

Evaluation of clinical parameters for aesthetic dentistry

¹Dr Megha Gupta, Assistant Professor, Department of Conservative Dentistry and Endodontics, Institute of Dental science, Bareilly

²Dr Mamnoon Ghafir, Assistant Professor, Department of Conservative Dentistry and Endodontics, Institute of Dental science, Bareilly

³Dr Ashutosh Agarwal, Assistant Professor, Department of Periodontology, Institute of Dental science, Bareilly

Corresponding Author: Dr Megha Gupta, Assistant Professor, Department of Conservative Dentistry and Endodontics, Institute of Dental Science, Bareilly

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Abstract

Aim: To investigate the gingival variations in the maxillary anterior teeth and premolars by quantifying the following aesthetic parameters; gingival zenith point (GZP), gingival zenith level (GZL) and gingival line angle (GLA) on right and left side.

Materials & Methods: A total of 500 maxillary casts were analyzed. Digital caliper and protractor was used to measure; Gingival Zenith Point (GZP) from the vertical bisected midline (VBM) in the maxillary anterior teeth, Gingival Zenith Level (GZL) related to the lateral incisors, and gingival line angle (GLA).

Results: According to the mean, all the maxillary central incisor displayed distal displacement from the vertical bisected midline, in lateral incisor and canine it showed coincident with the vertical bisected midline, with mean average of 0.55mm in the central incisors on both side, 0.09 and 0.07mm in the lateral incisors, and 0.12mm and

0.08mm in the canines right and left side respectively.

The gingival zenith level represents the coronal position to the gingival line 0.58mm and 0.97mm right and left side. The gingival line angle was acute 88° in right and obtuse 90° on left side

Conclusion: The gingival zenith point is located distally in central incisor and at the middle in lateral incisor, canine and premolars. The gingival zenith line was found to be coronal to the gingival line on both side. The gingival line angle was acute on right and obtuse on left side. These clinical parameters applied to the gingival contours may serve as reference points during aesthetic procedure.

Keywords: Aesthetic, gingival appearance, maxillary anterior dentition.

Introduction

Gingival aesthetics is an important component of aesthetic dentistry and gingival health is among the first

fundamental aesthetic objectives during treatment planning. Various clinical parameters are involved in aesthetic dentistry which can positively impact on smile. Among them gingival zenith is one of the important clinical parameters. Gingival zenith is defined as most apical aspect of marginal gingiva and significantly influences the aesthetics.¹

“White aesthetic” cannot satisfy aesthetic expectations of patient. “Pink white aesthetic” i.e. charming smile which consist of lips, teeth and gingiva must be considered white aesthetic planning.

It is an important anatomic landmark and has been described to have a specific spatial orientation in the apico-coronal and mesio-distal direction.

Another significant feature of gingival aesthetics is contour progression from the incisors to canine. Gingival line is generally used as clinical parameter to assess this feature. It is a line joining the tangents of the zeniths of the free gingival margins of the central incisor and canine.

Gingival line is generally used as clinical parameter to assess this feature. It is a line joining the tangents of the zeniths of the free gingival margins of the central incisor and canine. Gingival zenith of lateral incisor can be coronally, at the or apically to this gingival line.²

Gingival line angle is also used as an important clinical parameter for aesthetic guidelines. This angle is formed by the intersection of gingival line to the maxillary midline. This angle can be acute, obtuse or at 90° depending on the position of the Gingival Zenith point of canine in relation to Gingival Zenith point of central incisor. If this angle is acute (less than 90°) the position of canine is apically, if it is obtuse (more than 90°) it is placed coronally and if at right angle it is placed at the level of Gingival Zenith point of central incisor.³

In addition to anterior aesthetics, posterior gummy smile

also plays an important role in perceived smile aesthetics.

Most of the studies on aesthetic considerations in smile design have focused mainly on the anterior teeth region. Hence it is also important to determine the precise locations of gingival zenith point in both first and second premolar according to the clinical parameter. No studies have done yet in premolars

Material and method

This a clinical observational study conducted in the post-graduate department of Conservative Dentistry and Endodontics, Institute of Dental Science, Bareilly. The main purpose of this study was to “Evaluate the clinical parameters for aesthetic guidelines on left and right side of maxillary anterior dentition.”

A sample population of 500 patients (including males and females) with healthy gingival tissue were selected. The patients, who ranged in age from 20 to 60 years and were in good systemic health, were selected for study. Criteria for inclusion in the sample population were non restored maxillary anterior teeth, no anterior crowding or spacing, Teeth with no visible signs of excessive incisal attrition, gingival recession, gingival overgrowth, or altered passive eruption, no dental deformity. Patient had not undergone any periodontal, surgical or orthodontic treatment involving maxillary teeth.

After selecting the patient, impression tray (GDC by: Vasa Denticity Private limited, Delhi India) was selected according to size of maxillary arch. Rubber base impressions of the study group were made using reversible hydrocolloid impression material (DPI Photosil soft putty by: Vasa Denticity Private limited, Delhi India) and were poured with Type III dental stone (Den stone Dental stone plaster Type III By: Pankaj Enterprises New Industrial area- II, Mandi deep (M.P.), India). A digital calliper (Precise Digital caliper 150mm

6-inch with display screen Sudarshan Measuring & Engg (P) Ltd. 4781 Hauz Qazi, Delhi India) with a light-emitting diode (LED) display was used to measure the values of different parameters.

Landmarks identification and measurement

After the cast preparation, the tooth was divided in half with the help of Vernier calliper and to define the VBM of each clinical crown, the tooth width was measured at two reference points. These two points, proximal apical contact area position (ACAP) and incisal contact area (ICAP) marked with lead pencil. Then centre points were extended to a line toward the gingival aspect of the clinical crown to define the vertical bisected midline (VBM)

Evaluation of Gingival Zenith point (GZP)

After marking the reference points, the highest point of the free gingival margin was marked.

The distance of the highest gingival margin position to the VBM was measured along the vertical bisected midline of central incisors, lateral incisors, canine, to obtain the gingival zenith position in a medial-lateral direction to the nearest 1/100th millimetre.

Evaluation of lateral incisor distance (LID) from the gingival line

Draw the gingival line joining by the tangents of the gingival zenith of central incisor and canine. The distance between the gingival zenith of lateral incisor and gingival line on right and left side was marked. Hence the distance of the contour of the gingival margin for the lateral incisor was measured in relation to gingival line to assess apical-coronal position of the lateral incisors relative to the adjacent central incisor and canine.

Evaluation of gingival line angle (GLA)

After marking the gingival line, and maxillary midline and then measure the angle which was formed between

the gingival line and maxillary midline was measured. The gingival line angle on the left side were noted as GLA(L) and right gingival angle were noted as GLA(R).

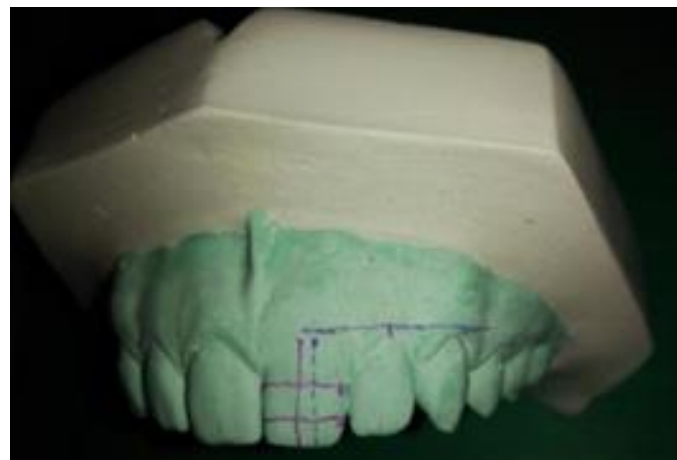


Figure 1: Distance between GZP and VBM

Result

The mean standard deviation of gingival zenith position from the vertical bisected midline was 0.55 ± 0.58 and 0.55 ± 0.61 , in lateral incisor 0.09 ± 0.27 and 0.07 ± 0.22 and in canine 0.12 ± 0.33 and 0.08 ± 0.29 right and left side respectively.

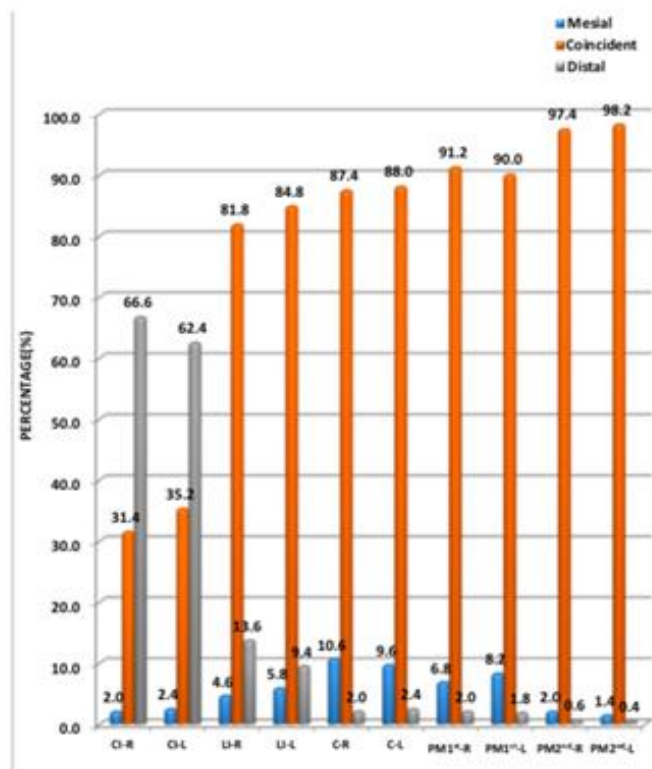


Figure 2: Prevalence of Gingival Zenith point in relation

to Vertical Bisected Midline.

About 66.6% of central incisor displayed a distal Gingival Zenith point in relation to vertical bisected midline on right side and 62.4% on left side. For lateral incisor 81.8% on right side and 84.8% on left side showed coincident with vertical bisected midline. In canine on right side in 87.4% and on left side in 88% study models observed coincident with vertical bisected midline. In first and second premolars around 90% study models depicted to be placed coincident with vertical bisected midline. (Figure:2)

The mean distance of contour of the gingival margin in an apico-coronal direction of the lateral incisor relative to the gingival line joining the tangents of the adjacent central incisor and canine were approximately 0.58 and 0.58 mm on right and left side respectively.

Table 1: Prevalence of position of Gingival Zenith point of lateral incisor with respect to gingival line.

No of samples		No of samples		No of samples	
Coronally to gingival line		On the gingival line		Apically to gingival line	
R n (%)	L n(%)	R n (%)	Ln (%)	R n (%)	Ln (%)
328 (65.6%)	337 (67.4%)	172 (34.4%)	163 (32.6%)	0 (0%)	0 (0%)

In 328 study models on right side and 337 on left side, distance of Gingival Zenith point of lateral incisor from the gingival line was coronal whereas in 172 study models on right side and in 163 on left side it was located on the gingival line. (Table 1)

Table 2: Mean distance between Gingival Zenith of lateral incisor to gingival line on right and left side (mm)

Gingival line angle(degree)	Mean ± S.D	t-value	P-value
Right	88.57 ± 4.23	-1.538	0.124#
Left	88.96 ± 3.81		

This study represents the acute prevalence of gingival line angle due to apical position of Gingival Zenith point

of canine as compared to central incisor. The mean standard deviation of gingival line angle was 88.57 ± 4.23 on right 88.96 ± 3.81 left sides. (Table 2)

Discussion

Gingival aesthetic is an important aspect of beautiful smile, hence in anterior teeth gingival contours turns out to be one of the important factors to be considered. The aim of this study was to evaluate the clinical parameters in left and right side of maxillary anterior teeth.

Gingival Zenith point can act as reference points, in conjunction with other subjective and objective aesthetic parameters to aid in diagnosis, treatment planning, and in reconstructing a natural smile involving crown lengthening, teeth selection, implant aesthetics and laminates.^{4,5,6} Establishing the proper location of Gingival Zenith point is an important step in alteration of mesial and distal dimensions, closure of diastema, to provide the illusion of bodily movement and reduce exaggerated triangular form and correction of tooth angulation.^{7,8} Correct spatial positioning 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.^{9,10,11-14}

In present study gingival zenith of central incisor was more prevalent distally both on right and left side with respect to the vertical bisected midline. Similar results in Indian population were reported by other researchers.^{3,4,15,16,18-20}

Similar results were observed in other populations like Chinese population,²¹ Catholic population,²² European population,²³ Nepalese, population,² British, population,²⁴ Turkey population,²⁵ Caucasian population.²⁶

In our study Gingival zenith of lateral incisor was

coincident with the vertical bisected midline. Similar results were reported only in few studies in Indian population like studies by Ahmad et al., (2005)¹⁹, Pawar et al., (2007)³. But some other researchers in Indian population reported it was located distally like Shah D et al., (2014)¹⁵, Bhatsange et al., (2015)¹⁶, Maradi p et al., (2017)²⁰, Appukuttan et al., (2018)¹⁸, Rajaraman V et al., (2018)⁴ Even in other population like Chinese population (Ke and wang et al., (2018)²¹, Catholic population (Zagar et al., (2010))²², Magne and Belser et al., (2002)²³, Nepalese population (Hum again et al., (2016))², British population (chu et al.,(2009))²⁴ also it was reported located distally.

Gingival zenith of canine was also reported coincident in relation to vertical bisected midline. Most of the studies like Bhatsange et al., (2015)¹⁶, Maradi et al., (2017)²⁰, Appukuttan et al., (2018)¹⁸, Rajaraman et al., (2018)⁴, Ahmad et al., (2005)¹⁹, Pawar et al., (2007)³ from different population (Indian, Chinese, Nepalese, British, catholic) had reported it to be located distally. Only Appukuttan et al., (2018)¹⁸ in Chennai population had reported it was placed mesially with relation to vertical bisected midline.¹⁸ Other study from Riyadh (Saudi) population Bamusa et al., (2018)²⁷ reported it to be located centrally.

But some study models of canine had depicted mesial displacement with respect to the vertical bisected midline of Gingival Zenith point on both right and on left side.

Prevalence of position of Gingival Zenith point of lateral incisor from the gingival line was more prevalent coronally both on right (65.6%) and left side (67.4%). and On the gingival line also it was observed both on right (34.4%) and left side (32.6%) Apical to gingival line it was not observed in any sample. Similar results were observed in other studies.^{3,18,17} This may be due to

fact that lateral incisor is square in shape.

Gingival line angle depends on the position of axial inclination of Gingival Zenith point. Establishing the correct gingival levels for each individual tooth is the key in the creation of harmonious smile.^{1,28} The cervical gingival height (position or level) of the centrals should be symmetrical. It can also match that of the canines. It is acceptable for the laterals to display the same gingival level.^{29,30} However, the resultant smile may be too uniform and it is preferable to exhibit a rise and fall in the soft tissue by having the gingival contour over the laterals located toward the incisal compared to the tissue level of the centrals and canines.^{31,32}

Conclusion

The gingival contour clinical parameters obtained in this research can provide reference for anterior teeth aesthetic rehabilitation analysis and design. Aesthetic dentistry has to be a multi-speciality branch, wherein all treatments like orthodontics, periodontics, surgical procedures have to be performed whenever deemed necessary

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