Symmetrical comparison of crown size, morphology and gingival shape in maxillary incisors

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Abstract

Background: Maxillary anterior tooth proportion has special value in dental aesthetics. Restorative dentistry often involves correcting tooth size discrepancies. Therefore, dental biometrics should play an important role in the planning of an aesthetic restoration.

Objectives: To assess and compare clinical crown dimensions and classify crown shape and gingival shape of the maxillary incisors in order to collect anatomical data on the anterior teeth of young population visiting the tertiary centre.

Methods: This descriptive cross-sectional study conducted in department of Prosthodontics in November 2021 after getting ethical approval among dental students and patients attending the hospital, with permanent healthy dentitions. Impression of maxillary and mandibular arches were made with alginate and poured in dental stone. Measurement of maxillary central incisors was done for length and thickness with the digital vernier calliper. Convenience sampling was done. Data were recorded and analysis done with SPSS v.20.

Results: The mean value of crown length, crown thickness, mesiodistal width of left central incisor was greater compared to the right side (Left vs Right: 9.01 ± 1.14 mm vs 9 ± 1.14 mm , 7.04 ± 0.67 mm vs 6.96 ± 0.61 mm, 8.25 ± 0.59 mm vs 8.20 ± 0.51 mm).

Conclusion: Crown length and crown width of maxillary left central incisor were greater compared to maxillary right central incisor. Shape of maxillary incisors determines the shape of the gingiva. The average values of length and widths of the central incisors derived from this study can be a valuable template for prosthodontic and aesthetic planning.

Key words: Central incisor; Crown size; Gingival shape; Maxillary incisors.

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INTRODUCTION

Aesthetic dentistry often involves correcting tooth size discrepancies. Proportion of each individual tooth within maxillary anterior region is percentage obtained by dividing its width by its length.[1] Several authors have tried to establish a set figure for this proportion in order to facilitate aesthetic restoration of a smile.[2-4] Width of anterior teeth and their relation to one another, play crucial role in planning of aesthetics rehabilitation where patients desire to improve their smile appearance.[1]

Treatment that restores masticatory function and treats active disease, without achievement of aesthetic ideals, is often not considered to be complete success and can give rise to dissatisfaction with treatment.[5] Understanding aesthetic perception and knowledge of ideal width to height ratio can facilitate decision making and provide guidance for achieving aesthetic result.[6] Factors that affect aesthetics of smile are shape, size, colour, symmetry of teeth, gingiva, and papillary shape.

These characteristics are different according to race, even among individuals of same race.[7] Purpose of this investigation was to analyse clinical crown dimensions and classify crown shape and gingival type, to collect anatomical data on anterior teeth of population visiting tertiary hospital which may open scope for future study in large scale to generalise the Nepali population.

METHODOLOGY

A descriptive cross-sectional study was conducted in department of Prosthodontics, in dental students and patients attending the hospital, with permanent healthy dentitions. The study was carried out during 1st November to 30th November, 2021 after getting ethical approval from the Institutional review committee of Kantipur Dental College and Hospital (Ref. 24/021). The inclusion criteria were complete permanent dentition. Patient with deformities of jaw and teeth, missing anteriors, attrition, severe malocclusion, history of previous or current orthodontics treatment, history of previous coronoplasty were excluded. Convenience sampling was done. Sample size was calculated as, n $= Z^2 SD^2/e^2 = (2.58)^2 \times (0.6)^2/ (0.25)^2 = 38.34$; where, n = Sample size; SD = Standard deviation = 0.6^1; e= Margin of error = (25%); Z = 2.58 at 99% CI.

The total sample size calculated was 38.34 however a sample of 43 patients were taken due to availability of study cases and better yield of result. All the selected participants were informed about the procedure to be performed and verbal consent was obtained.

Impression of maxillary arches was made with alginate (Dentsply) (Figure 1). Casts were poured in dental stone and a single investigator performed all measurements. The traditional vernier method was used with digital APCO aluminium vernier calliper that is precise to 0.01 mm. The measured values of tooth dimensions were Mesiodistal width of the clinical crown (MDW): The widest mesiodistal width between the inter proximal contacts on the labial surface of the tooth. Clinical crown length (CL): The longest apicocoronal distance (parallel to the long axis) of the tooth, from the incisal edge to the gingival zenith. Interdental papilla height (PH): The distance parallel to the long axis of the tooth from the highest point of the interdental papilla to the line that connects the gingival zenith of two adjacent teeth on the distal segment of each tooth. Crown thickness:

After evenly dividing the crown length into three parts, the buccopalatal thickness of the border between the middle one-third and the incisal one-third of the crown length (Figure 2).[8] All the measurements were recorded and statistical analysis were done in SPSS version 20. Mean and standard deviation of all the measurement were calculated. Student t test were applied to compare the mean of the measurement of either side. p-value of <0.05 is considered significant.

RESULTS

Measurements were done among 43 individuals. Mean clinical crown length (CL), crown thickness, mesiodistal width of the clinical crown (MDW), and papillary height (PH) of maxillary central incisors (MCI) were measured (Table 1). The mean value of the clinical crown length (CL) of MCI was 9.1 ± 1.14 mm on left and 9 ± 1.14 mm on right side. The average value of the crown thickness of MCI was 7.04 ± 0.67 mm on left and 6.96 ± 0.61 mm on right side. The average value of the mesiodistal width of the clinical crown (MDW) was 8.25 ± 0.59 mm on left and 8.20 ± 0.51 mm on right side. The average value of the interproximal papillary height was 3.53 ± 0.91 mm in between the right maxillary incisors, and 3.46 ± 0.88 mm on left side.

Upon dividing the incisors into three groups, the authors found that the ovoid type made up the largest proportion (24, 55.8%) of the central incisors followed by square type (13, 30.2%) and tapered type 6 (14%) (Figure 3). Gingival shape was classified according to tooth shape; thus, the distribution of gingival shape appeared the same as the distribution of tooth shape (Figure 4).[6]

Moreover, tapered teeth correlated with scallop shaped gingiva, while square teeth correlated with flat shaped gingiva, and oval teeth correlated with moderate shape.

Table 1: **Mean values and standard deviations (SD) of crown length, thickness, mesiodistal width and papillary height (N=43)**

Measurement (in mm)	Left	Right
Crown length	9.1 ± 1.14	9 ± 1.4
Crown thickness	7.04 ± 0.67	6.96 ± 0.61
Mesiodistal width	8.25 ± 0.59	8.20 ± 0.51
Papillary height	3.53 ± 0.91	3.46 ± 0.88

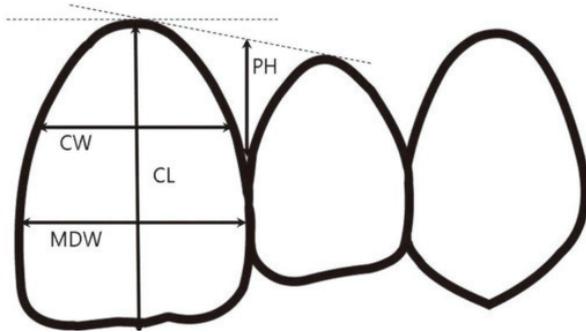**Figure 1:** Technique of measurement of tooth dimension

Figure 2: Tooth dimension

Abbreviation: MDW: Mesiodistal width of the clinical crown; CL: Clinical crown length; PH: Inter dental papilla height; CW: Crown width.
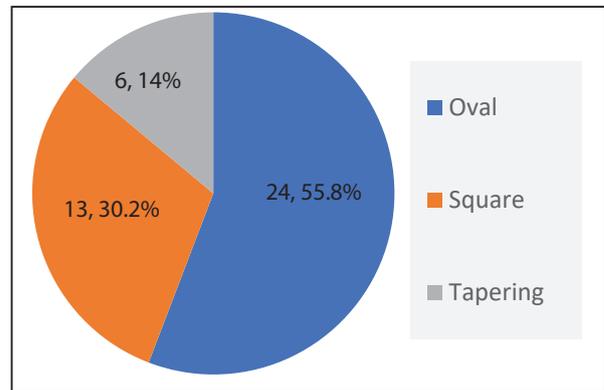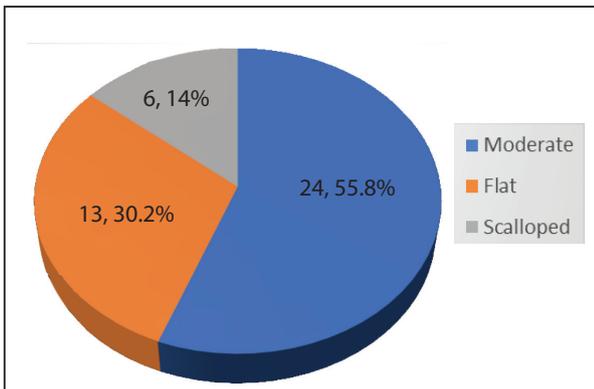

Figure 3: Shape of tooth

Figure 4: Shape of gingiva

DISCUSSION

Aesthetics of a person is a combination of qualities such as shape, proportion, colour of human face form or in other objects that delights the sight. For the aesthetics of smile, understanding of intraoral structures such as shape of teeth, gingiva, lips as well as surrounding oral mucosa is necessary. Artificial denture aesthetic is generally considered to be naturalness in the appearance of the orofacial regions, in the function of the mandible and lips and the using aesthetically appropriate tooth forms and alignments with composition and colours.[8] The relative dimensions of teeth seem to be the most objective dental criteria within the aesthetic requirement with the measurement of the anterior teeth and shape of gingiva.

To study tooth measurements, plaster model, radiographs, or three-dimensional measurements made with a computer are generally used.[9] This study used the plaster model method because the required data were limited to the clinical crown. The length was measured from the gingival margin to the incisal edge or where gingival recession was present then the cementoenamel junction to the incisal edge was considered. Tooth size ratios represent a valid diagnostic tool that allows prediction of treatment outcomes. This suggests that they could be helpful in the anterior tooth ratio and should therefore be examined clinically at the beginning of treatment to detect any major size and shape variation.[10]

In most cases it is assumed that the matching teeth on both sides have similar or even identical mesiodistal and gingivoincisal diameters.[11] Alqahtani and colleague compared the length and width of the corresponding right and left side teeth showed some minor variations. The maximum differences found were up to 0.06 of

a millimetre and were statistically nonsignificant.[12] In contrast to the study done by Vadavadagi and colleague, who evaluated the variation is size and form between left and right maxillary central incisor teeth and reported that crown width of maxillary central incisor was greater on the right side as compared to that of the left.[11] Statistically significant differences were observed on comparing the mean height and width values of the left and right central incisors (p-value <0.05). In a measurement done by Song among 50 Korean population, the average length of the maxillary central incisors was 9.89 mm and the mesiodistal width was 8.54 mm which is comparable to current study population.[8]

Regarding the maxillary anterior gingiva, Melo and colleague have reported that the morphological characteristics of periodontal tissue and clinical crown shape are related to each other and that the ratio of cervical width to crown length (CW/CL) in anterior teeth can be used to distinguish between periodontal biotypes.[13] Referring to these studies, the authors categorised gingival type according to tooth shape and divided teeth according to the CW/CL ratio. The result of correlation analysis between average tooth shape and papillary height signifies that a smaller CW/CL ratio is correlated with a greater papillary height.[14,15] In other words, tapered teeth are correlated with scallop shaped gingiva, while square teeth are correlated with flat shaped gingiva. In a measurement done by Song and colleague, ovoid type was the most common tooth shape (48%), followed by square type (29%) and tapered type (23%) in the central incisors.[8] Tooth shape and gingival type were correlated with each other. Similarly, in current study, shape of teeth was ovoid (24, 55.8%), square (13, 30.2%), and tapered (6, 14%). The width and

thickness of keratinised gingiva in relation to tooth shape is also a necessary avenue for future study.

The different studies published to date are characterised by a lack of homogeneity in the analytical methods used.[7,15-16] Some authors perform measurements on anatomical crowns of extracted teeth while others obtain digital photographs to measure the clinical crown using virtual callipers.[7,12] Plaster casts have also been used.[15] These methodological differences make it difficult to compare the different published studies. Variability is moreover also observed in the methods used to determine the proportions. Some studies use the Levin grid, while others base their calculations on digital photographs.[14,16] It therefore would be of great interest to define a standardised protocol allowing the systematic conduction of studies, with adequate comparisons of the results obtained.

CONCLUSION

Crown length and crown width of maxillary left central incisor were greater compared to maxillary right central incisor. The average values of length and widths of the central incisors derived from this study can be a valuable template for prosthodontic and aesthetic planning. Larger sample size with gender division, diverse ethnic groups will be needed to portrait this study as an average in the Nepali population.

ACKNOWLEDGEMENTS

REFERENCES

1. Shrestha P, Paudel S, Neupane M, Lamba S. Anterior tooth width measurements among patients in a tertiary hospital of Nepal: A descriptive cross-sectional study. J Nepal Med Assoc. 2020;58(226):396-9. [PubMed | Full Text | DOI]

2. Yin XJ, Wei BY, Ke XP, Zhang T, Jiang MY, Luo XY, et al. Correlation between clinical parameters of crown and gingival morphology of anterior teeth and periodontal biotypes. BMC Oral Health. 2020;20:1-8. [PubMed | Full Text | DOI]

3. Ngoc VTN, Tran DK, Dung TM, Anh NV, Nga VT, Anh LQ, et al. Perceptions of dentists and non-professionals on some dental factors affecting smile aesthetics: A study from Vietnam. Int J Environ Res Public Health. 2020;17(5):1638. [PubMed | Full Text | DOI]

4. Ahmed N, Abbas, Abbas AM, Maqsood A. Evaluation of recurring aesthetic dental proportion in natural smile of Pakistani sample. Pak Oral Dent J. 2014;34:739-42. [Full Text]

5. Cooper GE, Tredwin CJ, Cooper NT, Petrie A, Gill DS. The influence of maxillary central incisor height-to-width ratio on perceived smile aesthetics. Br Dent J. 2012 Jun 22;212(12):589-99. [PubMed | Full Text | DOI]

6. Chou YH, Tsai CC, Wang JC, Ho YP, Ho KY, Tseng CC. New classification of crown forms and gingival

characteristics in Taiwanese. Open Dent J. 2008;2:114-9. [Full Text | DOI]

7. Bhat V, Shetty S. Prevalence of different gingival biotypes in individuals with varying forms of maxillary central incisors: A survey. J Dent Implant. 2013;3(2):116-21. [Full Text]

8. Song JW, Leesungbok R, Park SJ, Chang SH, Ahn AJ, Lee SW. Analysis of crown size and morphology, and gingival shape in the maxillary anterior dentition in Korean young adults. J Adv Prosthodont. 2017;9:315-20. [PubMed | Full Text | DOI]

9. Magne P, Gallucci GO, Belser UC. Anatomic crown width/length ratios of unworn and worn maxillary teeth in white subjects. J Prosthet Dent. 2003;89(5):453-61. [PubMed | Full Text | DOI]

10. Townsend GC, Brown T. Heritability of permanent tooth size. Am J Phys Anthropol. 1978;49:497-504. [PubMed | Full Text | DOI]

11. Vadavadagi SV, Hombesh MN, Choudhury GK, Deshpande S, Anusha CV, Murthy DK. Variation in size and form between left and right maxillary central incisor teeth. J Int Oral Health. 2015;7(2):33-6. [PubMed | Full Text]

12. Alqahtani AS, Habib SR, Ali M, Alshahrani AS, Alotaibi NM, Alahaidib FA. Maxillary anterior teeth dimension and relative width proportion in a Saudi subpopulation. J Taibah Uni Med Sci 2021;16(2):209-16. [PubMed | Full Text | DOI]

13. Melo M, Ata-Ali F, Huertas J, Cobo T, Shibil JA, Galindo-Moreno P, Ata-Ali J. Revisiting the maxillary teeth in 384 subjects reveals a deviation from the classical aesthetic dimensions. Sci Rep. 2019;9(1):730. [PubMed | Full Text | DOI]

14. Kulshrestha R, Agarwal K, Kant A, Singh K, Singh D, Kant R. Evaluation of golden proportion in north Indian individuals with an aesthetic smile. J Dent Oral Care Med. 2019;3(1):1-5. [Full Text | DOI]

15. Al-Marzok, Abdul Majeed KR, Ibrahim KI. Evaluation of maxillary anterior and their relation to the golden proportion in Malaysian population. BMC Oral Health. 2013;13:9. [PubMed | Full Text | DOI]

16. Sah SK, Zhang HD, Chang T, Dhungana M, Acharya L, Chen LL, et al. Maxillary anterior teeth dimensions and proportions in a central mainland Chinese population. Chin J Dent Res. 2014;17(2):117-24. [PubMed | Full Text | DOI]