

Symmetry of gingival zenith: Defining esthetic outcome

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ABSTRACT

Background: The appearance of gingival tissues plays a critical role in the esthetics of maxillary anterior region. Location of gingival zenith in a medial-lateral position too long axis of teeth varies for each individual tooth. The position of lateral incisor teeth relative to gingival zeniths of adjacent proximal teeth that is the central incisor and canine also affects symmetry. **Aim:** The aim of the study was to quantify these clinical parameters useful as esthetic guidelines and to compare left and right sides of six maxillary anterior teeth. **Materials and Methods:** A sample population of 20 patients (6 males and 14 females) with a total of 240 teeth with healthy gingival tissue was selected by randomized sampling method. Two clinical parameters were evaluated on the right and left sides of maxillary anterior teeth-gingival zenith position (GZP) from the vertical bisected midline (VBM) of the tooth and gingival zenith level (GZL) of lateral incisors in an apical-coronal direction relative to line joining the tangents of the GZP of the adjacent central incisor and canine. The data were statistically analyzed using one-way ANOVA. **Results:** All incisors displayed a distal GZP from VBM, with a mean of 1.8 mm and 0.93 mm, on the right and left sides of central and 0.48 mm and 0.54 mm on the right and left sides of laterals, respectively. GZP of canine was centralized along the long axis of canine in, 60% of the population on the right side, and in 70% of the population on the left side. The GZL was approximately 1 mm and 0.93 mm, on the right and left side, respectively. **Conclusion:** There was a statistically significant difference in the GZP and GZL in the right and left sides ($P < 0.05$). The results could be used as reference points during esthetic anterior oral rehabilitation.

KEY WORDS: Esthetics, Gingival zenith, Gingival zenith line, Gingival zenith position

INTRODUCTION

Attitudes toward the significance of our general overall appearance have presented rapid changes as we step toward future. In this context, the dental appearance is no exception. To create a natural facial and dental appearance is a skill of the dental clinicians. Dentogingival complex is a part of the dentofacial esthetic paradigm.^[1,7] The attractiveness of smile is characterized by various factors involving both the teeth and the surrounding soft tissues.

Gingival esthetics has always been an important component of a beautiful smile.^[2,6] An ideal smile depends on the symmetry and balance of the facial and dental features. Beautiful restorations surrounded by unattractive gingival tissues can negatively impact on a smile. Gingival health is among the first fundamental esthetic objectives during treatment planning; it is also essential to consider gingival morphology and contour.

The ideal gingival architecture has been described as one that consists of knife-edged gingival margins tightly adapted to the teeth, interdental grooves, and cone-shaped interdental papilla.^[3,6] Nordland and Tarnow's classification of abnormal interdental papilla is one that fills the embrasure space to the apical extent of the interdental contact area.^[4,6]

The deviation from the normal interdental papilla will result in an unesthetic gingival "black triangle," and gingival asymmetry can lead to visual stress and imbalance.^[5] Adjunctive therapies, including periodontal plastic surgery, are recommended to optimize gingival contours for restorative treatment in the presence of severe gingival deformity. Understanding the dentogingival interface will allow clinicians to achieve a more satisfactory esthetic outcome during interdisciplinary diagnosis and treatment.

The purpose of this study was to use clinical parameters of the gingival zenith, as esthetic guidelines to craft the gingival contour and compare the left and right sides of six maxillary anterior teeth. Such consideration

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helps clinicians in the planning of dental treatments of smile designing, crown lengthening procedure, crown placement, teeth selection, implant esthetics, and laminates.

MATERIALS AND METHODS

A sample population of 20 patients (6 males and 14 females) with healthy gingival tissue was selected by randomized sampling method within Saveetha Dental College. The patients selected, ranged in age from 18 to 38 years, and were in good systemic health.

Inclusion Criteria

The following criteria were included in this study:

1. Non-restored maxillary anterior teeth,
2. Those with no anterior crowding or spacing,
3. Teeth with no visible signs of excessive incisal attrition, gingival recession, gingival overgrowth, or altered passive eruption.

Exclusion Criteria

The following criteria were excluded from the study:

1. Orthodontically treated patients,
2. Patients with systemic health conditions,
3. Smokers (>10 cigarettes per day).

Photographs were taken using a DSLR camera, focusing the area, used to measure the 240 sites of the anterior maxillary teeth from canine to canine [Figure 1]. Grid lines were used to record the readings using the software (Adobe Photoshop CC 2015). To define the VBM of each clinical crown, the tooth width was measured at two reference points. The proximal contact area and the apical contact area of the maxillary anterior teeth served as the reference points. Each width was divided in half, and the center points were marked. Center points were extended to a line along the long axis of each maxillary teeth, to define the VBM. The highest point of the gingival margin was highlighted and marked. The distance of the highest gingival margin position to the VBM was measured along the VBM of central incisors, lateral incisors, and canines to obtain the gingival zenith position (GZP) in a medialateral direction [Figure 2].

A gingival line (i.e., a line joining the tangents of the gingival zeniths of the central incisor and canine) joining maxillary central to the canines was drawn. 11, 13 the distance of the highest contour of the gingival margin for the lateral incisor was measured from the line previously mentioned, to obtain the gingival zenith level (GZL) in an apical-coronal direction of the lateral incisors relative to the adjacent central and canine gingival zenith points [Figure 3].

The measurements were made using the ruler tool from the same software (Adobe Photoshop CC 2015). The

data were statistically analyzed by one-way ANOVA using SPSS software.

RESULTS

About 100% of central incisors displayed a distal GZP from the VBM. For lateral incisors also, 100% of the population showed a distal displacement of GZP from the VBM. Only 8 of 20 canines (40%) in the right side and 6 of 20 canines (30%) in the left side showed a distal displacement of GZP from the VBM.

The mean distal distances of the GZP to the VBM of the clinical crown of central incisors on the right and left sides were 1.18 mm and 0.92 mm, respectively. For lateral incisors, the mean values were 0.47 mm and 0.54 mm for right and left, respectively, and for canine, it was 0.14 mm and 0.07mm, for right and left, respectively.

The range of values for mean distance of GZP from VBM was 0.6 mm to 2mm and 0.6 mm to 1.1 mm for right and left central incisor. The GZP of the lateral incisors ranged from 0.3 mm to 1mm on the right side and 0.3 mm to 0.9 mm on the left side. For right side canines the range of GZP from VBM was 0 mm to 0.5 mm, and for the left side it ranged from 0 mm to 0.4 mm [Table 1].

The mean distance of the contour of the gingival margin in an apico-coronal direction of the lateral incisors (GZL) relative to the gingival line joining the tangent of the adjacent central and canine GZPs were approximately 1 mm and 0.93 mm the right and left sides, respectively. The range of values measured was



Figure 1: Maxillary anterior teeth

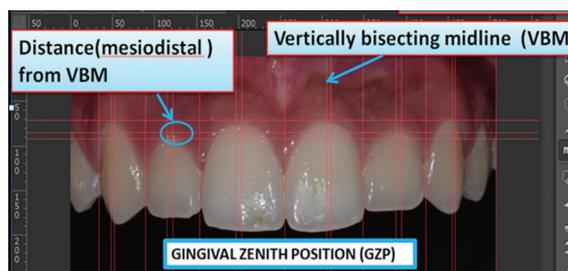


Figure 2: Gingival zenith position with respect to vertically bisected midline

0.9–1.3 mm for the right side and 0–1.4 mm, for the left side [Table 2].

Statistical differences were found in the GZP and GZL readings when compared right side to the left side ($P < 0.05$).

DISCUSSION

Many reference points can be used to design an ideal smile.^[10] Elements involved in designing an esthetic smile have been profoundly discussed in the dental literature.^[2,8,9,11-13] However, these studies, though discussing various aspects related to the gingival contours of the maxillary anterior teeth, have presented conflicting information on where the GZP should be. Magne and Belser suggested that the GZP was distal to the long axis of all the maxillary anterior teeth.^[2] Rufenacht proposed that the GZP was distally displaced on the central incisors and canines only^[8,9] whereas those of the lateral incisors were coincident with the VBM. Rufenacht suggested that for a Class 1 occlusion, the ideal GZL should be where the gingival contours of the central incisors and canines are at the same level, and the lateral incisor positioned slightly more coronal. In Class 2, Division 2 malocclusions, the GZL of the lateral incisors are more apical compared with that of the central incisors and canines, as the laterals tend to overlap the distal aspects of the central incisors.^[9] The subsequent tooth and root

positions of the lateral incisors within the dental arch affect the gingival contours. The findings reported herein are consistent with the GZP for the maxillary central incisors but are in disagreement with those for lateral incisors and canines. The GZP of the lateral incisors was almost concurrent with the VBM, and that of canines are coincident with the VBM within each tooth group.

The crafting of ideal smile requires analysis and evaluations of the face, lips, gingival tissues, and teeth and an appreciation of how they appear collectively such an ideal smile depends on the symmetry and balance of the facial and dental features.^[14] The appearance of gingival tissues plays an important role in the esthetics of the maxillary anterior teeth, and the abnormalities in symmetry and contour can significantly affect the harmony of the natural or prosthetically restored dentition. Gingival morphology, contour, and visibility play an important role in a beautiful smile and are among the first fundamental esthetic objectives during treatment planning. They are also essential to consider before the final decision about the prosthodontic esthetic treatment.

GZP is the most apical part of gingival margin which significantly influences the esthetics. It is an important anatomic landmark and has been described to have a specific spatial orientation in the apico-coronal and mesiodistal directions. Correct spatial positioning

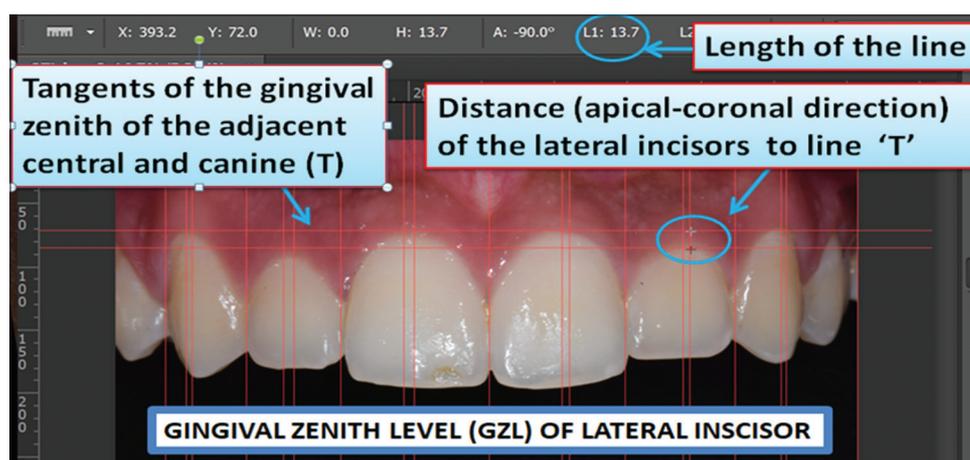


Figure 3: Gingival zenith level from tangent joining zenith of central incisor and canine

Table 1: Data of GZP for right and left sides maxillary anterior teeth with maximum and minimum range values

Descriptives								
VAR00001	n	Mean	SD	SE	Lower bound	Upper bound	Minimum	Maximum
CI right	20	1.1800	0.45259	0.10120	0.9682	1.3918	0.60	2.20
CI left	20	0.9250	0.26532	0.05933	0.8008	1.0492	0.60	1.90
LI right	20	0.4715	0.18340	0.04101	0.3857	0.5573	0.30	1.00
LI left	20	0.5470	0.17150	0.03835	0.4667	0.6273	0.30	0.90
Canine right	20	0.1350	0.18994	0.04247	0.0461	0.2239	0.00	0.50
Canine left	20	0.0750	0.13328	0.02980	0.0126	0.1374	0.00	0.40
Total	120	0.55556	0.46991	0.04290	0.4706	0.6405	0.00	2.20

SD: Standard deviation, SE: Standard error, GZP: Gingival zenith position

Table 2: Data of GZL on the right and left sides of the lateral incisor

Report			
VAR00001	Mean	n	SD
VAR00002			
1.00	1.0065	20	0.10246
2.00	0.9300	20	0.28672
Total	0.9683	40	0.21602

GZL: Gingival zenith level

of the zenith following therapeutic manipulation is mandatory because it can greatly influence the emergence profile and axial inclination of the teeth by modifying the line angle position of the long axis of the emergence of the crown from the gingiva and thus, add the proper symmetry to the entire soft tissue system.^[7] These data could be used as reference points during aesthetic anterior oral rehabilitation.^[15] To ensure correct outcome, clinicians should be familiar with the normal anatomical proportions and relationships.^[16]

Various morphometric studies and critical evaluations have been carried out in the past stating that the GZP for central incisor is distal to the vertical bisected midline (VBM). Minor controversies exist regarding GZP in relation to VBM for lateral incisors and canine. The GZP for lateral incisor is said to be coinciding with VBM,^[13,17-20] as contrast to Stephen and Joycelyn in 2009 who stated that GZP for canine was centralized along the long axis of it.^[6] Mattos in 2008 in quantitative evaluation of spatial displacement of GZ in the maxillary anterior dentition, found that GZ is not universally displaced toward distal aspect and the frequency and magnitude of distal displacement is found to be larger in central incisor, than in lateral which, in turn, is larger than canine.^[7] Goodlin 2003 and Stephen 2009 were of the opinion that central incisors displayed 1 mm, laterals 0.4mm deviation from VBM. Goodlin also suggested that the position of zenith will help create the desired axial inclination of the tooth by changing the line angle position of the long axis of the tooth.^[18]

Zagar M assessed distal displacement of the gingival zenith in the maxillary anterior dentition in young adults and found that the frequency and magnitude of distal displacement are tooth-dependent and larger in central than in lateral incisors, which, in turn, is larger than in canines.^[21]

In the present study, our aim was unique to analyze if there is symmetry in the GZP of the right and left sides in an individual with the help of standardized photographs. We found that the distance of GZP from the VBM is asymmetrical in the right and left sides in the population studied. Statistically significant variations were found in GZP of central incisors, lateral incisors, and canine of right and left sides.

The limitations of this study involve the inclusion of a small sample size. So further studies, in a larger sample can prove a pathway for generalizing the results to a wider population. Recognizing that form follows function and the anterior teeth that serve a key role in the oral health of the patient is paramount. A comprehensive approach should be used in diagnosis and treatment planning of the cases requiring esthetics, can help achieve a smile, that best augments the overall facial appearance of the patient, and provides added advantage of improved oral health.

CONCLUSION

Smile design is an inseparable component of dentofacial esthetics, where gingival component plays a strong role. A well-known saying goes that the human body is not perfectly symmetrical. Reinforcing this saying, the present study showed that there is statistical significant in the asymmetry in the gingival zenith of right and the left, maxillary anterior teeth. The clinical significance of the results in the clinical practice of this article can be utilized to replicate GZPs of the maxillary anterior teeth during dental procedures such as crown lengthening or root coverage procedures and also in final prosthodontic rehabilitation.

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