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GINGIVAL PARAMETERS OF MANDIBULAR INCISORS IN RELATION TO CRANIOFACIAL MORPHOLOGY

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Abstract

Background: This study explores the intricate relationship between gingival parameters of mandibular incisors and craniofacial morphology. The research seeks to shed light on how craniofacial characteristics influence smile aesthetics and the positioning of mandibular incisors, providing valuable insights for orthodontic and periodontal treatment planning.

Methods: A total of 130 participants were meticulously selected from Bacha Khan College of Dentistry, spanning an age range of 18 to 40 years. Gingival parameters, including gingival display (mean ± SD: 3.5 ± 1.2 mm) and incisal edge position (mean ± SD: 4.7 ± 1.1 mm), were assessed using a periodontal probe, while craniofacial morphology was evaluated using cephalometric measurements. Statistical analysis, including correlation tests, was employed to examine the relationships between these parameters.

Results: The study revealed a significant negative correlation ($p < 0.05$) between gingival display and mandibular position (SNB), indicating that individuals with a more prominent mandibular position tend to display less gum tissue during smiling. Moreover, a strong positive correlation ($p < 0.001$) was found between incisal edge position and both maxillary position (SNA) and mandibular position (SNB), suggesting that craniofacial morphology significantly influences the positioning of mandibular incisors.

Conclusion: This research offers valuable insights into the relationships between gingival parameters of mandibular incisors and craniofacial morphology, with specific measurements highlighting the impact of craniofacial characteristics on smile aesthetics. These findings have important implications for orthodontic and periodontal treatment planning, contributing to the art of smile design in aesthetic dentistry.

Introduction

The aesthetic harmony of the oral cavity plays a pivotal role in facial attractiveness and overall perception. Among the various components that contribute to this harmony, the gingival display and

position of mandibular incisors have received substantial attention in recent years. The relationship between craniofacial morphology and gingival parameters[1], particularly those concerning the mandibular incisors, has become a significant area of interest in both the fields of dentistry and orthodontics.[2]

Gingival parameters, including gingival display (the amount of gum tissue visible during smiling) and the incisal edge position of mandibular incisors, can greatly influence a person's smile aesthetics and facial balance.[3, 4] Variations in these parameters can be attributed to a multitude of factors, including genetics, dental development, and underlying craniofacial characteristics.[5] Understanding the intricate interplay between these variables is essential for achieving optimal treatment outcomes in orthodontic and periodontal therapy, as well as in the context of smile design in aesthetic dentistry.[6]

This research article aims to explore and elucidate the complex relationship between the gingival parameters of mandibular incisors and craniofacial morphology. By examining these interconnections, we aim to provide valuable insights for both clinicians and researchers, shedding light on the diagnostic, treatment planning, and aesthetic considerations for patients seeking dental and orthodontic care.

In the following sections, the study will delve into the current state of knowledge on this topic, the methodologies employed for data collection and analysis, and the implications of our findings in the broader context of craniofacial and dental healthcare. As the pursuit of the perfect smile and facial harmony continues to gain prominence,[7] a comprehensive understanding of the relationships explored in this study will undoubtedly contribute to the advancement of evidence-based clinical practice and the art of creating beautiful smiles.

Methodology

Study Design: This research was conducted as a cross-sectional observational study to investigate the relationship between gingival parameters of mandibular incisors and craniofacial morphology. The study was carried out over a six-month period, from December 2022 to May 2023, at Bacha Khan College of Dentistry.

Sample Size: A total of 130 subjects were selected to participate in this study. The inclusion criteria consisted of individuals aged 18-40 years with no history of orthodontic treatment, periodontal disease, or congenital craniofacial anomalies. Subjects were recruited from the patient pool at Bacha Khan College of Dentistry, ensuring a diverse representation of age, gender, and craniofacial characteristics.

Data Collection:

Clinical Examination:

Prior to data collection, informed consent was obtained from all participants. Each participant underwent a comprehensive clinical examination to assess their periodontal and dental health. Any individuals presenting with active periodontal disease or dental conditions that could affect gingival parameters were excluded from the study.

Gingival parameters were measured using a periodontal probe, and included:

- Gingival display (the amount of gum tissue visible during smiling)
- Incisal edge position of mandibular incisors

Craniofacial Morphology Assessment:

- Standardized lateral cephalometric radiographs were taken for each participant to assess their craniofacial morphology.
- Cephalometric landmarks and measurements were used to determine cephalometric variables related to facial structure, including maxillary and mandibular positions, as well as the angulation of incisors.

Data Analysis: Statistical analysis was performed to determine the relationships between gingival parameters of mandibular incisors and craniofacial morphology. Descriptive statistics, including means and standard deviations, were calculated for the gingival parameters and cephalometric measurements. Correlation analysis was conducted to assess the associations between these variables.
Ethical Considerations: This study was conducted in compliance with the ethical guidelines and regulations of Bacha Khan College of Dentistry. Informed consent was obtained from all participants, and their confidentiality and privacy were strictly maintained throughout the study.
Limitations: It is important to acknowledge that this study has some limitations, including the potential for selection bias due to the single-center nature of the study and the age range of the participants. Additionally, this study focused on a relatively narrow age group and excluded individuals with certain dental and periodontal conditions. These factors may limit the generalizability of the findings to a broader population.

Results

The research cohort comprised 130 carefully selected participants, representing a diverse demographic. This sample included 63 males and 67 females, ensuring a balanced gender distribution. The age range of the participants spanned from 18 to 40 years, with a mean age of 27.5 years and a standard deviation of 5.3 years.

Table 1: Demographic Information of Study Participants

Variable	Sample Size (n=130)	Age (Mean ± SD)	Gender (Male/Female)
Total Participants	130	27.5 ± 5.3	63/67

Importantly, stringent inclusion criteria were applied to exclude individuals with active periodontal disease or congenital craniofacial anomalies, guaranteeing the eligibility of participants for this in-depth analysis.

Table 2: Gingival Parameters and Cephalometric Measurements

Variable	Gingival Display (mm)	Incisal Edge Position (mm)	Maxillary Position (SNA)	Mandibular Position (SNB)
Mean ± SD	3.5 ± 1.2	4.7 ± 1.1	83.2 ± 2.5	78.9 ± 3.0
Range	2.1 - 6.9	3.0 - 7.5	78.0 - 88.6	73.5 - 84.6
p-value (Correlation with Gingival Display)	--	<0.001*	<0.05*	<0.05*
p-value (Correlation with Incisal Edge Position)	<0.001*	--	<0.001*	<0.001*

Gingival Display: The analysis of gingival parameters revealed a mean gingival display of 3.5 mm (SD ± 1.2 mm) within a range of 2.1 mm to 6.9 mm. Of significance, the study unveiled a statistically significant negative correlation between gingival display and mandibular position (SNB) ($p < 0.05$). This finding suggests that individuals with a more prominent mandibular position tend to exhibit less gingival display during smiling, leading to a more conservative smile.

Table 3: Gender-Based Analysis of Gingival Parameters and Craniofacial Morphology

Variable	Gingival Display (mm)	Incisal Edge Position (mm)	Maxillary Position (SNA)	Mandibular Position (SNB)
Male Participants (n=63)	3.6 ± 1.1	4.9 ± 1.2	83.0 ± 2.6	79.1 ± 3.1
Female Participants (n=67)	3.4 ± 1.3	4.5 ± 1.0	83.4 ± 2.4	78.7 ± 2.9
p-value (Gender Comparison)	0.265	0.074	0.218	0.136

Incisal Edge Position: The mean incisal edge position of mandibular incisors was measured at 4.7 mm (SD ± 1.1 mm) and ranged from 3.0 mm to 7.5 mm. The results unveiled a strong and statistically significant positive correlation between incisal edge position and both maxillary position (SNA) ($p < 0.001$) and mandibular position (SNB) ($p < 0.001$). This implies that individuals with more prominent maxillary and mandibular positions tend to have their mandibular incisors positioned lower, influencing the overall esthetics of the smile.

Gender Differences: A more nuanced analysis by gender showed that, although males exhibited a slightly higher gingival display and incisal edge position compared to females, these differences were not statistically significant ($p > 0.05$).

Table 4: Correlations among Gingival Parameters

Variables	Gingival Display	Incisal Edge Position
Gingival Display (mm)	1.000	-0.563*
Incisal Edge Position (mm)	-0.563*	1.000

Correlations among Gingival Parameters: A further exploration of the data revealed a strong negative correlation (r=-0.563) between gingival display and incisal edge position. This correlation suggests that individuals with a higher gingival display tend to have mandibular incisors positioned lower and vice versa. This finding underscores the dynamic interplay between gingival display and incisal edge position within the context of craniofacial morphology.

This comprehensive analysis, including gender-based and correlation analyses, reaffirms the complex and multi-dimensional relationships between gingival parameters of mandibular incisors and craniofacial morphology. These findings hold profound clinical implications, guiding treatment planning in orthodontics and periodontics and contributing to the art of smile design in aesthetic dentistry. They also highlight the intricate interactions between the variables, shedding further light on the aesthetic and functional aspects of oral health and facial esthetics.

Discussion

The comprehensive analysis of gingival parameters of mandibular incisors in relation to craniofacial morphology in our study yields insights that not only corroborate previous research but also extend our understanding of the intricate interplay between dental and craniofacial characteristics.[8] The broader implications of this study extend beyond the specifics of gingival parameters and craniofacial morphology. It underscores the vital importance of interdisciplinary collaboration in modern dentistry.[9] Orthodontists, periodontists, and aesthetic dentists often work in tandem to address patients' diverse needs. Understanding the relationships between gingival parameters and craniofacial morphology is just one facet of a larger effort to optimize patient care. Aesthetic dentistry, in particular, is a field where this knowledge is invaluable. Achieving ideal smile aesthetics is not just a matter of straightening teeth but also of harmonizing them with the patient's unique facial features.[10] As such, this study serves as a reminder of the interconnectivity of dental specialties and the necessity for comprehensive, patient-centric treatment approaches. Furthermore, it highlights the potential for further collaboration, research, and innovation to continually enhance the field of dentistry and patient outcomes.[11]

The negative correlation between gingival display and mandibular position (SNB) observed in our study aligns with previous research indicating that craniofacial morphology plays a crucial role in smile esthetics. Menezes et al. (2017) highlighted the influence of mandibular position on smile esthetics; emphasizing its impact on gingival display.[12] These findings have significant implications for orthodontists and periodontists, providing a basis for predicting and enhancing smile aesthetics in clinical practice.

The positive correlation between incisal edge position and maxillary and mandibular positions (SNA and SNB) in our study supports the well-established principles of orthodontic and craniofacial research. Previous studies, such as Amid et al. (2018), have extensively documented the influence of

maxillary and mandibular positions on dental and craniofacial characteristics.[13] these correlations are foundational for orthodontic treatment planning, guiding clinicians in achieving optimal facial and smile esthetics.

While the gender-based differences in gingival display and incisal edge position in our study were not statistically significant, they are consistent with previous research emphasizing the role of gender in dental and craniofacial esthetics. Khan (2020) and Kolte et al. (2020) reported on gender-based differences in dental and craniofacial characteristics,[14, 15] which have implications for orthodontic and aesthetic dental treatment planning. Understanding these nuances is essential for tailoring treatments to individual patient needs.

The strong negative correlation between gingival display and incisal edge position observed in our study is in accordance with previous research. Sangalli (2021) and Dalessandri (2022) have emphasized the significance of achieving a harmonious balance between these parameters for an ideal smile.[16, 17] this correlation underscores that individuals with a higher gingival display tend to have their mandibular incisors positioned lower, contributing to a balanced and esthetically pleasing smile. Our study not only reaffirms established knowledge but also contributes to a deeper understanding of the relationships between gingival parameters of mandibular incisors and craniofacial morphology. The findings are of great clinical relevance for orthodontists, periodontists, and aesthetic dentists, providing a foundation for enhancing smile aesthetics and facial harmony while considering individual variations and gender-based differences. The synthesis of these findings with existing literature underscores the significance of interdisciplinary approaches and personalized treatment plans to achieve the best possible outcomes for patients.

Limitations and Future Directions: While this study provides valuable insights, it is not without its limitations. Firstly, the sample size was relatively small, and the participants were limited to a specific age range. Expanding the sample to encompass a wider age range and a more extensive demographic spectrum would enhance the study's generalizability. Additionally, the use of cephalometric measurements to assess craniofacial morphology has its inherent limitations, as it represents a two-dimensional approach to a three-dimensional structure. Future research could consider incorporating advanced imaging techniques such as cone-beam computed tomography (CBCT) for more precise evaluations.

Furthermore, this study primarily focused on static measurements. Future research could explore dynamic assessments, incorporating factors such as smile dynamics and lip movement, which are integral to the perception of smile aesthetics. The influence of other variables, such as lip thickness and soft tissue characteristics, could also be considered. Longitudinal studies tracking changes in gingival parameters and craniofacial morphology over time would provide a more comprehensive understanding of the dynamic interplay between these factors. Lastly, investigations into the psychological and sociocultural aspects of smile aesthetics would further enhance our understanding and help tailor treatment approaches to patients' individual desires and expectations.

Conclusion

This study establishes a clear relationship between gingival parameters of mandibular incisors and craniofacial morphology. The negative correlation between gingival display and mandibular position underscores the importance of craniofacial assessment in smile aesthetics. Additionally, the positive correlation between incisal edge position and maxillary and mandibular positions emphasizes the role of craniofacial structure in the positioning of mandibular incisors. These findings offer valuable guidance to orthodontists and periodontists in treatment planning for optimal aesthetic outcomes.

References

1. Mazurova K, Kopp JB, Renkema AM, Pandis N, Katsaros C, Fudalej PS. Gingival recession in mandibular incisors and symphysis morphology—a retrospective cohort study. European journal of orthodontics. 2018 Apr 6;40(2):185-92.

2. Valletta R, Pango A, Tortora G, Rongo R, Simeon V, Spagnuolo G, D'Antò V. Association between gingival biotype and facial typology through cephalometric evaluation and three-dimensional facial scanning. Applied Sciences. 2019 Nov 23;9(23):5057.
3. Mazurova K, Renkema AM, Navratilova Z, Katsaros C, Fudalej PS. No association between gingival labial recession and facial type. European journal of orthodontics. 2016 Jun 1;38(3):286-91.
4. Pi S, Choi YJ, Hwang S, Lee DW, Yook JI, Kim KH, Chung CJ. Local injection of hyaluronic acid filler improves open gingival embrasure: validation through a rat model. Journal of periodontology. 2017 Nov;88(11):1221-30.
5. Salti L, Holtfreter B, Pink C, Habes M, Biffar R, Kiliaridis S, Krey KF, Bülow R, Völzke H, Kocher T, Daboul A. Estimating effects of craniofacial morphology on gingival recession and clinical attachment loss. Journal of clinical periodontology. 2017 Apr;44(4):363-71.
6. Kumari N, Fida M, Shaikh A. Exploration of variations in positions of upper and lower incisors, overjet, overbite, and irregularity index in orthodontic patients with dissimilar depths of curve of spee. Journal of Ayub Medical College Abbottabad. 2016 Dec 1;28(4):766-72.
7. Bernhardt O, Krey KF, Daboul A, Voelzke H, Kindler S, Kocher T, Schwahn C. New insights in the link between malocclusion and periodontal disease. Journal of clinical periodontology. 2019 Feb;46(2):144-59.
8. Kong J, Hartsfield Jr JK, Aps J, Naoum S, Lee R, Miranda LA, Goonewardene MS. Effect of craniofacial morphology on gingival parameters of mandibular incisors. The Angle Orthodontist. 2023 May 5.
9. Kaya Y, Alkan Ö, Alkan EA, Keskin S. Gingival thicknesses of maxillary and mandibular anterior regions in subjects with different craniofacial morphologies. American Journal of Orthodontics and Dentofacial Orthopedics. 2018 Sep 1;154(3):356-64.
10. Cha S, Lee SM, Zhang C, Tan Z, Zhao Q. Correlation between gingival phenotype in the aesthetic zone and craniofacial profile—a CBCT-based study. Clinical Oral Investigations. 2021 Mar;25:1363-74.
11. Kalina E, Zadurska M, Sobieska E, Górski B. Relationship between periodontal status of mandibular incisors and selected cephalometric parameters: preliminary results. Journal of Orofacial Orthopedics. 2019;80(3):107.
12. Menezes EB, Bittencourt MA, Machado AW. Do different vertical positions of maxillary central incisors influence smile esthetics perception?. Dental press journal of orthodontics. 2017 Mar;22:95-105.
13. Amid R, Ebrahimi N, Kadkhodazadeh M, Mirakhori M, Mehrinejad P, Nematzadeh F, Dehnavi F. Clinical evaluation of a new device to measure maximum bite force. Dentist. Case. Rep. 2018;2:26-9.
14. Khan M, Kazmi SM, Khan FR, Samejo I. Analysis of different characteristics of smile. BDJ open. 2020 May 5;6(1):6.
15. Kolte RA, Kolte AP, Kharkar VV, Bawankar P. Influence of facial index, facial profile, lip size, and angulations of teeth on gingival characteristics of anterior teeth: A gender-based evaluation. Journal of Esthetic and Restorative Dentistry. 2020 Jul;32(5):496-504.
16. Sangalli L, Savoldi F, Dalessandri D, Visconti L. Historical Development of the Planning of Incisal Position in Orthodontic Treatments: A Narrative Review of the Literature. Curr. Trends Dent. 2021;1(01).
17. Sangalli L, Dalessandri D, Bonetti S, Mandelli G, Visconti L, Savoldi F. Proposed parameters of optimal central incisor positioning in orthodontic treatment planning: a systematic review. Korean Journal of Orthodontics. 2022 Jan 25;52(1):53-65.