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Analysis of Gingival Zenith Positions and its Levels in the Maxillary Anterior teeth in Mixed Indian Population.

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Abstract

Aim of the study: The location of the gingival zenith in a medial-lateral position relative to the vertical tooth axis of the maxillary anterior teeth remains to be clearly defined. The position of apex of the free gingival margin on lateral incisor teeth relative to the gingival zeniths of the adjacent proximal teeth showed a greater variation in literature.

The Location of Gingival Zenith in its relative position to the long axis in and their variation in maxillary anterior teeth in Indian population are being studied in the present study with an aim to evaluate the clinical parameters like relative position of Gingival Zenith levels (P-GZ) from the midline long axis of the teeth (M-LA) of the maxillary anterior teeth and the levels of the gingival zenith (L-GZ) of the lateral incisors in the apico-coronal direction relative to the adjacent central Incisor and canines in healthy gingiva without any clinical signs of Inflammation.

Materials and Methods: A total of 600 sites in 100 healthy patients (50Females, 50 males) with an average age of 29.4 years were evaluated. The inclusion criteria included absence of periodontal disease, gingival recession, or gingival hypertrophy and teeth without loss of interdental papillae, spacing, crowding, existing restorations, and attrition. P-GZ dimensions were

measured with calibrated digital callipers for each individual tooth and within each tooth group in a medial-lateral direction from the M-LA. L-GZs were measured in an apical-coronal direction from a tangent line drawn on the diagnostic casts from the P-GZs of the adjacent teeth.

Results: This present demonstrated that all central incisors displayed a distal P-GZ from the M-LA, with a mean average of 1 mm. Lateral incisors showed a deviation of the gingival zenith by a mean of 0.45 mm. In 94.5% of the canine population, the P-GZ was centralized along the long axis of the canine. The mean distance of the contour of the gingival margin in an apical coronal direction of the lateral incisors (L-GZ) relative to gingival line joining the tangent of the adjacent central and canine P-GZs was approximately 1 mm.

Conclusion: This Present study revealed a P-GZ mean value of 1 mm distal from the M-LA for the central incisor tooth group. The lateral incisors showed a mean average of 0.5 mm. The canine tooth group demo nstrated almost no deviations of the P-GZ from the M-LA. The position of L-GZ of the lateral incisors when compared to the adjacent incisor and canine were more coronal by approximately 1 mm. The data presented from this study may be utilised for the placement of gingival zenith levels in aesthetic rehabilitation cases and for enhancing the natural aesthetics for the studied population

Clinical importance of the study

The information provided in this currentarticle can be used in clinical scenario tore-establish the proper P-GZs of the maxillary anterior teeth during surgical crown lengthening or root coverage procedures. In addition, the intra-arch gingival level of the lateral incisor gingival zenith can be established for the studied population.

Keywords: Gingiva, Gingival zenith, Aesthetics, Surgical crown lengthening

Introduction

Gingival aesthetics plays an important attribute of a beautiful smile. Gingival tissues define aesthetics of the dentition especially the anterior teeth and the variations in symmetry and contour affect the proportions of the natural or prosthetic resto rations. Best of the resto rations surrounded by unattractive gingival tissues can be gloomy to the definition of an aesthetic smile. [1] Maintaining the Gingival health should be a first priority during any aesthetic dental treatment planning and includes consideration on gingival morphology and contour with gingival zenith levels. Ideal Gingival architecture has been described like knife-edged margins and tightly adapted to the teeth, with presence of fully filled interdental papilla. The aberration from normal interdental papilla in terms of reduction of the fullness will result in presentation of Black Triangle with variations in symmetry and such variations will be unpleasant smile. [2.3]

The current accepted classification for the presence of interdental papilla was provided by Nord land and Tarnow based on the papillary fill of the embrasure space and apical extent based on inter-dental contact area.[4]

In the literature most of the aesthetic correction of the gingival contours are made by correction of contours by gingivo plasty, gingivectomy and in more complicated cases with period ontal plastic surgery. Such procedures are routinely done to optimize contours of restorations or to enhance smile in the presence of severe gingival deformity. [5,6] Understanding the dent gingival interface will allow clinicians to achieve more satis factory aesthetic outcome during interdisciplinary diag nosis and treatment. The current available literature

primarily consists conflicting results and presented varying information on where the gingival zenith position (P-GZ) is located from the vertical bisected midline(M-LA) axis of each individual maxillary anterior tooth and where it should be placed. [8,9]

Currently the objective information regarding the gingival levels of the lateral incisors relative to the gingival line joining the tangents of the gingival zenith of the adjacent central and canine under healthy conditions is very limited.[10,11] Information available in literature is mostly skewed to the western population and the need for assessing such applicability to Indian Population is limited.[7] Charruel and colleagues investigated the gingival line angle (GLA) asymmetry between the right and left sides from the frontal perspective only using an analysis of study cast photo graphs. They reported a directional asymmetry GLA difference of 4.1 ± 3 degrees for the right side.[12] The P-GZ of the canine is apical to that of the incisors, and the gingival zenith level (L-GZ) of the lateral incisor is below 81.1% or on 15% of the gingival lines from the frontal view. The measured the mean apical-coronal position of the lateral incisor L-GZ relative to the adjacent P-GZ was 0.68 ± 0.52 mm from the frontal perspective.

Limited data is available in the Indian Context with the main aim to evaluate and establish these two clinical parameters

(1) the P-GZ from the M-LA axis of each individual maxillary anterior tooth; and

(2) the L-GZ (in an apical-coronal direction) of the lateral incisors relative to the gingival line joining the tangents of the gingival zenith of the adjacent central and canine under healthy conditions.

Through analysis of the patient's gingival architecture with proper diagnosis and treatment of discrepancies the patient can be provided with can for predictable designing a ideal and a pleasing smile

Material and Methods

A sample population of 100 patients (50 females, 50 males) with healthy gingival tissue (39 thick and 61 thin gingival phenotypes) was studied. The patients, who ranged in age from 18 to 52 years (mean 31.6 years), were in good systemic health. Inclusion and exclusion criteria were formulated and had patients visiting dental OPD will be taken as subjects for the study with non-restored maxillary anterior teeth, those with no anterior crowding or spacing, and teeth with no visible signs of incisal attrition, gingival recession, gingival overgrowth, or altered passive eruption.

Irreversible hydrocolloid Alginate impressions of the maxillary arches were made using and were immediately poured with Type -III Dental stone (Company). A digital calliper with display was used to measure the 600 sites of the all-maxillary anterior teeth subjected to study.

Each cast was measured by an operator using 3.5X magnification optical loupes Control measurements were completed by a second investigator. Digital callipers with LED backlight display with criterion of standards i.e., graduations: 0.01 mm, accuracy: _0.02 mm, repeat ability:0.01 mm) were used for measurement. The caliper was calibrated prior to each measurement. Operator Training involved the measurements were assessed by a single operator who has been trained to on 10 models (60 teeth) before proceeding with actual test and was reconfirmed by a second neutral assessor.

To define the M-LA of each clinical crown, the tooth width was measured at two reference points. The proximal incisal contact area position and the apical contact area position served as the reference points. Each width was divided in half, and the centre points were marked. Center points were extended to Aline toward

the gingival aspect of the clinical crown to define the M-LA. The highest point of the free gingival margin was marked. The distance of the highest gingival margin position to the M-LA was measured along the M-LA of central incisors, lateral incisors, and canines to obtain the P-GZ in a medial-lateral direction. A gingival line (i.e., a line joining the tangents of the gingival zeniths of the central incisor and canine) joining maxillary centrals to the canines was drawn. The distance of the contour of the gingival margin for the lateral incisor was measured from the line to obtain the L-GZ in an apical-coronal direction of the lateral incisors relative to the adjacent central and canine gingival zenith points.All the data was collected was tabulated in Microsoft Excel sheet and was exported to SPSS Software (Ver 20.0) and Statistical analyses were performed by in Depen dent sample t-tests and paired samples correla tions.

Results

The study results denoted that all the central incisors displayed a distal P-GZ from the M-LA. For lateral incisors, 74% of the population showed a distal displacement of P-GZ from the M-LA, and 26% showed that the P-GZ was concurrent and centralized along the vertical axis of the tooth. Only 1 of canine sites (2.5%) showed a distal displacement of P-GZ from the M-LA (Figure -)

The mean distal distances of the P-GZ to the M-LA of the clinical crown of central incisors, lateral incisors, and canines were 1.16, 0.45, and 0.05 mm, respectively.

Table 1 shows the descriptive values of P-GZ distances to the M-LA of clinical crowns of the maxillary anterior dentition.

The P-GZ tends to be located at the M-LA of canine crowns, whereas lateral incisors demonstrate a deviation of the gingival zenith by a mean of 0.45 mm and central incisors by 1 mm to the M-LA of the clinical crown.

Table 2 shows the comparison of the two groups and the test data were observed using T- test but were not statistically significant ($p = 0.23$).

The mean distance of the contour of the gingival margin in an apical coronal direction of the lateral incisors (L-GZ) relative to the gingival line joining the tangent of the adjacent central and canine P-GZs was approximately 1 mm. The range of values measured was 0 to 1.73 mm.

Discussion

Elements involved in designing an aesthetic smile have been profoundly discussed in the dental literature. Details such as the P-GZ, the most apical point of the free gingival margin in reference to the margins of the gingiva and the L-GZ of the lateral incisor relative to the central incisors and canine teeth can significantly influence and characterise the aesthetic appearance of a smile. [13,14,15]

However, these studies, though discussing various aspects related to the gingival contours of the maxillary anterior teeth, have presented conflicting information on where the P-GZ should be. The appropriate placement of the gingival zenith is critical, as it helps to determine the desired axial inclination of the tooth by manoeuvring the line angle of the tooth vertical axis.[16]

Subsequently, knowing the P-GZ of each maxillary anterior tooth from the M-LA as well as the L-GZ of the lateral incisors can help facilitate a reference point during Esthetic periodontal plastic surgery procedures. [18,19] Magne and Belser suggested that the P-GZ was distal to the long axis of all the maxillary anterior teeth.[17]Re-enact proposed that the P-GZ was distally displaced on the central incisors and canines only,[4,5] whereas those of the lateral incisors were coincident with the M-LA.[5] Good line described the P-GZ for

central incisors at the distal third, laterals at the M-LA, and canines ranging from the anterior third to the distal third of the M-LA.[14] Re-enact suggested that for a Class 1 occlusion, the ideal L-GZ 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 L-GZ 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.

The subsequent tooth and root positions of the lateral incisors within the dental arch affect the gingival contours.[20] The findings reported herein are consistent with the P-GZ for the maxillary central incisors but are in disagreement with those for lateral incisors and canines. The P-GZ of the lateral incisors were almost concurrent with the M-LA, and that of canines are coincident with the M-LA within each tooth group. These quantified mean standards are representative for average tooth dimensions values of 8.3-mm width and 10.3-mm length.[15] The L-GZ values presented herein differ by a mean of + 0.3 mm (1–0.7 mm) from those reported by Charruel and colleagues since they measured photographs taken of diagnostic casts from the frontal perspective (SD = _0.5 mm) versus direct measurements of casts. Variations for photography variances were accounted for in that study. Only 15% of the lateral incisor L-GZs were at the same level with the P-GZ of the central incisors and canine teeth.[12] This finding was in concurrence with other studies.

Conclusions

The mean location of the P-GZ (Table 1) from the M-LA of the clinical crown of central incisors, lateral incisors, and canines was about 1 mm, 0.4 mm distally, and0 mm, respectively.

The L-GZ (Table 2) in an apical-coronal direction of lateral incisors relative to the gingival tangential zenith line joining adjacent central incisor and canine was approximately1 mm under healthy conditions.

These reference points could be used in conjunction with other subjective and objective aesthetic parameters during diagnosis, treatment planning, and in recon structing a natural smile.

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Legend Tables

Table 1: Distance of the gingival zenith position (mm) distal to the vertical bisected midline of the clinical crown along the long axis, sorted by tooth position and tooth groups.

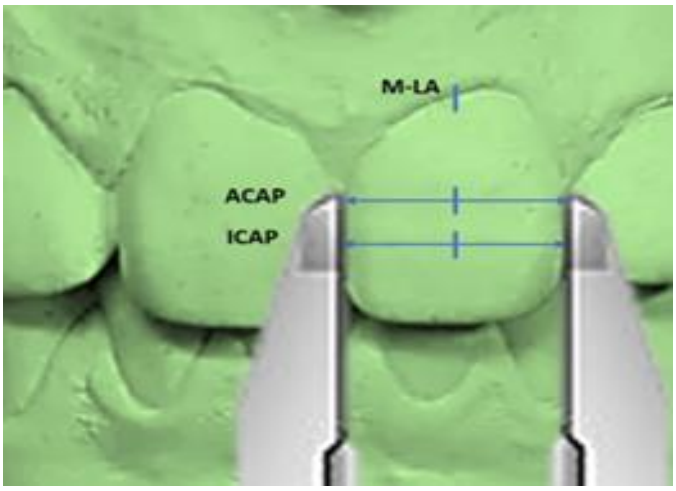
Tooth	N	Group	Mean (±SD)	Minimum	Maximum
Right Central Incisor	100	Central Incisor	1.18 ± 0.35	0.81	1.82
Right Lateral Incisor	100	Lateral Incisor	0.5± 0.32	0	1.14
Right Canine	100	Canine	0 ± 0.03	0	1.12
Left Central Incisor	100	Central Incisor	0.5 ± 0.33	0.79	1.82
Left Lateral Incisor	100	Lateral Incisor	1.08 ± 0.33	0	1.13
Left Canine	100	Canine	0 ± 0.03	0	1.1

Table 2: distance of the gingival zenith level (mm) of the lateral incisors (li) in an apical-coronal direction relative to the gingival line, joining the tangents of the gingival zenith position of the adjacent central incisor and canine teeth.

Tooth	N	Group	Mean (±SD)	Minimum	Maximum
Right Lateral Incisor	100	LI	0.92 ± 0.51	0	1.8

Left Lateral Incisor	100	LI	0.92 ± 0.49	0	1.8

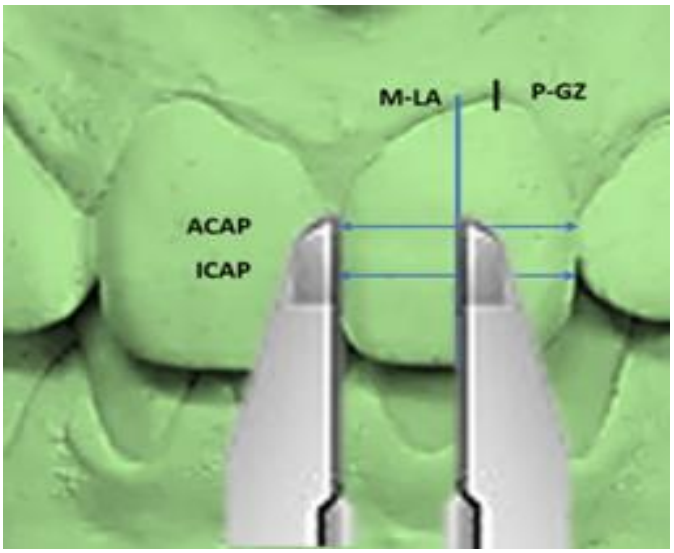
Figure 1



Measurement of proximal Incisal Contact Area Position (ICAP) and Apical Contact Area Position (ACAP)

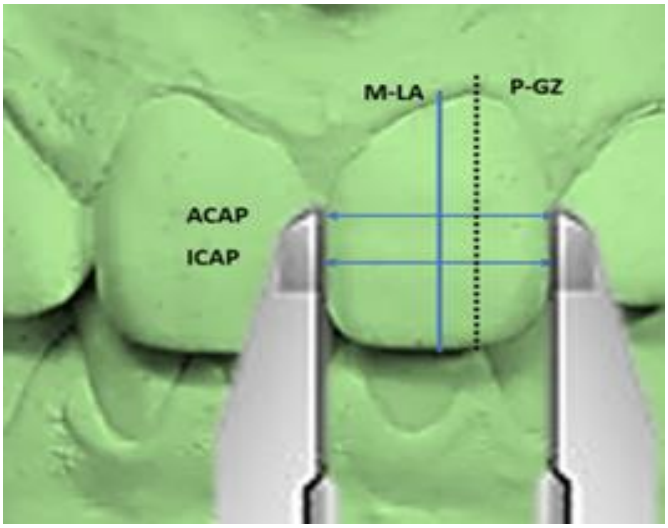
To define the vertical bisected midline of each clinical crown, the tooth width was measured at two reference points (digital callipers). The proximal incisal contact area position (ICAP) and the apical contact area position (ACAP) served as reference points.

Figure 2



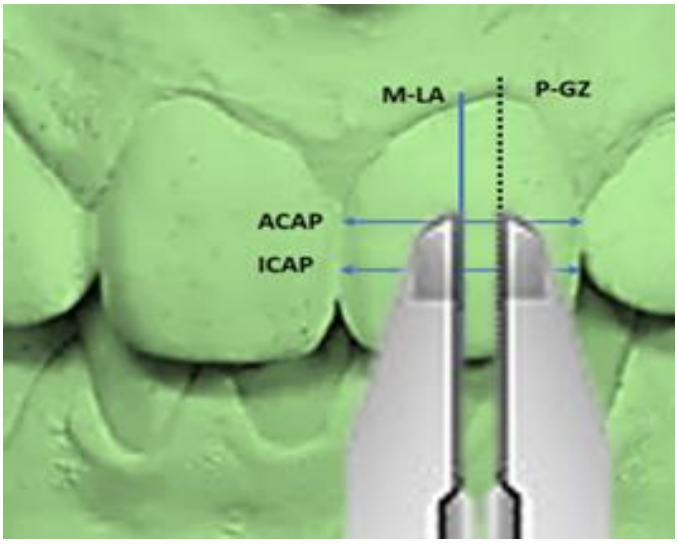
Each width was divided in half, and the Center points were marked. Center points were extended to a line toward the gingival aspect of the clinical crown to define the vertical bisected midline (M-LA). ACAP = apical contact area position; ICAP = incisal contact area position; P-GZ = gingival zenith position.

Figure 3



The highest point of the free gingival margin was marked. The distance of the highest gingival margin position to the vertical bisected midline (M-LA) was measured along the M-LA. Incisal and apical contact area reference positions, M-LA, and gingival zenith position (P-GZ) are pictured. ACAP = apical contact area position; ICAP = incisal contact area position.

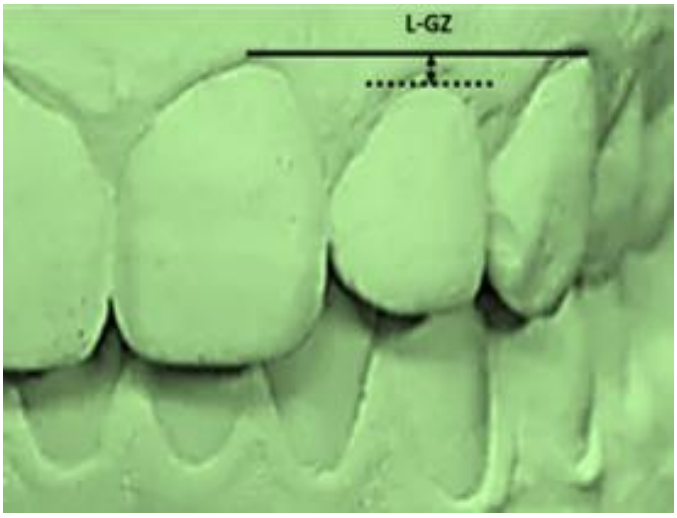
Figure 4



Marking of the highest point of the free gingival margin was measured from the vertical bisected midline (M-LA) along the long axis of the tooth of the maxillary anterior dentition, including the central incisors, lateral incisors,

and canine teeth, to obtain the gingival zenith position (P-GZ) in a medial-lateral direction.

Figure 5



The gingival zenith level (L-GZ) for both right and left lateral incisors relative to the adjacent gingival zenith position of the central incisor and canine teeth were coronal by approximately 1 mm.