DIVINE PROPORTIONS ASSESSMENT IN EDENTULOUS PATIENTS BEFORE AND AFTER COMPLETE DENTURE INSERTION

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ABSTRACT

The objective of the present study was to evaluate the ratios between bones of the skull and face of edentulous patients, before and after complete denture insertion through cephalometry and evaluate the presence of divine proportion between bones. This was done to evaluate the fact that after esthetically restoring the vertical dimension whether the proportions between skull bones are near or far from divine proportions. If there is existence of divine ratio then this proportion can be used for complete denture fabrication in vertical and horizontal planes to evaluate esthetics. It was a cross sectional study carried out in five months duration from December 2018 to April 2019.

Thirty edentulous patients 15 males and 15 females, fulfilling the inclusion criteria were selected from the department of Prosthodontics, Lahore Medical and Dental College, Lahore. Non probability purposive sampling was used for subjects selection. Informed consent was taken.

Patients complete dentures were fabricated by conventional method. Two standardized lateral cephalometric head films were made of every patient, first without denture in mandibular rest position and second with denture in maximum intercuspation. The means of five different ratios before and after denture insertion were analyzed statistically by using paired t test. The difference between the mean ratios of face and skull bone with the golden ratio (1.618) was also calculated. The ratio R2 (N- Me/ANS-Me) which is related to total anterior facial height and lower anterior facial height, were closer to golden ratio after the insertion of complete denture. Furthermore R3 (Or-Me /ANS-PNS) also showed ratios closer to divine proportion.

Key Words: Divine proportions, Complete denture fabrication, Cephalomatery, Golden ratio

INTRODUCTION

The rate of completely edentulous patients has markedly reduced over the last decade in the developed countries.[1] However the prevalence of edentulism is constantly increasing in developing countries. This increase is due to the lack of health facilities and high prevalence of caries and periodontal diseases.[2] Complete denture fabrication for a Prosthodontic patient is always challenging as it requires the reconstruction and replacement of lost hard and soft tissues, that should also satisfy patient's esthetics and functional needs.[3,4]

The concept of golden proportion was described by Pythogoras, an ancient Greek mathematician.[5, 6] He correlated science with beauty. His concepts were later used by da Vinci's classic drawings of human anatomy.[7] According to various researchers golden proportion or divine proportion is the most pleasant proportion present between two measures. This golden ratio is 1.618 : 1.[8, 9] The concept of divine proportion has been applied in cephalometric analysis by many

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authors like Rickett's,[10] Zietsman et al, [11] Gil,[12] Gil and Medici Filho and[13] Medici Filho at al.[14] All these authors demonstrated the existence of divine proportion between various skull bones.

Restoring esthetics is one of the main objectives to meet during complete denture fabrication.[1] It is important to evaluate the position of mandible in relation to maxilla in vertical and horizontal plane if esthetics and functions have to achieved. [2, 1] In dental literature there are few studies, that relate the cephalometric measures and divine proportions as a tool to evaluate the results of Prosthodontic treatment.[5, 11, 12, 13, 14]

The purpose of the current study was to evaluate the proportions between skull and face bones in edentulous patients before and after complete denture insertion, using lateral cephalometery. If the ratios of these bones after complete denture insertion closely relate to the golden or divine proportion 1.618, then this ratio between stable and reproducible bone structures can be used for esthetic evaluation of complete denture fabrication in vertical and horizontal planes respectively.

MATERIALS AND METHODS

Thirty edentulous patients, 15 males and 15 females were selected from the Prosthodontics department, Lahore Medical and Dental College, Lahore. The study was carried out in 5 months duration from December 2018 till April 2019. Demographic data like age and sex was recorded. The age ranged from 38 to 75 years. Patients requiring complete denture prosthesis of both genders were included in the study. Patients with acquired and congenital orofacial defects, facial asymmetry and those not willing to undergo radiographs were excluded. Verbal consent was taken.

Cephalographs of patients were taken twice, one prior to complete denture insertion at rest position and the second the cephalograph was taken after complete denture insertion in maximum intercuspation. The cephalogram manufactured by Villa (Italy) model no. MRO5 with standardize ear plug, nose clamp and chin support was used.

According to Gill and Medici-Fillo,[13] if we want to evaluate the existence of divine proportion of skull and facial bones then it is important to obtain ratios for these bones. This can be obtained by distance between two points. So following points were considered (Orbitale Or - the lowest point on the margin of the orbit, Menton Me - the lowest point of contour of the mandibular symphysis, Anterior Nasal Spine - anterior point of nasal floor, Posterior Nasal Spine - posterior point of nasal floor, Gonion Go - most inferior, posterior, and lateral point on the external angle of mandible, Condillion Co - most superior posterior point on condyle, Nasion N- the most anterior point of the fronto-nasal suture in the midsagittal plane, Pogonion Pog - the most anterior point on the soft tissue chin.)

To determine the divine proportion of skull and

facial bones, the ratios R1, R2, R3, R4 and R5 were selected according to Gil and Medici-Fillo and separated in two groups that is before and after denture insertion (Table 1).

To avoid intra-examiner error the landmark in cephalograms were traced by one examiner. Average values of all five proportions of 30 individuals were calculated and their difference with golden ratio (1.618) was obtained (Table 1).

The comparison of the mean value of each ratio before denture and after denture was statistically analyzed by paired t test (Table 2).

To analyze data SPSS 20 was used. Quantitative variables like ratios between skull and face bones were presented as mean and ± standard deviation. A qualitative variable like sex was presented as frequency percentages. P-value ≤ 0.05 was considered for statistical significance.

RESULTS

A total of 30 edentulous patients 15 males and 15 females requiring complete dentures were included to evaluate the existence of divine proportion between various skull and face bones. Descriptive analysis like mean and ±SD were obtained by SPSS version 20. The mean age of the patients was 60 years with minimum age 38 and maximum 75 years respectively.

To check golden ratios among the groups, the difference between the ratios of face and skull bone with the golden ratio (1.618) was calculated. The ratio R2 (N- Me/ANS-Me) which is related to total anterior facial height and lower anterior facial height was closer to golden ratio after the insertion of complete denture (mean value 1.8). The ratio R3 (with the mean of 1.6) after denture insertion became closer to the divine proportion (1.618) Table 1.

The difference in mean ratios between the groups before denture and after denture insertion was verified by paired t test (P <0.05). Statistically insignificant difference was found between the two groups (before and after denture insertion) (Table 2).

DISCUSSION

The divine proportion or the golden ratio represents the most pleasing proportion that exist between two segments.[7] It is said from ancient times that stable, esthetically pleasing and functionally efficient structures are related to divine proportions. [15]

Esthetics is one of the important requirements of a patient undergoing Prosthodontic treatment. An improper vertical dimension can affect facial harmony and balance.[1, 2, 4] Cephalometry has been used to obtain the standardized radiographs of skull bones.[16, 17] Many authors have used cephalometry to investigate the presence of divine proportion in skull bones and orofacial structures and found satisfactory out comes.[18, 19, 20, 21, 22, 23] The present study reported evaluation of measurements

TABLE 1: AVERAGE VALUES FOR 5 PROPORTIONS IN 30 SUBJECTS (BEFORE AND AFTER DENTURE) INSERTION WITH DIVINE PROPORTION (N=30)

Before denture	Ratio	Mean	SD	Difference (Divine proportion- Ratio)
R1	Or-Me/COGO	1.353	±0.167	0.26
R2	Or-Me/N-ANS	1.925	±0.227	0.30
R3	Or-Me/ANS-PNS	1.671	±0.177	0.05
R4	N-Me/ANS-Me	1.810	±0.143	0.19
R5	N-Me/ANS-PNS	2.54	±0.291	0.92
After denture				
R1	Or-Me/COGO	1.337	±0.142	0.28
R2	Or-Me/N-ANS	1.877	±0.214	0.26
R3	Or-Me/PNS-ANS	1.667	±0.135	0.04
R4	N-Me/ANS-Me	1.836	0.121	0.22
R5	N-Me/ANS-PNS	2.505	0.234	0.88

TABLE2: COMPARISON OF PROPORTIONS (WITH AND WITHOUT DENTURE)

Ratio	Group	N	Mean	Paired t test	P value
R1	Or-Me/COGO Without denture	30	1.35 ±0.167	. 376	. 71
	With denture	30	1.337 ±0.142		
R2	Or-Me/N-ANS Without denture	30	1.925 ± 0.227	.802	. 43
	With denture	30	1.877 ± 0.214		
R3	Or-Me/PNS-ANS Without denture	30	1.671 ± 0.177	.538	. 59
	With denture	30	1.667 ±0.135		
R4	N-Me/ANS-Me Without denture	30	1.810 ±0.143	.757	. 44
	With denture	30	1.836 ± 0.121		
R5	N-Me/ANS-PNS Without denture	30	2.54 ±0.291	.471	. 64
	With denture	30	2.505 ±0.234		

of human skull bones by linear measurements before and after Prosthodontic treatment. This was done to evaluate the fact that after esthetically restoring the vertical dimension whether the proportions between skull bones are near or far from divine proportions.

In the present study we selected 30 edentulous patients, age ranged from 37 to 75 years. The results of the present study have shown that R2 and R3 values decreased after dentures due to decrease in Or-Me. This is due to the fact that radiograph of patient taken before treatment was at rest position, while in second radiograph the patient after denture insertion is in intercuspation. We found R2 ratio before and after treatment to be as 1.92 and 1.87 respectively. Costa CB and coworkers[24] did a similar study on 30 edentulous subjects and found R2 values before and after dentures up to 1.7and 1.8.The ratio R3 in current study before and after treatment was found to 1.7 and 1.67.This value has been closer to divine proportion that is 1.618 .Similarly Costa et al[24] found similar values 1.73 and

1.78. These values are closer to divine proportion. The ratio R4 in Costa[19] study was close to divine proportion as the values before and after treatment were 1.74 and 1.7 and they concluded that despite the significant difference between values they are closer to divine proportions. They further stated that these ratios are from two important segments N-Me total anterior facial height and ANS- Me lower anterior facial height, both are for verification of facial harmony. Similarly we found ratios of 1.81 and1.83 respectively which approached closer to the divine ratio . Just like present study Santos da Silva and the coworkers[18] found the presence of divine proportions in more than 80% of their sample. Furthermore Ricketts[10] found divine proportion when related similar measurements to Na-Me and ANS-Me. Gil, [12] Gil and Medici Filho[13] observed divine proportions in 80%of patients who had normal occlusion. Similarly S Rupesh and coworkers[25] found existence of divine proportions in facial profile of young females.

The ratio R3 in the present study approached to the

divine proportion. This ratio R3 relates two important segments, the total anterior facial height (N-Me) and the lower anterior facial height (ANS-Me) required to assess facial harmony and esthetics.

Thus we found the importance of divine proportion as mathematical key to get harmony and beauty that can be used as an auxiliary tool to assess esthetics in Prosthodontics. The present study attempted to find out the relationship of face and skull bone proportions to the divine proportion, considering other factors which are influential in determination of esthetics. On the basis of this it may be concluded that if the divine proportion is to be used as an aid to treatment planning, it should be used along with other factors.

CONCLUSION

It was concluded that statistically insignificant difference in means of all values were present before and after Prosthodontic treatment.

The ratio between Orbitale - menton /anterior nasal spine-posterior nasal spine approached closed to divine proportion after Prosthodontic treatment. The ratio nasion - menton /anterior nasal spine-menton depicts two important segments, the total anterior facial height and the lower anterior facial height, after Prosthodontic treatment approached closer to the divine proportion or golden ratio and this finding can be used to assess the esthetics of a patient after denture insertion.

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