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Evaluation of Maxillary Anterior Teeth Proportion in Maharashtrian Population Using Chu's Proportion Gauge.

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Abstract

Background: Creating geometric proportion to relate width and height of maxillary anterior teeth is a critical aspect in Esthetic dentistry.

Aim: To evaluate width to height proportion of maxillary anterior teeth in Maharashtrian population using Chu's proportion gauge.

Settings and Design: The study was carried out human subjects in the department of Prosthodontics.

Methods and Material: This study was conducted on 100 Maharashtrian subjects, 50 being male subjects and 50 female subjects. Individuals who fulfilled all the inclusion criteria set for the study were clinical examined and Chu's proportion gauge was used to determine the width and height ratio in these individuals.

Results and Conclusions: It was observed that 93.3% of male population with aesthetic smile followed the Chu's proportion gauge while for female it was 95.7% and in total 94.5 % of the subjects from Maharashtrian population followed Chu's proportion gauge.

Keywords: Anterior teeth, Chu's proportion gauge, Esthetics, Tooth proportion.

Introduction

Anterior aesthetics is of prime importance for all individuals. It is of importance in aesthetic dentistry to replace or restore the anterior teeth in harmony as during a smile it is the facial aspect of these teeth that is visible. Authors have given the ratio of 1:1.618 as a means of achieving aesthetic dental relationships.[1-3] This is known as the golden proportion or the divine proportion. It is considered as a cornerstone in the smile designing theory.

Lombardi was the first to suggest the application of the golden proportion in dentistry. He said that the golden proportion was 'too strong' for use in determining tooth size. He also described the use of a 'repeated ratio' in the maxillary anterior teeth. This implies that an optimized dentofacial composition of the lateral to central incisor width and the canine to lateral incisor width are repeated in proportion.[4] Levin suggested the use of the theory of Golden proportion to relate the successive width of the anterior teeth, as viewed from the labial aspect. He said that the width of the central incisor should be in golden proportion to the width of the lateral incisor and that the lateral incisor should be in golden proportion to the width of the canine, when viewed from the front.[3] He invented a grid to evaluate golden proportion and to apply it in the dentition to achieve appropriate proportions of the teeth. Golden proportion is a relation which is ideal, perfect, desirable and helps in the evaluation of dominance, symmetry and proportion in the dentition.[3]

Aesthetic measurement gauges (ie, Chu's Aesthetic Gauges, Hu-Friedy Inc, Chicago, IL), designed for diagnosis and correction of tooth size discrepancies and deformities, have been developed to eliminate the subjectivity associated with restorative care. These measurement tips include the Proportion Gauge (PG), which represents an objective mathematical appraisal of tooth size ranges. Through the use of such instrumentation, the clinician has a clearly visible means of applying aesthetic values to a patient chair side, directly or indirectly in the laboratory during projected treatment planning, and to objectively determine the intended treatment outcome.[5]

These measurement gauges (ie, Chu's Aesthetic Gauges, Hu-Friedy Inc, Chicago, IL) allow standardization of tooth size parameters, as well as objective communication between clinicians and auxiliaries involved in comprehensive patient care from diagnosis, indirect case planning treatment provisional restorations, and verification of tooth size correction to the final aesthetic restorative outcome.[5]

Clinical data on applicability of Chu's Proportion gauge is lacking in Maharashtrian population. The Maharashtrian population seeming to have an aesthetic smile and its relation with Chu's proportion gauge is yet to be studied. Following study relates the Chu's proportion gauge values with Maharashtrian population.

Method

A total of 100 dentulous subjects comprised 50 males and 50 females, with age ranging between 21 and 30 years were chosen for the study. The subjects were the students (postgraduates, undergraduates, interns and technicians), patients, and their attendants who visited the hospital. All subjects were from various places in the state of Maharashtra, India. The sample was grouped according to gender to determine the effect on the correlation of the measurements. Informed consent was obtained from all the subjects prior to their participation.

The inclusion criteria were:

1. No missing maxillary and mandibular anterior teeth,
2. Age group of 21-30 years old.
3. No History of dental anomalies associated with tooth size and morphology alteration.
4. No mal-alignment, crowding, spacing or restoration.
5. No inflamed gingival or periodontal conditions or periodontal surgery.
6. No history of orthodontic treatment.

The exclusion criteria were

1. Teeth having maxillary anterior restorations or history of trauma or maxillofacial surgery.
2. Presence of rotation, spacing or crowding.
3. Presence of severe dentofacial deformities or obvious asymmetries.

Individuals having satisfied the inclusion/exclusion criteria of the study were taken. Incisal edge position of the tooth was determined. Chu's proportion gauge comprises of T-bar tip (regular alignment) and In-line tip (crowded alignment). T-bar tip is screwed to the handle. Chu's proportion gauge was held in upright position with incisal edge/ tip of tooth touching the incisal rest part of the gauge. The colour coded band on the horizontal arm of T-bar was adjusted to the width of the tooth, and then the colour coded band on vertical arm for height was checked. If the colour coded band of width matched with the colour coded band of height, then 'YES' was marked. If the colour coded band of width did not matched with the colour coded band of height, then 'NO' was marked.

Result

This study was conducted on 100 Maharashtrian subjects, 50 being male subjects and 50 female subjects. Individuals who fulfilled all the inclusion criteria set for the study were clinical examined and Chu's proportion gauge was used to determine the width and height ratio in these individuals.

It was observed that 93.3% of male population with aesthetic smile followed the Chu's proportion gauge while for female it was 95.7% and in total 94.5 % of the subjects from Maharashtrian population followed Chu's proportion gauge. (Table 1)

Discussion

This study was carried out with the aim of determining the width to length ratio of maxillary anterior teeth using Chu's Proportion Gauge. In recent years, aesthetic dentistry has become a major focus for the public.

It is relatively difficult and inconvenient for dentist to mathematically calculate the width and height ratio of maxillary teeth as a diagnostic approach for further treatment planning. Thus Dr. Chu introduced Proportion gauge inorder to make it easy for the dentist to carry out diagnosis and treatment planning. Sterrett et al.[6] in 1998 had carried out a study to know the mean width to length ratio of anterior teeth. They had concluded that within male and female Caucasians, the mean width/ length ratio of the maxillary 3 anterior tooth groups is 0.81. This 0.81 width to length ratio is highly accepted and widely used.

Dr. Chu's Proportion gauge is based on a pre-determined width and height ratio of 78 %.

Till now no study was found which checked the validity of Chu's proportion gauge in Maharashtrian population. Therefore, this study was taken up.

This study was conducted on 100 Maharashtrian subjects, 50 being male subjects and 50 female subjects. Individuals who fulfilled all the inclusion criteria set for the study were clinical examined and Chu's proportion gauge was used to determine the width and height ratio in these individuals.

Chu's proportion gauge was held in upright position with incisal edge/ tip of tooth touching the incisal rest part of the gauge. The colour coded band on the horizontal arm of T-bar was adjusted to the width of the tooth, and then the colour coded band on vertical arm for height was checked.[5] It was observed that 93.3% of male population with aesthetic smile followed the Chu's proportion gauge while for female it was 95.7% and in total 94.5 % of the subjects from Maharashtrian population followed Chu's proportion gauge. The PG is designed as a double-ended instrument (ie, gauge) with a T-Bar and In-Line tip screwed into the handle at opposing ends. The T-Bar tip features an incisal edge position (ie, incisal stop); when a tooth is oriented with the tip accordingly, the practitioner can accurately evaluate its length (ie, vertical arm) and width (ie, horizontal arm) dimensions simultaneously. The width is indicated in equidistant 0.5-mm increments bilaterally, each with a vertical mark in a corresponding color. [5]

Individual tooth size is considered as building blocks of a smile design. Once the tooth size and proportion of the maxillary anterior teeth are corrected, they can then be arranged within the dental arch. Intra-arch tooth relationship proportions such as the recurring aesthetic dental proportion, which has been found to be amenable to patients and clinicians, can be used to arrange the teeth for a pleasing smile. This task is simplified in removable prosthodontics, in which selection of the proper tooth size and form is the primary step before their arrangement within the dental arch or tooth setup. With the natural dentition, this task is infinitely more difficult, since the dilemma is such that existing teeth may exhibit altered width and/or length discrepancies due to developmental anomalies, changes resulting from the aging process, or prior restorative procedures. Therefore, correction may require combination therapies such as orthodontics and/or Periodontics prior to aesthetic restorative dentistry.[5]

In daily practice, the clinician's use of "nonstandard" proportions to treat teeth with abnormal size relative to accepted width and height values can yield narrow or square teeth that are unnatural in size and shape and fail to achieve the aesthetic expectations of either the patient or clinician. This can be particularly challenging when performed with visual assessment only (ie, absent of clinical tools). Standardized individual tooth size and proportions fall within a given range around mean values, however, and gender differences exist between anterior tooth groups. Therefore, these parameters can be used to predictably diagnosis and correct discrepancies in tooth size and individual tooth proportion. Aesthetic tooth dimensions can be evaluated and treated by similar numerical analysis. To test the application of these concepts, Dr. Chu created a prototype instrument which was later modified into a more sophisticated Chu's proportion gauge.[5] The present study may prove the applicability of Chu's proportion gauge in Maharashtrian population. Still a large number of subjects should be tested to prove the applicability of Chu's gauge in Maharashtrian as well as Indian population and also different race, religion and ethnicity of people should be tested.

Conclusion

Within limitation of present study, Chu's proportion gauge was proved to be applicable in 94.5% of Maharashtrian population.

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Legends Tables and figure

Table 1: Master table

Sr. No.	Age	M/F	Acceptability according to Chu's Proportion Gauge for maxillary anterior teeth (YES/NO)					
			LCI	LLI	LC	RCI	RLI	RC
1.	25	M	YES	YES	YES	YES	YES	YES
2.	28	M	YES	YES	YES	YES	YES	YES
3.	26	M	YES	YES	YES	YES	YES	YES
4.	27	M	YES	NO	YES	YES	YES	YES
5.	24	M	YES	YES	YES	YES	YES	YES
6.	27	M	YES	NO	YES	YES	YES	YES
7.	25	M	YES	YES	YES	YES	YES	YES
8.	24	M	YES	YES	YES	YES	YES	YES
9.	24	M	YES	YES	YES	NO	YES	YES
10.	21	M	YES	YES	YES	YES	YES	YES
11.	22	M	YES	YES	YES	YES	NO	YES
12.	23	M	YES	YES	YES	YES	NO	YES
13.	21	M	YES	YES	YES	YES	YES	YES
14.	24	M	YES	YES	YES	YES	YES	YES
15.	25	M	YES	YES	YES	YES	NO	YES
16.	24	M	YES	YES	YES	YES	YES	YES
17.	22	M	YES	YES	YES	YES	YES	YES
18.	21	M	YES	YES	YES	YES	YES	YES
19.	25	M	YES	YES	YES	YES	YES	YES
20.	23	M	YES	YES	YES	NO	YES	YES
21.	21	M	YES	YES	YES	YES	YES	YES
22.	26	M	YES	YES	YES	YES	YES	YES
23.	29	M	YES	YES	YES	YES	YES	YES
24.	26	M	YES	YES	YES	YES	YES	YES
25.	27	M	YES	NO	YES	YES	YES	YES
26.	24	M	YES	YES	YES	YES	NO	YES
27.	24	M	YES	YES	YES	YES	YES	YES
28.	23	M	YES	YES	YES	YES	YES	YES
29.	22	M	YES	YES	YES	YES	YES	YES
30.	21	M	YES	YES	YES	YES	NO	YES

31.	23	M	YES	YES	YES	YES	YES	YES
32.	23	M	YES	YES	NO	YES	YES	NO
33.	24	M	YES	YES	YES	YES	NO	YES
34.	23	M	YES	YES	YES	NO	YES	YES
35.	22	M	YES	YES	YES	YES	YES	YES
36.	25	M	YES	YES	YES	YES	YES	YES
37.	21	M	YES	YES	YES	YES	YES	NO
38.	24	M	YES	YES	YES	NO	YES	YES
39.	22	M	YES	NO	YES	YES	YES	YES
40.	23	M	YES	YES	YES	YES	YES	YES
41.	27	M	YES	YES	YES	YES	YES	YES
42.	26	M	YES	YES	NO	YES	YES	YES
43.	25	M	YES	YES	YES	NO	YES	YES
44.	27	M	YES	YES	YES	YES	YES	YES
45.	24	M	YES	YES	YES	NO	YES	YES
46.	24	M	YES	YES	YES	YES	YES	YES
47.	23	M	YES	YES	YES	YES	YES	YES
48.	23	M	YES	YES	YES	YES	YES	YES
49.	25	M	YES	YES	YES	YES	YES	YES
50.	23	M	YES	YES	YES	YES	YES	YES
51.	23	F	YES	YES	YES	YES	YES	YES
52.	24	F	YES	YES	YES	YES	YES	YES
53.	21	F	YES	YES	YES	YES	YES	YES
54.	21	F	YES	YES	YES	YES	YES	YES
55.	24	F	YES	YES	YES	YES	YES	YES
56.	23	F	YES	YES	YES	YES	YES	YES
57.	25	F	YES	YES	YES	YES	YES	YES
58.	26	F	NO	YES	YES	YES	YES	YES
59.	23	F	YES	YES	YES	YES	YES	YES
60.	21	F	YES	NO	YES	YES	YES	YES
61.	21	F	YES	YES	YES	YES	YES	YES
62.	21	F	YES	YES	YES	YES	YES	YES
63.	21	F	YES	YES	YES	YES	YES	YES
64.	25	F	YES	NO	YES	YES	YES	YES
65.	28	F	YES	YES	YES	YES	YES	YES

66.	27	F	YES	YES	YES	YES	YES	YES
67.	28	F	YES	YES	YES	YES	YES	YES
68.	29	F	YES	YES	YES	YES	YES	YES
69.	25	F	YES	YES	YES	NO	YES	YES
70.	24	F	YES	YES	YES	YES	YES	YES
71.	24	F	YES	YES	YES	YES	YES	YES
72.	22	F	YES	YES	NO	YES	YES	YES
73.	23	F	YES	YES	YES	YES	YES	YES
74.	21	F	YES	YES	YES	YES	YES	YES
75.	21	F	YES	YES	YES	YES	YES	YES
76.	22	F	YES	NO	YES	NO	YES	YES
77.	21	F	YES	YES	YES	YES	YES	YES
78.	23	F	YES	YES	YES	YES	YES	YES
79.	23	F	YES	YES	YES	YES	YES	YES
80.	22	F	YES	YES	YES	YES	YES	YES
81.	23	F	YES	YES	YES	YES	YES	YES
82.	21	F	YES	YES	YES	YES	YES	NO
83.	23	F	YES	YES	YES	YES	YES	YES
84.	22	F	YES	YES	YES	YES	YES	YES
85.	25	F	NO	YES	YES	YES	YES	YES
86.	24	F	YES	YES	YES	NO	YES	YES
87.	23	F	YES	YES	YES	YES	YES	YES
88.	22	F	YES	YES	YES	YES	YES	YES
89.	21	F	YES	YES	YES	YES	YES	YES
90.	21	F	YES	YES	YES	NO	YES	YES
91.	24	F	YES	YES	YES	YES	YES	YES
92.	24	F	YES	YES	YES	YES	YES	YES
93.	23	F	YES	YES	YES	YES	YES	YES
94.	23	F	YES	YES	YES	YES	YES	YES
95.	26	F	YES	YES	YES	YES	YES	YES
96.	24	F	YES	YES	YES	YES	NO	YES
97.	24	F	YES	YES	YES	YES	YES	YES
98.	21	F	YES	YES	YES	YES	YES	YES
99.	23	F	YES	YES	YES	YES	NO	YES

100.	22	F	YES	YES	YES	YES	YES	YES

Figure

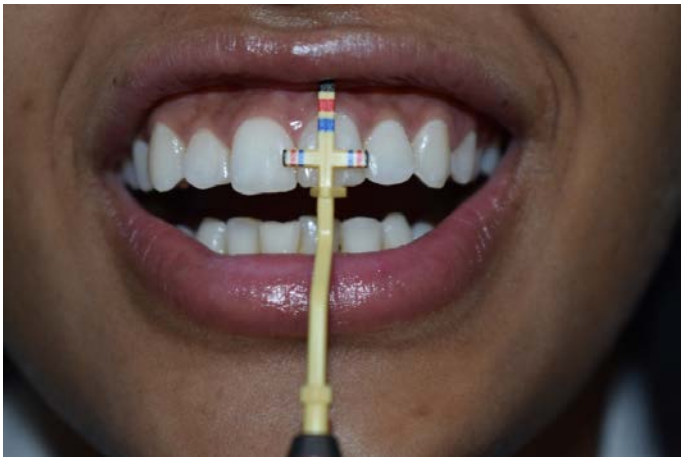

Figure 1: Measuring maxillary central incisor by using Chu's proportion gauge

Figure 2: Measuring maxillary lateral incisor by using Chu's proportion gauge

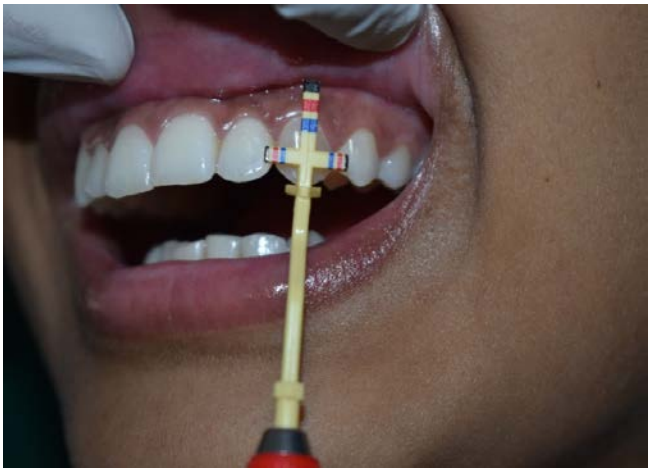

Figure 3: Measuring maxillary canine by using Chu's proportion gauge