

Relationship of Inter-Condylar Distance with Inter-Dental Distance of Maxillary Arch in Positioning Upper Posterior Teeth

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ABSTRACT

Background: To find out the correlation of intercondylar distances with inter-canine and inter-molar distance of maxillary arch in dentate individuals among males and females of South Indian population.

Materials and method: A total of 120 dentate subjects of age group 24 – 60 yrs. with absence of severe crowding, trauma, orthodontic treatment and craniofacial syndrome were selected. They were equally divided into 2 groups; Group A consisting of males and Group B consisting of females. The Interfacial width (IFW) was measured by slidematic facebow (Stratos 300). The mean intermediate soft tissue thickness of 9mm on either side of face and the distance from outer side of ear bow to the tissue contact point which was measured as 30mm on each side was subtracted from interfacial width (IFW) to obtain the exact intercondylar distance (ICD). The intercondylar widths were correlated with intercanine (U3) and intermolar (U6) distances which are obtained intraorally. The anthropometric measurements thus obtained were statistically analyzed to determine the importance of intercondylar distances as a guideline for complete denture fabrication in edentulous patients.

Results: Since the U6/ICD ratio remains constant in group A and group B, the ICD can be used as a guideline to estimate the U6 and its bucco-palatal position, regardless of age and sex. When comparing the ICD/U3 to ICD/U6 ratios, there was a statistically significant difference. In both groups, there was no statistically significant difference in the U3/ICD and U6/ICD ratios ($p > 0.05$).

Conclusion: Thus, ICD can be used as a reliable guideline to determine the bucco-palatal position of maxillary first molar irrespective of sex. The study concludes that the clinical acceptance of this ratio can be taken as a biometric guideline for teeth arrangement as compared to the conventional guidelines in immediate denture patient.

Keywords: Inter-Condylar Distance, Inter-Dental Distance, Maxillary Arch.

INTRODUCTION

For edentulous patients, the selection and arrangement of teeth in a normal and aesthetically pleasing shape and function has remained a challenging endeavour. Dentists use their

professional experience and aesthetic sense to seek advice from different approaches to achieve appropriate outcomes. Keshvad et al. suggested that the use of the ICD as a guideline for teeth

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arrangement is a crucial factor contributing to the attractiveness of edentulous patients on the dento-facial stage¹. Many anthropometric studies have been done in the literature to standardise the location of the tooth in the dental arch but most studies have been concerned with anterior teeth. Very few studies have examined the scientific methods for determining the positioning of posterior teeth in complete dentures. There has been no best clinical anthropometric study done in Indian population to determine the importance of ICD as a guideline for complete denture fabrication.

Hence, the aim of the study was to find out the correlation of intercondylar distance(ICD) with intercanine(U3) and intermolar(U6) in South Indian population.

MATERIALS AND METHODS

The Slidematic Facebow (Stratos 300) with an accurate earbow that moves straight horizontally for different facial widths, unique “speed-slide” gear mechanism makes it very easy to assemble the bow on the patient. A total of 120 dentate south Indian individuals were selected for the study & were divided into 2 groups Group A as males and Group B as females.

Inclusion criteria:

The inclusion criteria's were age group between 25-60years, dentate individuals with the presence of all natural teeth.

Exclusion criteria:

The study excluded individuals with any form of malocclusion, retained teeth, facial asymmetry and history of attrition, abrasion, TMJ discomfort, or with Orthodontic and Prosthodontic treatments.

Methodology:

All the subjects were made to seat in reclined position then, at 43 millimeters above the incisal edge of the central or lateral incisors, the anterior reference point is marked using the Reference Plane Locator and Marker (Fig 1).The slidematic facebow was then positioned, which uses the external auditory meatus as a reference point for determining the position of the arbitrary hinge axis,

and the interfacial width (IFW) was calculated.(Fig 2, Fig 3).



Fig 1: Anterior reference point marked using the Reference Plane Locator and Marker, at 43mm above the incisal edge of central or lateral incisors.

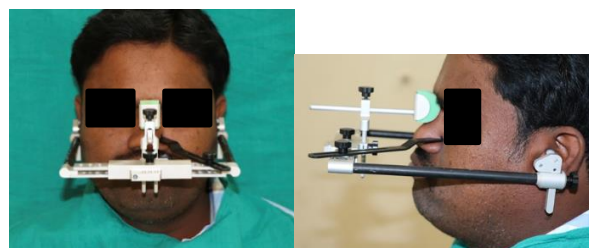


Fig 2: Arbitrary hinge axis location determined with Slidematic Facebow.



Fig 3: ICD was calculated by subtracting the mean intermediate soft tissue thickness 18mm and 30mm of measured earbow distance (from outer side of earbow to the tissue contact point), from measured IFW.

As already proved by other studies², that the mean intermediate soft tissue thickness on either side of the face was 9mm, so by taking it into consideration,

the exact ICD was calculated by subtracting the mean intermediate soft tissue thickness as 18mm and 30mm of measured earbow distance (from outer side of earbow to the tissue contact point), from measured IFW(fig 3). U3 and U6 was measured intra-orally with the help of screw latched divider and measuring scale by taking the tip of cuspid and mesiobuccal tip of maxillary first molar as reference point (Fig 4).



Fig 4: U3 and U6 was measured intra-orally.

Statistical analysis:

All statistical analysis was carried out using Student t-test. The U3/ICD, U6/ICD ratio of Group A individuals was applied to Group B individuals and the measured and calculated values of U3, U6 and

ICD were compared. The ICD/U3, ICD/U6 ratios for all 120 subjects were compared.

RESULTS

The mean and standard deviation values of U3, U6, ICD were calculated (Table 4). There was a significant difference ($P < 0.005$) found between male and female when measured U3 (Group A, 35.8 ± 2.2), (Group B 34.9 ± 2.0) (p -value - 0.022), U6 (Group A, 55.3 ± 2.6), (Group B, 54.0 ± 2.8) (p -value- 0.016), ICD (Group A, 161.1 ± 6.0), (Group B 155.2 ± 4.6) (p -value - 0.001) (table 1). No statistically significant difference in the ratios of U3/ICD (Group A, 0.223 ± 0.014), (Group B, 0.225 ± 0.015) (p -value - 0.319) and U6/ICD (Group A, & Group B, 0.346 ± 0.020) (p -value - 0.168) in both the groups ($p > 0.05$). Since the ratio of U6/ICD remains constant in group A and group B, the ICD can be used as a guideline to estimate the U6 and its bucco-palatal position, irrespective of sex(table 2). There was statistically very high significant ($p < 0.001$) difference when compared the ratios of ICD/U3 (4.49 ± 0.30) to ICD/U6 (2.90 ± 0.17) (P -value - 0.001)(table 3)

Table 1: There was a significant difference found between male and female when measured U3,U6,ICD ($P < 0.005$).

Parameters in males	Groups	N	Mean(SD)	P value
Mean inter canine distance (U3) of study population	Males	60	35.8 (2.2)	0.022
	Females	60	34.9 (2.0)	
Mean inter- molar distance(U6) of study population	Males	60	55.3 (2.6)	0.016
	Females	60	54.0 (2.8)	
Mean Inter facial width (IFW) of study population	Males	60	179.2 (5.9)	0.001
	Females	60	173.2 (4.6)	
Mean inter condylar distance (ICD) of study population	Males	60	161.1 (6.0)	0.001
	Females	60	155.2 (4.6)	

Table 2: Results showed no statistically significant difference in the ratios of ICD to U3 and ICD to U6 in both the groups ($p > 0.05$). Since the ratio of U6/ICD remains constant in group A and group B in South Indian population, the ICD can be used as a guideline to estimate the U6 and its bucco-palatal position, irrespective of se

Ratios	Groups	N	Mean (SD)	P value
U3/ICD	Males	60	0.223(0.014)	0.319
	Females	60	0.225(0.015)	

U6/ICD	Males	60	0.346(0.020)	0.168
	Females	60	0.348(0.020)	

Table 3: Student t test analysis of the ratios of ICD/U3 and ICD/U6 in all 120 study population p-value <0.001 statistically highly significant difference.

Ratios	N	Mean (SD)	P value
ICD/U3	120	4.49+/-0.30	0.001
ICD/U6	120	2.90+/-0.17	

Table 4: Table total collected data of 120 samples showing data collected.

	Age (in years)	IFW (inmm)	ICD (in mm)	U3 (in mm)	U6 (in mm)	ICD/U3	ICD/U6	U3/ICD	U6/ICD	IFW/U3	IFW/U6	U3/IFW	U6/IFW
min	23	164	146	28	48	3.85	2.53	0.18	0.29	4.3	2.83	0.16	0.26
max	58	193	175	40	60	5.57	3.48	0.26	0.39	6.21	3.85	0.23	0.35
mean	33.08	176.2	158	35.3	54.6	4.49	2.9	0.22	0.35	5	3.23	0.2	0.31
SD	9.51	6.05	6.08	2.15	2.78	0.3	0.17	0.01	0.02	0.32	0.18	0.01	0.02

DISCUSSION

Ideal arrangement of teeth for an edentulous patient becomes difficult in the absence of pre-extraction records. However, reliability of pre-extraction records if present in long period of edentulousness will be limited¹⁰. Various methods have been adapted for the ideal arrangement of teeth mostly depend on the physical characteristics of the dento-facial landmarks such as Inter-alar width, Bi-zygomatic width and Facial heights. Besides these, various intra oral landmarks like Incisive papilla, Inter-canine distance have also been taken into consideration for selection and arrangement of teeth. Accurate Bucco-palatal position of teeth in prosthesis, in relation to the underlying supporting alveolar ridge is important for proper esthetic, function, comfort and phonetics of the patient.

Hasanreisoglu et al³ concluded that the dimensions of the maxillary central incisors and canines varied in men and women, with the canines exhibiting the greatest gender-based differences. No statistically significant golden ratio or any other continuous proportion for the anterior teeth as a whole was found in the population studied. Proportional smile

tests are usually based from a frontal view on the perceived scale of the anterior teeth. In this respect, the central incisors are the most prominent anterior teeth in the dental arch, since they can be seen at maximum height. There were no statistically significant differences between the 1:16 ratio of bi-zygomatic distance to width of central incisor, and the interalar distance to intercanine distance in women. These linear measurements may be used as an initial guide when determining the width of the central incisors or the position of the canines, particularly for women.

A study by Awotile et al. showed moderate correlation between bi-condylar distance. The interalar width was widely used to estimate maxillary canine location^{4,5,6}. Acc to Debnath et al., the ICD was measured with CT scan and IFW with Dentatus face bow, concluded that average thickness of soft tissue from the surface of the skin to the lateral tip of the mandibular condyle head was approximately 9 mm and the ratio of ICD to U3 and U6 varies among different racial population groups². In the present study, we have taken this mean value into consideration to obtain ICD with slidematic facebow, U6 to ICD has been found to be constant regardless of age and sex, so ICD can be

used as a reliable guideline to determine the bucco-palatal position of the maxillary first molar.

ICD was 4.4 times greater than U3, 2.8 times of U6. John J Sharpy⁷ stated that the lateral tip of the condyle lies about 13 mm below the surface of the skin and can be found by palpation. Stuart concluded that there is an average distance of around 17 mm between the skin surface and the condyle rotation center. Tradowsy et al⁸ studied the, Intercondylar distances of 130men were compared with those of 130women. The mean intercondylar distance for men was 108mm, while the mean intercondylar distance for women was 102mm. The difference was highly significant. Mandilaris et al⁹ studied, the accuracy of measurements of the ICD between the Pantronic and mechanical pantographic recordings were evaluated using 45 subjects. These recordings were used to adjust the Denar D5A articulator and determine the actual ICDs of the examined patients and the relationship of these distances to their interfacial width.

They concluded that, the difference between the interfacial width and the actual ICD of the examined subjects was 15.1 mm on the right side and 14.9 mm on the left side. The average for both sides was 15 mm. At the 95 % confidence level, the average value of this difference for the total population should be between 13.9 and 16 mm. Therefore 15 mm is better than the 12.5 mm that is used with the Pantronic to represent an accurate estimation of the average distance between the vertical condylar axes of rotation and skin surface in condylar region. No statistically significant difference was found between the differences of the interfacial width and ICD values for men and women subjects ($p > 0.05$). A very weak correlation was found between the difference of the interfacial width and the ICD for the right and the left side ($k = 0.349$). The mean ICD for the 45 subjects was 56.5 mm on the right side and 56.7 mm on the left side. A statistically significant difference was found between the mean ICDs of men and women subjects ($p < 0.05$)⁹.

Limitation of this study:

Since this research was performed in the South Indian population alone, universal acceptance of the ratios is doubtful. Therefore, a potential analysis could be a comparison of the ratios between the different ethnic and racial groups. It was found that

the U6 to ICD ratio remained the same for all 120 research individuals but the U3 to ICD ratio differs. Thus, in respect of Interdental distance, the future analysis should include the correlation of ICD with the palatal arch type.

CONCLUSION

In the present study done in South Indian population, U6 to ICD was found to be constant irrespective of age and sex. Thus, ICD can be used as a reliable guideline to determine the bucco-palatal position of maxillary first molar regardless of age and sex. The study concludes that the clinical acceptance of this ratio can be taken as a biometric guideline for teeth arrangement as compared to the conventional guidelines in immediate denture patients.

CONFLICTS OF INTEREST

The authors declare they have no potential conflict of interests regarding this article.

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