Last few decades have seen a dramatic increase in life expectancy which has led to an in increase in number of edentulous patients. Restoration or preservation a natural appearance and masticatory efficiency is a vital part of the treatment of every edentulous patient.[1] Any patient receiving the prosthodontic treatment for complete denture puts more emphasize on the esthetics, mastication and stability of complete denture. Therefore, a prosthodontists helps the patient to regain his lost confidence by fulfilling these criteria.

Extraction of all the teeth in completely edentulous patients leads to the residual

ridge resorption.[2] The residual ridge resorption is a multifactorial process which is a combination of mechanical anatomical, metabolic factors.[3] The continuous resorption pattern causes the maxillary alveolar process to migrates upwards and inwards.[4] whereas the mandibular ridge migrating downwards and outwards. The long term edentulisim thus makes the arrangement of the artificial teeth more challenging.[5] As the anterior teeth meet the esthetic requirements, similarly, the role of posterior teeth in complete denture is that of mastication. Both the foresaid requirements get fulfilled only when the complete denture is stable in patient's mouth. There are many factors affecting the stability of complete denture, the most important among them being the proper tooth position.

Proper tooth position (and ultimately denture stability) is governed by two most important factors – neutral zone and denture occlusion. After the teeth have been lost, muscle function and activity remain highly individual for each patient and greatly influences any complete denture that are placed in the mouth. It is therefore, extremely important that the teeth be placed in the mouth within the area compatible with muscular forces.

Over the years, many dental professionals have suggested the norms, criteria and guidelines for proper tooth selection and arrangement. However the selection and arrangement of teeth for edentulous patients in a natural and aesthetically pleasing form and function has remained an elusive and challenging endeavour.[6] Innumerable methods have been adopted for the ideal tooth arrangement, most of them show a dependence on the dento-facial landmarks which are extra-oral landmarks such as Inter-alar width, Bi-zygomatic width and Facial heights and various intra oral landmarks like Incisive papilla, Inter-canine distance have also been taken into consideration for selection and arrangement of teeth.[2]

Accurate Bucco-palatal position of anterior and posterior teeth in prosthesis, in relation to the underlying supporting alveolar ridge is important for proper esthetic, function, comfort and phonetics of the patient. It also provides adequate clearance for tongue and buccal corridor space and improves the stability of the prosthesis.[1] The literature highlights many anthropometric studies to standardize the tooth position in dental arch, but most of the studies were concerned for anterior teeth arrangement. Very few studies have examined the scientific methods for determining the positioning of posterior teeth in complete dentures.[6] To the best of Authors knowledge, there has been no clinical anthropometric study done in Gujarat's population to determine the importance of inter-condylar and inter-canine distance as a guideline for posterior teeth arrangement.

The purpose of the present study is to determine the relationship of inter-

condylar and inter-canine distance to inter-molar distance of maxillary first molars in different maxillary arch forms so as to provide reliable and reproducible guide for the arrangement of the maxillary posterior teeth, and also to determine the gender based variations for the same.

MATERIALS AND METHODS:

Sample selection:

120 Volunteers, with no gender bias, in age range of 20-40 years reporting at Department of Prosthodontics and Crown and Bridge of AMC Dental College and Hospital, Khokhra, Ahmedabad and fulfilling the inclusion criteria were selected for the study.

Selection criteria

A. Inclusion criteria:
   1. Patients of either gender.
   2. Patient who is able to read and understand the informed consent declaration.
   3. Presence of permanent dentition
   4. Age group between 20-40 years.
   5. Individuals having full component of periodontally healthy and caries free teeth.
   6. Class I molar relation.

B. Exclusion criteria
   1. Age above 40 years and below 20 years.
   2. Individual with TMJ disorder/ dysfunction.
   3. Congenital/ acquired orofacial deformity.

   4. Orthodontically treated individual.
   5. Individuals with neuromuscular disorders.
   6. Subjects with crowded and mal-aligned dentition.
   7. Subjects with restored maxillary first molars (crowns, onlays).
   8. Subjects with attrited teeth.
   9. Mentally retarded patients.

METHODOLOGY:

The proposed study was conducted at DEPARTMENT OF PROSTHODONTICS AND CROWN AND BRIDGE, AMC DENTAL COLLEGE & HOSPITAL, Ahmedabad, Gujarat. The individuals were informed about the purpose of the study and the procedure for taking alginate impression and recording inter-condylar distance. The informed consent form (Gujarati &/ or English) were signed by each participate in this study.

Method for Collection of Data

- Basic Information of the study subject was entered in the form.

- Intercondylar distance was measured with the help of the arbitrary face bow (FASCIA TYPE FACEBOW). The impression compound(Y-DENTS; MDM CORPORATION) was used to attach the fork to the teeth. The tragus canthus line was drawn and the hinge axis were marked 13 mm anterior to the upper border of the tragus. The marks were confirmed by the manual palpation. The distance between the two condylar rods

were recorded in millimetres using the vernier caliper. Every distance was measured three times by the same operator to ensure the accuracy .The mean value was taken.(Figure 1)

The impression of maxillary arch was taken using alginate impression material (TROPICALGIN ALGINATE POWDER, ZHERMACK, ITALY) in a metal perforated tray.(Figure 2) The dental cast was fabricated using dental stone (KALABHAI KALSTONE, MUMBAI, INDIA). The distance between the tip of maxillary canines were measured using a vernier calliper (Figure 4). Similarly, the distance between the mesio-buccal cusps tips of maxillary first molars were measured with the help of the vernier calliper (Figure 5). Every distance was measured three times by the same operator to ensure the accuracy. The mean value was taken.

The data was analyzed using statistical software (SPSS version 11). Quantitative variables intercondylar distance, maxillary intermolar distance and maxillary intercanine distance were presented as mean and ± standard deviation. The correlation of maxillary intermolar distance with intercondylar distance and that of maxillary intermolar distance to intercanine distance was found out by applying Pearson's correlation coefficient. P-value < 0.05 was considered for significance.

RESULTS:

The total number of the dentate subjects included in the present study was one hundred twenty, out of which 52(43.33%) were male and 68(56.66%) were female. The age of most of the patients in the present study was ranging from 20 to 40 years. In the present study, the average age of most of the patients was in the range of 20 to 25 years that is 69(57.5%) individuals as shown in the **figure 6**. The mean age of the patients was 25.07±3.47 years.

The average **inter - condylar distance** obtained in the present study was 122.36±5.05. The average inter-condylar distance was 124.153±5.25 mm for males and 120.98±5.04 mm for females**.** The average **maxillary inter-molar distance** was 52.09±4.03 and the **maxillary inter-canine distance** was 34.47±2.29.

The inter-condylar and maxillary inter-canine average distances were significantly higher in male than female while the difference in inter-molar distance was higher in females than in males and was relatively insignificant, (p<0.05) as shown in table 1.

The inter-condylar and the inter-molar distances means are in the ratio of 1: 2.36 and maxillary inter-canine and inter-molar distance means are in the ratio of 1:1.51. According to the results obtained, it is thereby suggested that this ratio can be used for the purpose of the posterior teeth arrangement.

The Pearson correlation coefficients (r) showed positive correlation and significance (r=0.39 p=0.001), when the correlation test was applied between the

inter-condylar and maxillary inter-molar distances (Table 2). Similarly, the Pearson correlation coefficients (r) showed positive correlation and significance (r=0.44 p=0.0005), when the correlation test was applied between the maxillary inter-canine and inter-molar distances (Table3).

DISCUSSION:

One of the objectives of denture fabrication is proper positioning of artificial teeth. The resorbed residual ridges pose a greater challenge for the Prosthodontist, when it comes to arranging artificial teeth. There is very little research regarding the posterior teeth arrangement.[10] The available methods for the posterior teeth arrangement are based on the hard tissue references that resorb with time and are not stable. However the inter-condylar distance is stable and reproducible landmark.[10]

The present study was conducted to investigate the potential relationship between the inter-condylar distance and interdental distance of maxillary first molars and the relationship between maxillary inter canine and inter molar distance to provide reliable and reproducible guide for the arrangement of the posterior teeth. The study was carried out at Department of Prosthodontics and Crown & Bridge at AMC Dental College & Hospital, Ahmedabad for which 120 subjects were selected according to inclusion and exclusion criteria. All these subjects were

Gujarati population. The population sample comprised of 52(43.33%) male and 68(56.66%) female, with no gender bias. The age range of the subjects was from 20 to 40 years. The average age of the patients was 25.07±3.47 years.

Like our study, a similar study was conducted by Irfan Ahmed Shaikh et al.[9] to find out the positional relationship of the inter condylar and inter-molar width to aid in denture teeth positioning. They used the vernier caliper to measure the distance between the mesio-buccal cusps tips of maxillary first molars. The measurements were obtained three times by the same operator to avoid biasness of the results, as used in various studies.

For measuring the distance between the two condyles an arbitrary face bow (Hanau –H2) was used, as used by Irfan Ahmed Shaikh et al.[9] In the present study the intercondylar distance showed the mean value that correlates with the mean value reported by Lazic B et al.[7] However the mean of the intercondylar distance of the present study is less than the values reported by Irfan Ahmed Shaikh et al. A significantly higher mean value of intercondylar distance was found for male than for female. These findings are in agreement with the findings reported Lazi B et al.[7] and Irfan Ahmed Shaikh et al.[9] in their respective studies. All of these studies have reported gender based variations as in the present study.

In the present study, the mean maxillary intermolar distance value was in agreement with the mean reported by Irfan Ahmed Shaikh et al. A strong correlation between the intercondylar and the maxillary intermolar distance measurements was found (r=0.39, p=0.001) just as found by Irfan Ahmed Shaikh et al.[9] in their study(r=0.53 p=0.0005). A strong correlation was also found between the maxillary intermolar and intercanine distance. (r=0.44, p=0.0005)

When the mean measurement of maxillary inter molar distance and inter condylar distance were compared the ratio obtained was 1:2.36. Similarly Irfan Ahmed Shaikh et al reported their ratio of 1:2.34 that is almost similar to the ratio in the present study. When the mean measurement of maxillary intercanine distance and inter molar distance were compared the ratio obtained was 1:1.51. From the results of the present study it was concluded that these ratios can be used for the posterior teeth arrangement.

The value of the results of this work is that denture posterior teeth can be positioned accurately by determining the intercondylar distance and maxillary intercanine distance. The condylar landmark is stable and reproducible and does not change as a result of resorption or ageing. However, no assessment was made regarding skeletal relationships or ethnic variation. Further studies are necessary to find out if these factors lead to different ratios.

CONCLUSION:

As is the arrangement of anterior teeth necessary for esthetics and phonetics, similarly accurate arrangement of posterior teeth is required for mastication.

Dental Literature has studies focusing on the maxillary anterior teeth arrangement using anatomical landmarks as guides with only sparse studies concerning the arrangement of posterior teeth. In this paper a new method has been introduced for the arrangement of the maxillary posterior teeth using a constant mathematical relationship derived from the natural dentition and stable anatomical landmark that is TMJ.

The present study showed that;

➢ The correlation between the intercondylar and maxillary intermolar distance and maxillary inter-canine and inter-molar distance is positive and significant.
➢ The intercondylar and maxillary inter-molar ratio and maxillary inter-canine and inter-molar ratio could be utilized for the maxillary posterior teeth arrangement is 1:2.36 and 1:15 respectively.
➢ Intercondylar distance and intercanine distance measurements may be helpful in the arrangement of the posterior teeth in edentulous patients.
➢ Average intercondylar and maxillary intercanine distances were found to be significantly higher in male than female, while intermolar distance

was higher in females than in males.

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TABLES:

Table 1: Comparison of tooth measurements between groups

Variables	Male(n=52)	Female(n=68)	P values
Inter-condylar Distance(mm)	124.153±5.25	120.98±5.04	0.001*
Inter-molar Distance(mm)	51.41± 2.35	52.98±4.36	0.07
Inter-canine Distance(mm)	35.22±3.059	34.38±4.36	0.02*

t-Test :Assuming two samples with unequal variance applied (*significant difference – checked at two tail, p<0.05) mm-Millimeteres n=Number of Subjects

Table2: Correlation between intercondylar distances with intermolar distances

Intercondylar distance (mm)

	Overall (n=120)		Male(n=52)		Female(n=68)	
	R	P-value	R	P-value	R	P-Value
Inter-molar Distance(mm)	0.39	0.001*	0.54	0.001*	0.258	0.001*

Regression test applied (*Significant) mm-Millimeteres n=Number of Subjects

Table3: Correlation between intercanine distances with intermolar distances

Intercanine distance (mm)

	Overall (n=120)		Male(n=52)		Female(n=68)	
	R	P-value	R	P-value	R	P-Value
Intermolar Distance(mm)	0.44	0.0005*	0.68	0.001*	0.44	0.001*

Regression test applied (*Significant) mm-Millimeteres n=Number of Subjects

FIGURES/ GRAPH:

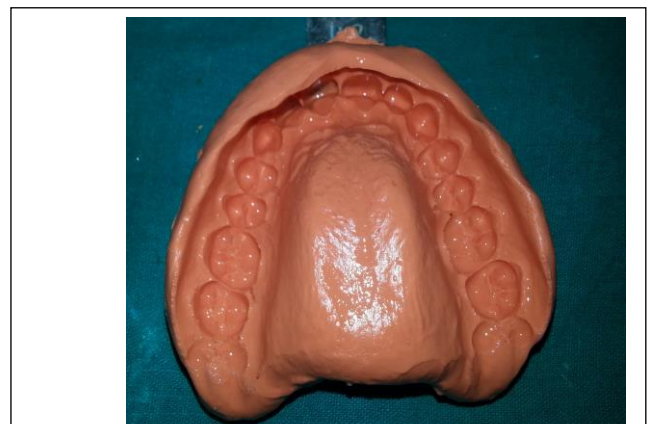Figure 1: Measurement of intercondylar distance using fascia facebow

Figure 2: Maxillary alginate impression

Figure 3: Vernier calliper
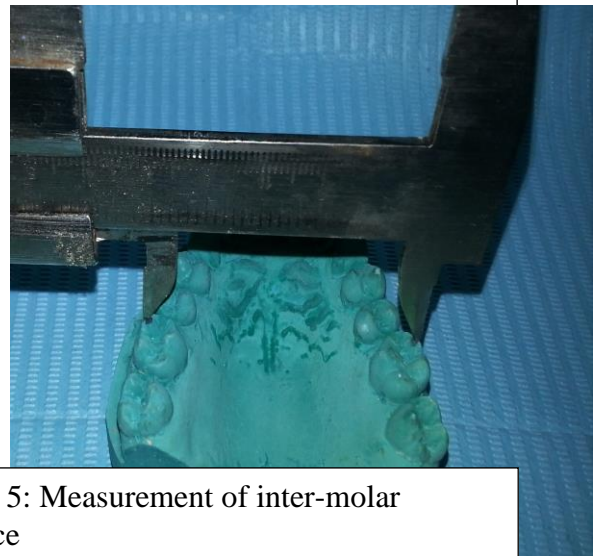

Figure 4: Measurement of inter-canine distance
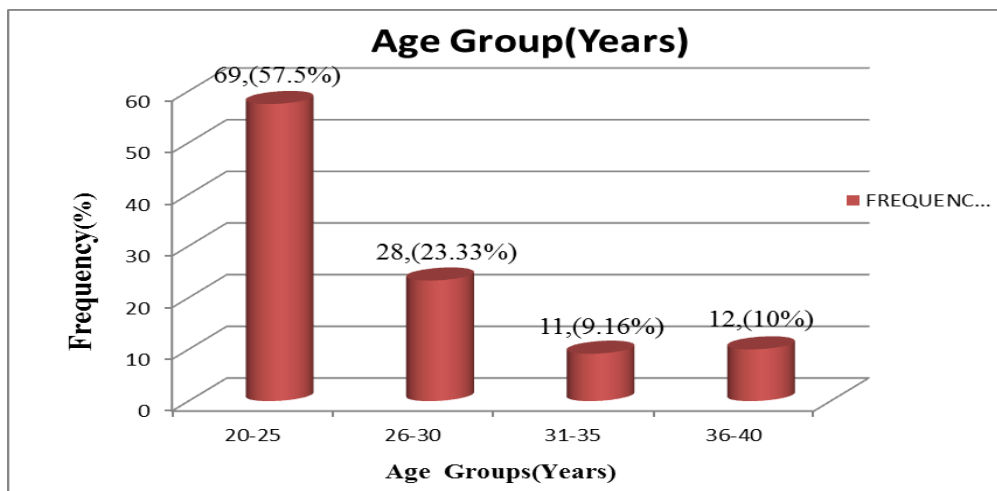

Figure 5: Measurement of inter-molar distance

Figure 6: Age distribution of the patients (n=120)