

THE SIGNIFICANCE OF INNER CANTHAL DISTANCE IN PROSTHODONTICS

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فوائد قياس مسافة ما بين العينين في صناعات التركيبات التعويضية

لقد أفرح مؤخراً استخدام علم مقاسات الوجه للمساعدة في اختيار حجم الأسنان وخاصة الأسنان العلوية الستة الأمامية خلال عملية تصنيع التركيبات التعويضية للفم الأدرود.
إن قياس المسافة مقاسات ما بين العينين الداخلية هي من الإعتبارات الأساسية التي تشكل هيئة الوجه والتي لم يتم بحث فوائدها أو التقرير عن استخدامها في تصنيع التركيبات التعويضية لحد الآن أن المسافة ما بين العينين هي المسافة بين الزوايا الداخلية لشقي جفني العينين.
تدرس هذه الورقة علاقة مسافة ما بين العينين وعرض جناح الأنف وعلاقتها بحجم الأسنان العلوية الستة الأمامية وهذه الدراسة أجريت على ٣١٠ مرضى.
وقد أوضحت النتائج أن هناك علاقة مباشرة بين مسافة موق العينين وعرض الأسنان العلوية الستة الأمامية ويمكن تقديرها على أن عرض الأسنان الستة الأمامية تساوي ١.٣٥ من المسافة بين موق العينين.

Abstract

Several anthropometric facial measurements have been suggested to aid in the estimation of the overall width of the maxillary six anterior teeth for edentulous patients. However, the inner canthal distance, which is an important anthropometric parameter, has not been investigated or reported. The inner canthal distance is the distance between the medial angles of the palpebral fissures. The relationship amongst the inner canthal distance, inter-alar width and the combined width of the maxillary anterior teeth of 310 subjects was investigated. The results indicated that the combined width of maxillary six anterior teeth may be estimated by multiplying the inner canthal distance by a factor of 1.35.

Introduction

In the construction of complete dentures, the estimation of the combined width of maxillary six anterior teeth is an important clinical procedure when pre-extraction records are not available. Several facial measurements, including bizygomatic width, inter-commissural width, inter-pupillary width and inter-alar width have been suggested to aid in the estimation of an overall width of the maxillary six anterior teeth.¹⁻⁴ However, there seem to be conflicting views on the value of such estimations.

Hoffmann et al³ noted that the combined width of the maxillary six anterior teeth may be established through the use of inter-alar width. They suggested that inter-alar width may be multiplied by a factor of 1.31 to obtain the combined width of the maxillary six anterior teeth. Still

another anthropometric measurement of the face is the distance between the inner canthus of the eyes. The inner canthus is a point at the medial angle of the palpebral fissure [Fig.1], with the inner canthal distance defined as the distance between the medial angles of the palpebral fissures.⁵ Laestadius et al⁶ reported that, in 78% of adults, the inner canthal distance is attained by one year of age, after which the rate of growth in the area is slow in contrast to the outer orbital dimension. In the estimation of the combined width of the maxillary six anterior teeth, the value of this anthropometric parameter has not been investigated or reported in the literature.

The purpose of this study was to determine the relationship of the inner canthal distance with interalar width and the combined width of the maxillary six anterior teeth.

Materials and Methods

Three hundred and ten subjects comprising 164 (52.9%) males and 146 (47.1%) females were studied. Their age ranged from 17 to 57 years with a mean of 37 (+ 13.0) years. Only subjects who were free of congenital facial defects, interdental spacing or

Received 01/07/96; accepted 20/10/96

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crowding, and who had not had orthodontic treatment and/or crown restorations of the maxillary anterior teeth were included in the sample.

The three parameters, viz. inner canthal distance (ICD), inter-alar width (IAW), and combined width of the maxillary six anterior teeth (CWAT) of each subject were measured with Boley Gauge* having a resolution of 0.1 mm. The ICD was measured from the medial angle to the medial angle of the palpebral fissures [Fig.2]. The IAW was measured as the widest points between the two alae [Fig. 3]. The mesiodistal width of the anterior teeth for each subject was measured using a Boley Gauge. The distance between the two proximal contact points was measured and recorded as the mesiodistal width of the tooth. The CWAT was recorded by adding the mesiodistal width of each of the six teeth. Each parameter was measured three times and the average value was computed and recorded separately by two investigators. To determine the concordance level, the two investigators measured the three parameters independently for each of 20 randomly selected subjects. The concordance level was determined by Dahlberg formula,⁷ coefficient of reliability,⁸ paired t-test and Pearson Correlation.

Besides total sample measurements, the subjects were further divided into two groups according to their age. The mean age of Group A was 21.6 (+1.4) years with a range of 17-27 years; while the mean age of Group B was 48.3 (+4.8) years with a range of 38 - 57 years (Table 2).

Results

Low Dahlberg formula⁷ values, high coefficient of reliability values, significantly different P-values in the t-test, and high Pearson correlation values showed a high concordance level between the two investigators (Table 1).

Table 1. Concordance level of measurements between two investigators.

| | dahlberg Agreement | Coefficient of Reliability | Paired t-test P-value | Pearson Correlation |
|----------------------------------|--------------------|----------------------------|-----------------------|---------------------|
| Inner canthal distance | 0.286 | 0.985 | 0.307 | 0.992 |
| Inter-alar distance | 0.326 | 0.983 | 0.883 | 0.991 |
| Combined width of anterior teeth | 0.254 | 0.989 | 0.487 | 0.995 |

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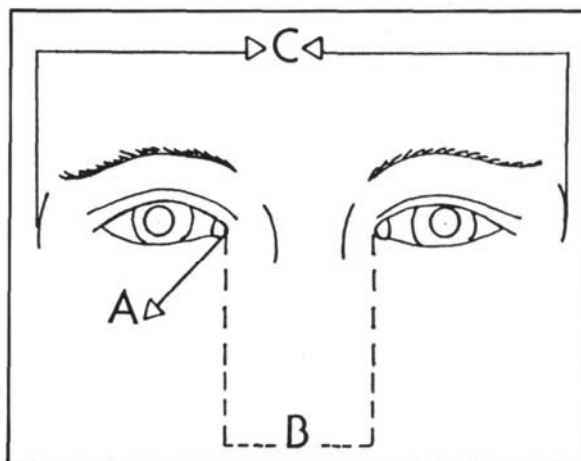


Fig. 1. A, Inner Canthus (point at the commissure of the eye fissure); B, Inner-Canthal Distance; C, Outer Orbital Distance.

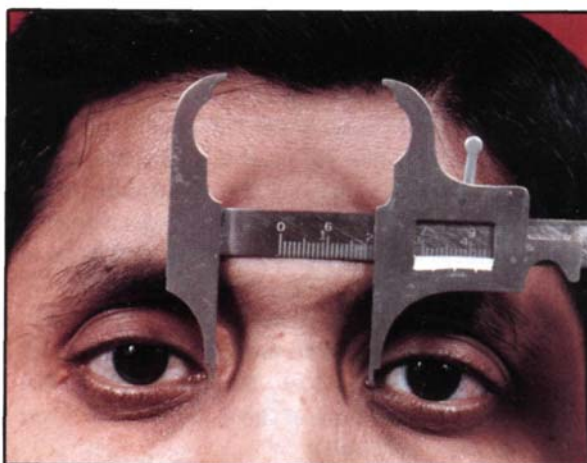


Fig. 2. Measurement procedure of inner canthal distance.

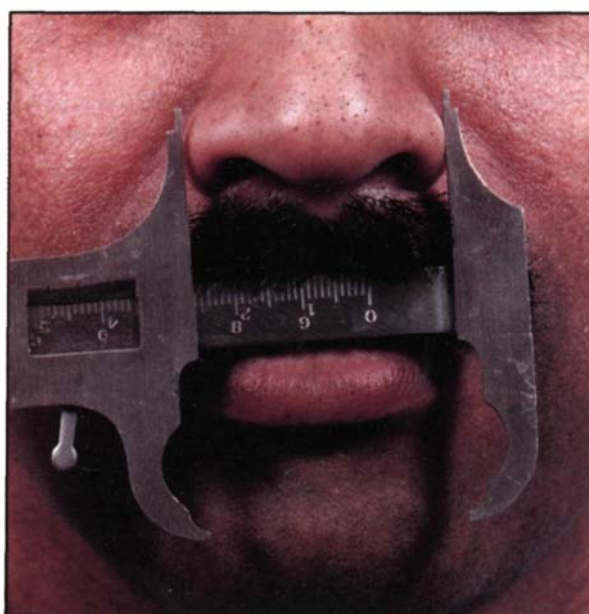


Fig. 3. Measurement procedure of interalar width of nose.

Table 2. Descriptive statistics of measurement for Groups A and B.

| | Age (i ears; | | Inner Canthal Distance | | Inter-alar distance | | Combined Width of Max. Six anterior teeth (mm) | |
|---------------------------------|--------------|---------|------------------------|---------|---------------------|---------|--|---------|
| | Group A | Group B | (mm) | | (mm) | | Group A | Group B |
| | | | Group A | Group B | Group A | Group B | | |
| Mean | 21.6 | 48.3 | 31.6 | 32.7 | 32.6 | 36.7 | 42.0 | 44.8 |
| Standard deviation | 1.4 | 4.7 | 3.6 | 2.4 | 3.4 | 3.0 | 4.0 | 2.9 |
| Coefficient of variation | 6.48% | 9.78% | 11.48% | 7.55% | 10.44% | 8.17% | 9.57% | 6.49% |
| Minimum | 17.0 | 38.0 | 24.1 | 25.0 | 22.9 | 30.0 | 30.0 | 36.0 |
| Maximum | 26.0 | 57.0 | 39.4 | 41.0 | 42.0 | 44.0 | 50.0 | 51.2 |
| P-value for difference of means | | | <0.01 | | < 0.0001 | | < 0.0001 | |

The means of measurements obtained from 30 subjects are shown in Fig.4. The mean ICD was 32.0 (+3.31) mm with a range of 24.1 - 41.0 mm. The mean IAW was 34.0 (+3.8) mm with a range of 22.9 - 44.0 mm. The mean CWAT was 43.0 (+3.9) mm with a range of 30.3 - 51.2 mm.

The mean ICD of Group A was 31.6 (+3.6) mm with a range of 24.1 - 39.4 mm. The mean ICD of Group B was 32.7 (+2.5) mm with a range of 25.0 - 41.0 mm. Due to small standard deviations, the difference between the means of the two groups was statistically significant ($P<0.01$) even though it was not large (Table 2).

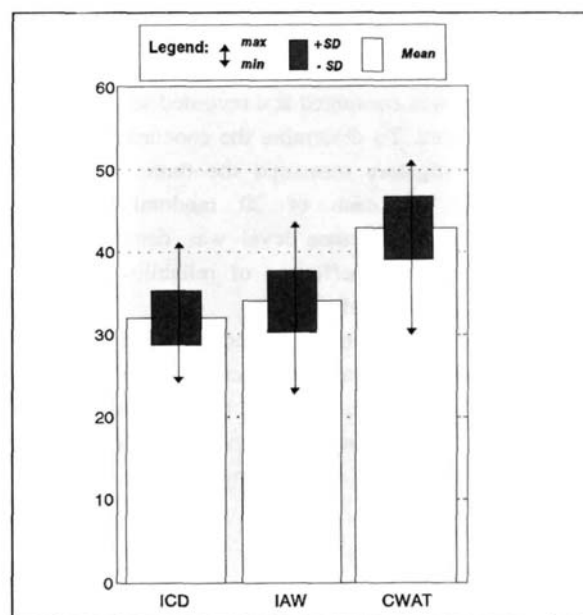
The mean IAW of Group A was 32.7 (+3.4) mm with a range of 22.9 - 42.0 mm and the mean of Group B was 36.7 (+3.0) mm with a range of 30.9 - 50.0 mm (Table 2). The difference between the means of Group A and Group B was highly significant ($P<0.0001$).

The mean CWAT of Group A was 42.0 (+4.0) mm with a range of 30.0 - 36.0 mm and that of Group B was 44.9 (+2.9) mm with a range of 36.0 - 51.2 mm (Table 2). The difference between the means of Group A and Group B was highly significant ($P<0.0001$).

For the total sample, the mean CWAT of 43.0 was 35% greater than the mean ICD of 32.0 mm, and 26% greater than the mean IAW of 34.0 mm. The average multiplying factor to estimate the CWAT from the mean ICD was 1.35 and for IAW was 1.26 (Table 3).

Discussion

To evaluate the relationship of inner canthal distance and inter-alar width with the combined width of the maxillary six anterior teeth, measurements from 310 subjects were obtained. The inner canthal distance (32.0 mm) was greater than the value reported by Laestadius et al⁶ (30.0 mm). The mean inter-alar width (34.0 mm) compares favorably with the measurements reported by Hoffman et al³ (34.28 mm), while the mean combined width of the maxillary six anterior teeth (43.0 mm) was less than the means reported by Hoffman et al.³ (44.85 mm), Shillingburg et al⁹ (45.8 mm), and Scandrett et al² (53.61 mm).

**Fig. 4.** Means, standard deviations, and ranges of ICD, IAW and CWAT (mm)**Table 3.** Multiplication factor of ICD and IAW to obtain CWAT.

| | FACTOR | |
|--------------|----------|----------|
| | ICD/CWAT | IAW/CWAT |
| Group A | 1.33 | 1.29 |
| Group B | 1.37 | 1.22 |
| Total Sample | 1.35 | 1.26 |

ICD = Inner Canthal Distance

IAW = Interalar width

CWAT = Combined width of maxillary six anterior teeth

An increase in inter-alar width and inner canthal distance with age has been reported.^{5,6} Therefore, the subjects were divided into two age-groups, to determine the effect of age on these dimensions. The results showed that the

differences between the mean IAW of Group A and Group B (Table 2) was highly significant ($P < 0.0001$), whereas, the difference between mean ICD of Groups A and B was less significant ($P < 0.01$), suggesting that its increase is less age-dependent.

Furthermore, when the ratio between the ICD and CWAT in Group A and Group B were compared with the ratio of IAW and the CWAT in both groups, the ratio of the former was marginally higher (Table 3), suggesting that there is less difference between ICD and IAW values with respect to age.

Hoffman et al³ found that the CWAT may be estimated by increasing the IAW by 31% or multiplying it by a factor of 1.31. In the present study, the multiplying factor of IAW was 1.26 and for ICD was 1.35 (Table 3). The existence of the factor suggests that ICD may be used as a tentative predictor for the estimation of the CWAT in such cases, for example when IAW cannot be used due to obliteration of the nose in cleft lip patients. Additional studies are required to replicate the present findings so as to confirm the relationship among the anthropometric parameters investigated.

Conclusion

Measurements of inner canthal distance, inter-alar width and the combined width of the maxillary anterior teeth were made on 310 subjects. Analysis of these measurements showed that the inner canthal distance may be used as a tentative predictor for the estimation of the combined width of the maxillary six anterior teeth, and serve as a useful additional factor in tooth selection.

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