

## ASSESSMENT OF THE GINGIVAL ZENITH POSITIONS AND LEVELS OF THE MAXILLARY ANTERIOR TEETH AMONG SAUDI POPULATION: COMPARISON BETWEEN MALES AND FEMALES

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### ABSTRACT

**Introduction:** Understanding of the dentogingival interface allows the clinicians to achieve a more satisfactory esthetic outcome during interdisciplinary diagnosis and treatment planning of beautiful smile.

**Aim:** To evaluate the gingival variations in the maxillary anterior teeth by quantifying the following esthetic parameters; marginal gingival zenith positions (MGZP), gingival zenith level (GZL) and to assess the difference of these parameters among males and females.

**Materials & Methods:** A total of 20 maxillary casts (10 males and 10 females) were analyzed. Digital caliper and protractor was used to measure; the marginal Gingival Zenith Position (MGZP) from the vertical bisected midline (VBM) of 120 sites in the maxillary anterior teeth, the Gingival Zenith Level (GZL) of 40 sites related to the lateral incisors, the data were analyzed using Mann Whitney u test.

**Results:** According to the mean, all the maxillary anterior teeth displayed distal (MGZP) from (VBM), with mean average of 1 mm in the central incisors, 0.4 mm in the lateral incisors, and 0.2 mm in the canines among the study samples. Comparisons between males and females presented no statistically significant differences. The Gingival zenith level (GZL) showed statistically significant differences between right and left teeth in males and females and revealed positive values in all 40 sites (100%) when appeared coronal to the gingival aesthetic line. The mean of the males and females (GZL) in mm were 1.05 and 0.95 respectively with no statistically significant differences between both gender.

**Conclusions:** The marginal gingival zenith position (MGZP) is located distally in all anterior teeth. The gingival zenith line (GZL) was found to be coronal to the gingival aesthetic line in all teeth with significant differences between right and left sides within each group (males, females). In all recorded parameters there were no differences between males and females. These clinical parameters applied to the gingival contours may serve as reference points during esthetic anterior oral rehabilitation.

**KEY WORDS:** Esthetic, gingival appearance, maxillary anterior dentition.

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## INTRODUCTION

Gingival health is among the first fundamental esthetic objective during treatment planning, which allows the clinicians to achieve a more satisfactory esthetic outcome during interdisciplinary diagnosis and treatment. Adjunctive therapies, including periodontal plastic surgery, are recommended to optimize gingival contours for restorative treatment in the presence of severe gingival deformity <sup>[1]</sup>.

Understanding the dentogingival interface will allow clinicians to improve the esthetic results during treatment planning <sup>[2]</sup>. Adjunctive therapies, including periodontal plastic surgery, are recommended to optimize gingival contours for restorative treatment in the presence of severe gingival deformity <sup>[3]</sup>.

Gingival zenith (GZ) is the most apical point of the marginal gingival scallop. Which considered as an important component of aesthetics <sup>[4]</sup>.

The literature presented differing information on where the gingival zenith position (GZP) is located from the vertical bisected midline (VBM) axis of each individual maxillary anterior tooth and where it should be placed [5-9].

Chu et al., evaluated GZP from VBM along the long axis of anterior teeth and GZL of the lateral incisors in an apical – coronal direction relative to the line joining the tangent of the GZP of adjacent central and canine. The study demonstrated that all central incisors displayed a distal GZP from the VBM, with a mean average of 1 mm. Lateral incisors showed a deviation of the gingival zenith with a mean average of 0.4mm <sup>[2]</sup>.

Charruel et al., and Pawar et al., quantified some clinical parameters useful as esthetic guidelines when gingival contour was modified and compared left and right sides of six maxillary anterior teeth<sup>[10-11]</sup>.

While, Pini et al., evaluated the width/length ratio and the gingival zenith, by means of dental casts and digital caliper in patients with missing maxillary lateral incisors after treatment with implant placement and with tooth recontouring. Results revealed that group treated with tooth recontouring showed the greatest differences in values with regard to the ratio of GZ <sup>[12]</sup>.

Rigolin Ferreira et al., reported that both esthetic and functional rehabilitation were obtained by recontouring the gingival zenith followed by placing ultraconservative porcelain veneers <sup>[13]</sup>.

Since it is the clinician's task to balance the patient's esthetic needs and since there are basic universally recognized principles to be considered to have an attractive smile, the present study was planned to evaluate the gingival variations in the maxillary anterior teeth by quantifying the following esthetic parameters; marginal gingival zenith positions (MGZP) and gingival zenith level (GZL), and to assess the difference of these parameters among males and females seen in Outpatient Clinics of Riyadh Elm University.

## MATERIALS AND METHODS

### Ethical guidelines:

Prior to initiation of the study, ethical approval was obtained from the research Ethics Committee of Riyadh Elm University. The study was conducted between August 2016 and January 2017.

### Sample Selection:

A total of 20 maxillary study casts (10 males and 10 females) obtained from the laboratory Section of Riyadh Elm university, Preventive Dental Science Department were analyzed. Digital caliper and protractor was used to measure; the marginal Gingival Zenith Position (MGZP) from the vertical bisected midline (VBM) of 120 sites in the maxillary anterior teeth, the Gingival Zenith Level (GZL)

from 40 sites related to the lateral incisors. Inclusion criteria were Saudi general population from Riyadh City, with healthy periodontium, presence of all anterior tooth, non-restored maxillary anterior teeth, no crowding or spacing, and no wearing in incisal edge. Patient's consents were first obtained.

### Materials and Instruments

Alginate impressions (Jeltrate Plus - Dentsply©) of the study subjects were made in stock trays using irreversible hydrocolloid impression material and immediately poured with stone following manufacturer's instructions.

A digital caliper (Carrera Precision©, accuracy to 1/1000<sup>th</sup> of an inch) [Figure 1]. was used to measure the 180 sites of Marginal Gingival Zenith Position (MGZP) and the 60 distance of the Gingival Zenith Level (GZL) of the anterior maxillary teeth, from canine to canine.

A flexible ruler was used to draw the tangent lines of the anatomical landmarks on the dental casts. A digital T protractor (i Gaging©, accuracy 0.2°, repeatability 0.1° and measure range 0-360°).

Each cast was measured by one operator using (3.5X) optical loupes. The caliper was calibrated prior to each measurement.

### Methodology and Measurements

To determine the VBM of each clinical crown on the mounted cast, 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 center points were marked. Center points were extended to a line toward the gingival aspect of the clinical crown to determine the VBM. 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 VBM of central incisors, lateral incisors,

and canines to obtain the MGZP in a medial-lateral direction.

If the mean of marginal gingival zenith positions (MGZP) = 0; that represent it on the center of vertical bisected midline (VBM), the positive value when the mean > 0 ; will indicate marginal gingival zenith positions (MGZP) is located distally, and the negative value when the mean < 0 ; marginal gingival zenith positions (MGZP) is found mesially. These findings were agreed to the suggestion of (Magne and Belser,) and (chu et al.)<sup>[1-2]</sup>.

Gingival aesthetic line (GAL) was drawn on the cast through the MGZP of canines and central incisors to cross the vertical maxillary midline. The distance from the gingival aesthetic line (GAL) to the MGZP of lateral incisors was measured to create the gingival zenith level (GZL) of the lateral incisors [Figure 2].

### Statistical Analysis

The Descriptive statistics of mean and standard deviations were calculated for gingival zenith positions (CI, LI and Canine) and zenith level between male and female participants. Comparison of mean ranks of Zenith position and line males and females was performed by using Mann-Whitney U test. For all statistical purposes, a p-value of  $\leq 0.05$  was considered significant.

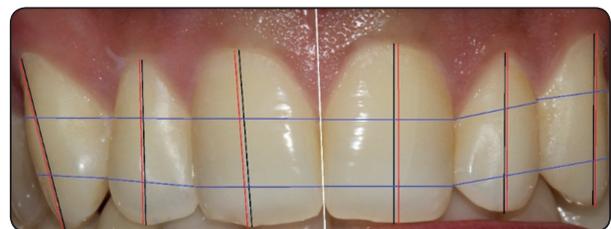


Fig. (1) Anatomical clinical landmarks which help to determine the marginal gingival zenith position MGZP (red) per each tooth; two horizontal lines (blue) which represent the proximal incisal contact area position and the apical contact area (tip of papilla) position and served as the reference points to locate the vertical bisected midline (black) on the center of these lines. MGZP deviations from the VBM were measured.

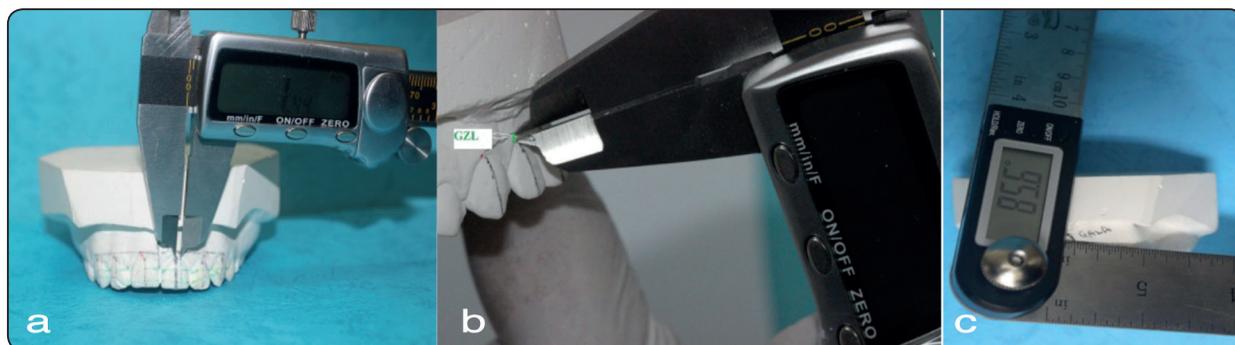


Fig. (2) Measurements were done on the casts of the maxillary anterior teeth; Digital caliper was applied for determining both parameters (MGZP) (a) and (GZL) (b). Digital protractor measured (GALA) ° (c).

**RESULTS**

The results of the present study showed that the mean ± standard deviation of the marginal gingival zenith positions MGZP in mm to vertical bisected midline VBM among male study participant of right central incisor CI, lateral incisor LI and canine C were 1.02 ± 0.21, 0.65 ± 0.15 and 0.48 ± 0.12 respectively. While, left central incisor CI, lateral incisor LI and canine C were 0.96 ± 0.24, 0.63 ± 0.14 and 0.60 ± 0.30 respectively.

As regards the GZL, it was found to be coronal to the gingival aesthetic line in all teeth [Table1].

Also, the results of the present study showed that the mean ± standard deviation of the marginal

gingival zenith positions MGZP in mm to vertical bisected midline VBM among female study participant of right central incisor CI, lateral incisor LI and canine C were 1.18 ± 0.19, 0.68 ± 0.14 and 0.50 ± 0.23 respectively. While, left central incisor CI, lateral incisor LI and canine C were 1.05 ± 0.20, 0.66 ± 0.16 and 0.44 ± 0.12 respectively.

As regards the GZL, it was found to be coronal to the gingival aesthetic line in all teeth. [Table 2].

There were no significant differences among males and females as regards the GZP of all anterior teeth. In all teeth it was positioned distally to the VBM. There were also no significant differences among males and females as regards the GZL as it was found to be placed coronal to the GAL (Table 3)

TABLE (1): Distribution of Gingival Zenith position and level among male study participants in millimeter

Gingival Zenith Position	Right				Left			
	Mean	SD	Max	Min	Mean	SD	Max	Min
Central incisor	1.02	0.21	1.40	0.80	0.96	0.24	1.50	0.70
Lateral incisor	0.65	0.15	0.82	0.40	0.63	0.14	.80	0.40
Canine	0.48	0.12	0.69	0.30	0.60	0.30	1.40	0.40
Gingival zenith level	0.77	0.55	1.60	0.00	0.95	0.52	1.70	0.00

TABLE (2) Distribution of Gingival Zenith position and level among female study participants in millimeter.

Gingival Zenith Position	Right				Left			
	Mean	SD	Max	Min	Mean	SD	Max	Min
Central incisor	1.18	0.19	1.50	0.89	1.05	0.20	1.40	0.70
Lateral incisor	0.68	0.14	0.82	0.46	.66	0.16	.86	0.40
Canine	0.50	0.23	1.11	0.30	.44	0.12	.59	0.21
Gingival zenith level	0.84	0.48	1.30	0.00	.86	0.51	1.40	0.00

TABLE (3) Comparison of gingival zenith positions and level between genders.

Gender		N	Mean	SD	Mean ranks	<i>p</i> * value
GZP_R_C	Male	10	1.02	0.21	8.10	0.068
	Female	10	1.18	0.19	12.90	
GZP_L_C	Male	10	0.96	0.24	8.85	0.209
	Female	10	1.05	0.20	12.15	
GZP_R_L	Male	10	0.65	0.15	10.05	0.731
	Female	10	0.68	0.14	10.95	
GZP_L_L	Male	10	0.63	0.14	9.65	0.514
	Female	10	0.66	0.16	11.35	
GZP_R_Can	Male	10	0.48	0.12	10.50	1.000
	Female	10	0.50	0.23	10.50	
GZP_L_Can	Male	10	0.60	0.30	12.05	0.233
	Female	10	0.44	0.12	8.95	
GZL_R_L	Male	10	0.77	0.55	9.95	0.676
	Female	10	0.84	0.48	11.05	
GZL_L_L	Male	10	0.95	0.52	10.95	0.733
	Female	10	0.86	0.51	10.05	

*\*These "p" values are obtained after comparing mean ranks from the Mann-Whitney U test.*

## DISCUSSION

The maxillary anterior teeth are considered the gate for the esthetic in dentistry so good evaluation of these teeth and soft tissues around them is very important to create beautiful smile<sup>[1]</sup>.

This study was conducted to evaluate two main parameters, marginal gingival zenith positions

(MGZP) and gingival zenith levels (GZL) related to soft tissue for the maxillary anterior teeth from the right canine to the left one among male and female.

Measurements were done on the maxillary study casts for all patients, by the use of a digital caliper (accuracy to 1/1000th of an inch) as previously described by other studies<sup>[14-17]</sup> who used the

caliper and dental casts in their studies to measure the marginal gingival zenith positions (MGZP) and gingival zenith levels (GZL) for the maxillary anterior teeth from the right canine to the left one.

In the present study, the mean descriptive analysis for marginal gingival zenith positions (MGZP), showed distal positions in all six maxillary anterior teeth in relation to the vertical bisected midline (VBM). These results are similar to those described by Regolin et al 2014 and Singhal et al 2012.

Zagar et al., evaluated specific distal deviations of the gingival zenith in the maxillary anterior teeth in young adults, measuring the gingival zenith position of the maxillary incisors and canines. They found that the magnitude and the frequency of distal displacement is tooth dependent and that it is greater in the central than in the lateral incisors, which in turn, is greater than in the canines<sup>[14]</sup>. This is in agreement of the present study.

The marginal gingival zenith positions (MGZP) for the lateral incisor is said to be coinciding with vertical bisected midline (VBM) [18] which disagrees with the results of this study.

In the present study, the mean descriptive analysis for gingival zenith levels (GZL) of the right and left sides showed that the lateral incisor gingival margin is just coronal to the neighboring central incisors and canines because the mean > 0. Whereas, Chiche, and Pinault., identified two esthetically pleasing patterns for the gingival level: the first one when the lateral incisor gingival margin is just coronal to the neighboring central incisors and canines which coincides with the results that were found in the present study. The second one when the gingival margin of lateral incisor is on the same line with the neighboring central incisors and canines that is not in agreement with the results of our study<sup>[7]</sup>. Also, Pawar, et al.:2014 found that the gingival zenith of lateral incisor is frequently below the gingival line (83%) versus on the line (17%) which agrees with the results of the present study.

The gender comparison of the gingival zenith positions and levels for all the participants did not show any significant differences for all the maxillary anterior teeth from the right canine to the left one. This was similar to Pini et al. who observed that there were no significant differences between the gender in the right and left sides<sup>[12]</sup>. On the other hand, Humagain et al. 2016 found significant differences in the GZP while they found no gender differences as regards the GZL.

### LIMITATION

The limitations are a limited sample size and a single center study; However, such studies may enable comparison and future planning of dental services to the patients among males and females.

### CONCLUSIONS

- 1- The marginal gingival zenith position (MGZP) is located distally in all anterior teeth. It shows its maximum distal shift in the central incisors.
- 2- The gingival zenith line (GZL) was found to be coronal to the gingival aesthetic line in all teeth with significant differences between right and left sides.
- 3- In all recorded parameters there were no differences between males and females.
- 3- These clinical parameters applied to the gingival contours may serve as esthetic guidelines and may enable us to obtain a more predictable esthetic outcome.

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