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Opening Ratio for Canine & Molar Area in Relation to Incisor

[1]Dr. Rashmi Gangavati, [2]Dr. Kamala K.A, [3]Dr. Ashwini Rani SR, [4]Dr. Siddhartha Varma, [5]Dr. Vaishali Mashalkar, [6]Dr. Girish Suragimath,

[1]Asst. Professor, Dept. of Oral Pathology, rashmiopath@yahoo.in
[2]Asso. Professor, kamsweetsmile@gmail.com
[3]Asst. Professor, drashwiniranisr@gmail.com
1,2,3Dept. of Oral Medicine and Radiology, Krishna Vishwa Vidyapeeth "Deemed to be University",Taluka-Karad, Dist-Satara, Pin-415 539, Maharashtra, India
[4]Asso. Professor, siddhartha_varma@yahoo.co.in
[5]Asso. Professor, vaishu.nm90@gmail.com
[6]Professor and Head, drgirishsuragimath@gmail.com
4,5,6Dept. of Periodontology, School of Dental Sciences, Krishna Vishwa Vidyapeeth "Deemed to be University",Taluka-Karad, Dist-Satara, Pin-415 539, Maharashtra, India

ABSTRACT

Background: The modification of OVD is a procedure that is regarded as both important and significant in the area of prosthodontics. Incorrect estimation of the space available between opposing teeth may lead to an improper framework design.
Aim: To determine and assess the average opening ratio in the canine and molar area in relation to the extent of opening in the incisor area.
Material & method: Intra oral scans of 34 participants were made using Medit i500 intraoral scanner. After mounting the virtual casts the central incisors were opened between 0 to 5mm and thereby analyses of the openings were checked in the canine and first molar region.
Result: On evaliation with Karl Pearson's statistical test and plotted them on the scatter diagrams. The average ratio of incisor opening to that in the canine region (I:C) was 1.10 and the average incisor opening to molar ratio (I:M) was nearly 1.55.
Conclusion: The average ratio of incisor opening to that in the canine region is 1.10 and the average incisor opening to molar ratio is nearly 1.55.
Keywords: OVD, scatter diagram, incisor, canine , molar, distance, opening, ratio, average ,space.

INTRODUCTION

During the period of maximum intercuspation, the occlusal vertical dimension (OVD) plays a significant part in determining facial proportions.[1] Additionally, the OVD has an effect on facial dimensions while the face is in a relaxed condition. The underdevelopment of alveolar bone may result in a reduction in lower facial height as well as facial signs of aging at an earlier age. The loss of facial height may be exacerbated by this underdevelopment.[1] The phrase "vertical dimension of occlusion" refers to the distance that occurs between two physical or anatomical sites (often the tip of the nose and the chin) while the human is working at their maximum intercuspal posture. [2] This distance is usually measured horizontally. [2] Adapting the OVD to meet the needs of the therapeutic process requires preliminary preparation. Due to the molars' relative proximity to the hinge axis of the jaw, an increase in OVD in the molar area inevitably results in a wider opening in the incisal area.[2] Therefore, to get a reliable rehabilitation result, it is important to engage in preliminary planning using an articulator.[3] Inaccurate assessment of the gap between adjacent teeth might result in the incorrect design of the framework.[3] Hence, the capacity to calculate this proportion beforehand may aid in forecasting the precise quantity of tooth structure that has to be extracted or added in any region of the dentition.[3] As part of full prosthetic treatment, it

is necessary to increase the OVD in order to create enough intermaxillary space for temporary or permanent restorations.[4,5] The use of digital technology has a lot of benefits, some of which include a shorter processing and working time, as well as an increased level of precision, honesty, and accuracy. In recent years, the dentistry field has created some of the most cutting-edge technologies, such as virtual articulators, intraoral scanners, occlusal recordings, and facebows.[6] With the advent of Internet technology, there is no longer a need for stone models for transmitting patient data to dental laboratories and technicians. Introducing intraoral scanners has brought about a significant change, as they offer a viable alternative to traditional hydrocolloid and polyvinyl siloxane imprints.[7] It is possible to avoid all of the fabrication errors that result from using traditional fabrication procedures, including casting shrinkage, impression material distortion, plaster expansion, and model attachment deviation.[8]

AIM

To evaluate the average opening ratio in canine & molar area with incisior area.

INCLUSION CRITERIA

1. Participants with complete denture, excluding 3rd molar .
2. Stable complete denture upto 2nd molar teeth in upper & lower arch.
3. Angles class I molar relation on both the sides.
4. Horixontal & vertical overlap of 2 to 4 mm .

EXCLUSION CRITERIA

1. Subjects with Angle class II or III molar relation .
2. Missing permanent teeth i.e. either upper or lower incisor teeth or canine or molar.
3. Patient undergoing orthodontic treatment in present or past.

MATERIALS & METHODS

In our study we have included a total of 34 patients who underwent full arch scanning of both jaws with the help of intaroral scanner by Medit i500(MEDIT corp.23 Goryeodae-ro 22 gil, Seongbukgu, Seoul , Korea) as shown in figure 1.

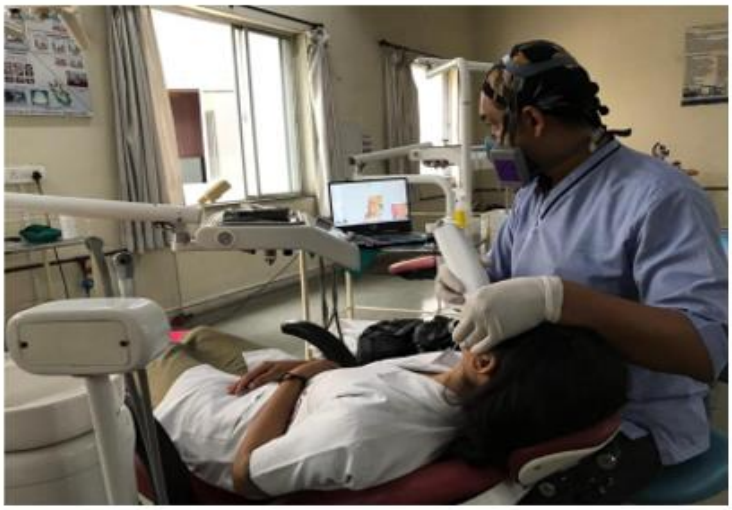

Figure 1: Intraoral scan of the patient performed using the Medit i-500 Intraoral Scanner

For our convenience & ease , we have stored the scanned files in standard tenssellation language (STL) format. The individual scans of patient were accessed in exocad software & digital cast was obtained. The cast was mounted on virtual articulator that was provided by the software as shown in figure 2.

Figure 2: Virtual casts mounted on the virtual articulator on the exocad software

The scans were opened at incisor region from 0 mm upto 5 mm [at 0mm, 0.20mm, 0.50mm, 0.75mm,1.0mm,1.20mm,1.50mm,1.70mm,2.0mm,2.20mm,2.50mm,2.70mm,3.0mm,3.20mm,3.50mm,3.70mm,4.0mm,4.20mm,4.50mm,4.70mm and 5.0mm]. At each opening , corresponding reading at canine & 1st molar was also recorded as shown in figure 3 .

Figure 3: Mouth opening increased at different vertical heights

STASTICAL ANALYSIS

Karl Pearson correlation coefficient test was used to obtained the results.The data was obtained at different levels used to drive an equation that can aid to predict the opening level.

RESULT

Variables	Correlation between Distances (mm) with		
	r-value	t-value	p-value
At molar	0.6862	25.1750	0.0001*
At canine	0.6424	22.3681	0.0001*
At incisor	0.6378	22.0982	0.0001*

TABLE 1: CORRELATION FOR DISTANCE (mm) WITH CHANGE

Using Karl Pearson correlation coefficient in table 1, we found that there was significant difference found on evaluation of 3 variables differently as the p value was 0.0001 at molar, canine and incisior respectively.

Variables	Correlation between incisor opening with		
	r-value	t-value	p-value
Ratio of incisor to molar	0.5318	16.7550	0.0001*
Ratio of incisor to canine	0.5879	19.3915	0.0001*

TABLE 2: COMPARISON AT DIFFRENT LEVEL

On evaluation of differnt varibales in table 2 we found that ,ratio of insior to molar and incisor to canine showed a significant differnce between the 2 variables as the p value was 0.0001respectively.

SIMPLE LINEAR REGRESSION ANALYSIS

Independent variables	Regression coefficient	SE of regression coefficient	t-value	p-value
Intercept	0.8506	0.0421	20.1889	0.0001*
Incisor opening	0.0669	0.0040	16.7550	0.0001*
RR=0.5317, R^2=0.2827,F(1,712)=280.73 p<0.05,S, Std.Error of estimate: .18733				

TABLE 3 : INCISOR TO MOLAR OPENING

On evaluation of ratio difference in table 3 , we found that ratio was stastistically significant as the p value was 0.0001 respectively and ratio of I + M (Y) =0.8506+0.0669* incisor opeining(X).

Independent variables	Regression coefficient	SE of regression coefficient	t-value	p-value
Intercept	0.7484	0.0189	39.6106	0.0001*
Incisor opening	0.0347	0.0018	19.3915	0.0001*
R=0.5878, R^2=0.3456, F(1,712)=376.03 p<0.05,S, Std .Error of estimate:0.08400				

TABLE 4 : INCISOR TO CANINE OPENING

On evaluation of ratio difference in table 3, we found that ratio was stastistically significant as the p value was 0.0001 respectively and ratio of I + C (Y) = 0.7484+0.0347* incisor opeining(X).

Thus, scatterplot showed that there was a strong positive linear relationship between the 2 variables which was also confirmed with Pearson ‘s correlation coefficient of 0.5879 . Simple linear regression showed a significant relationship between ratio of incisor to canine and incisor opening (F (1,712)=376.03 p<0.05). The slope coefficient for incisor opening was 0.0347, so the I to M increases by 0.0347 for each extra incisor opening. The R2 value was 0.3456, so 34.56% of the variation in incisor to canine can be explained by the model containing only incisor opening. The scatterplot of standardised predicted values verses standardised residuals, showed that the data met the assumptions of homogeneity of variance and linearity and the residuals were approximately normally distributed.

DISCUSSION

The loss of the occlusal vertical dimension has a detrimental effect on the function, comfort, and aesthetics of the patients receiving treatment.[9] Using the dentoalveolar compensatory mechanism, which includes the extrusion of worn or attuned teeth, it is possible to have the vertical dimension preserved. In spite of the fact that tooth wear may result in the loss of the occlusal vertical dimension, it is still possible to maintain the vertical dimension over time.[10] In order to achieve a balanced and aesthetically pleasing appearance of the teeth and face, provide room for dental restorations, and improve the alignment of the upper and lower teeth, it may be necessary to make adjustments to the OVD. Provided that the dentist adheres to the function envelope, the OVD should not be seen as a rigid value but rather as a flexible dimension that falls within the range of physiological tolerance. Vertical shifts in the maxillo-mandibular relationship may give rise to biomechanical, aesthetic, functional, and biological problems.[11] Similar to our study literature has proved an increase of aOVD to be safe when indicated & performed.[4,11-20]

Abduo came to the conclusion that a procedure that involves a permanent expansion of the occlusal vertical dimension, up to 5 millimeters, is a method that is dependable, safe, and does not have any adverse consequences. On average, the signs and symptoms that are related to this rise are quite transitory and diminish within a period of two weeks.[13] Therefore, taking this into consideration, it was decided that the vertical height should be progressively increased between 0 and 5 millimeters, as this does not exceed the physiological restrictions of the temporomandibular joint complex. Sharon E. recently published a method that calculates changes in the molar and canine regions during intraoral incisor opening. A digital photography camera measures changes in vertical height in this technique, which uses a Wolefel sliding guide device.[21] CBCT scans may be utilized to yield diagnostically accurate findings, according to a study.[22] Another study reported that the intraoral imprint may serve as the foundation for a wide variety of alternative procedures. Therapy planning, diagnostics, patient communication, cast fabrication, and the development of restorations and appliances are a few of these operations.[23] It is of the utmost importance to make certain that the intraoral impressions are correct when it comes to the fabrication of restorations that are a good fit for the patient. [24]

According to the findings of this study, it was determined that the average ratio of incisor opening to that in the canine region is 1.10, while the average incisor opening to molar ratio is approximately 1.55. These results question the validity of previous studies that suggested a ratio of 3:1. In his study on mounted casts, Wright demonstrated that when using a 1.5mm opening of the anterior guidance pin, the occlusal adjustment needed for the second molar was found to be less than 1.5mm. For this clinical evaluation, a group of volunteers underwent intraoral scanning to directly measure their teeth, eliminating any potential distortion that can occur with mounted casts. With low standard deviations and the close proximity of the median and means, the findings of this study strongly support the model and its results. In addition, the equation obtained from the findings can be used to address the openings in the canine and first molar regions without the need to mount the casts to an articulator. Deriving a mathematical equation can have a significant impact, especially when it comes to correcting an open bite. By carefully monitoring and reducing the tooth structure, this approach can effectively address the issue at hand. In cases of full-mouth rehabilitation where an increase in the vertical height is necessary, the equation can assist in making more accurate predictions of outcomes.

CONCLUSION

The present clinical study comprised a group of participants for whom intraoral scans were performed directly. This resulted in the elimination of any distortion that may have been caused by mounted casts using indirect measures. Furthermore, despite the fact that a substantial quantity of data was gathered, the results demonstrated a low degree of variation.

The validity of the model and the results may be inferred from the fact that the present study showed modest standard deviations and that the median and means were very close to one another. The foundation for calculating and forecasting changes in the vertical dimension was set by these results for the first time.

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