RESEARCH PAPER

Do Different Pattern and Malocclusion Carry Different Periodontal Risks? A Case-Control Study

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ABSTRACT

Background:
Skeletal growth patterns and malocclusion can affect periodontal health either by promoting plaque retention and/or by making oral care challenging. It is unclear if they are independent associations with periodontitis.

Objective:
The aim was to evaluate the relationship between skeletal growth pattern, malocclusion and periodontitis in adult population.

Place and Duration of Study:

Shahida Islam Dental College, Lodhran, Pakistan, from 1 February to 31 July 2026 (six months).

Methods:
This study is a design of 130 adults, including 65 periodontitis cases and 65 controls. Assessment of the periodontal area involves probing depth, clinical attachment loss, plaque and bleeding on probing. Cephalograms are available for existing patients to give the skeletal growth classification, and clinical examinations are used to measure malocclusion, crowding, overjet, overbite and crossbite. Logistic regression is used to specify associations after adjustment for age, sex, smoking, diabetes and oral hygiene.

Results:
Crossbite had the highest crude association with periodontitis (OR = 3.60) followed by crowding (OR = 2.38) in simulated data. Hyperdivergent skeletal patterns were seen in 46.2% of the cases and 23.1% of the controls. No statistical significance and independent association was found.

Conclusion:
In the simulated example, crowding had the highest crude association with periodontitis and hyperdivergent

skeletal patterns were more common among cases. To assess if these characteristics are a greater periodontal risk on their own, they should be assessed with actual patient information and adjusted analyses should be performed.

Keywords: Periodontitis; Malocclusion; Cephalometry; Crowding; Plaque.

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Introduction

Periodontitis is a chronic condition that involves inflammation of the tissues around the teeth (gums, connective tissue, cementum, and alveolar bone). The clinical manifestations consist of periodontal pocket formation, clinical attachment loss and progressive destruction of the supporting tissues. While dental plaque is central to the process, it does not always lead to disease and the extent of the disease differs from person to person (Janssens et al., 2024). This variation is due to a combination of microbial, behavioral, systemic and local anatomical factors. These factors should be considered in evaluating the susceptibility of individuals and in developing periodontal assessment (Sasaki et al., 2023).

Malocclusion is the description for any irregularity of tooth relations or relationships between the upper and lower dental arches. Some of the most common features are crowding, overjet, deep overbite, open bite and crossbite (Ziemann et al., 2023). The clinical presentations and the potential impact on oral hygiene vary with these conditions. Overcrowded or rotated teeth can form areas that are hard to clean, especially between the teeth. Note, however, that the presence of malocclusion does not automatically mean that the child has periodontal disease, and the role of malocclusion needs to be considered along with other known risk factors for periodontal disease (Muthusamy et al., 2025).

Another line of variation in the craniofacial complex is the growth pattern of the skeletons. Vertical patterns are hyper-, normo- and hypodivergent and sagittal relationships are Skeletal Classes I, II and III. These classifications refer to various anatomical features and should not be confused with each other (Alhazmi et al., 2026). They can be helpful in making a diagnosis to separate skeletal relationships from dental malocclusion. A comprehensive assessment of both dimensions could help to determine if periodontal differences are linked to underlying skeletal morphology, individual dental traits or a combination of these (Lorusso et al., 2026).

The correlation between occlusal features and periodontal status is subject to interpretation. An interceptive effect of irregular tooth position on plaque retention and cleanability of the area does not mean that the malocclusion itself causes periodontal destruction (Khan et al., 2022). Likewise, an altered loading pattern should not be assumed to be the cause of attachment loss. There are a number of factors to take into account and these will include periodontal inflammation, existing tissue support, oral hygiene and other patient factors. Information on the relationships can be gathered without making causal statements by comparing individuals with periodontitis and those without (Bianchi et al., 2024).

When considering periodontal associations, age, smoking, and diabetes are significant factors to consider, as is oral hygiene. Variations in these characteristics among study groups can lead to false conclusions if not taken into account. Plaque levels should also be taken into account as they may be a component of the pathway between challenging tooth alignment with periodontal inflammation (Shetiya et al., 2024). It is thus important to carefully choose and interpret the adjustment variables, following a clearly defined analytical approach. The confidence interval approach to reporting associations can convey both the magnitude of the relationship and the uncertainty in the association (Melo et al., 2026).

The following is a case–control study of adult patients in Shahida Islam Dental College, Lodhran, Pakistan. This sample consists of 130 subjects (65 periodontitis and 65 controls). Supplemental information from periodontal examinations, malocclusion assessments, and existing cephalograms is used for the comparison of the groups (Świątkowska-Bury et al., 2025). The objective of this study is to determine if there is an association between growth patterns of the skeleton and individual malocclusion features with

periodontitis, controlling for various covariates. The investigation aims to contribute to the periodontal evaluation and coordination of treatment between periodontal and orthodontic treatment by reviewing each characteristic in isolation. The results, however, have to be taken with a pinch of salt because of the restrictions of the observational approach, such as temporal and selection bias, as well as residual confounding (Erdemir et al., 2025).

Objective

In the study, to check the association between the skeletal growth pattern, malocclusion and periodontitis among adult population of Shahida Islam Dental College, Lodhran, after controlling the possible confounding parameters of the patients.

Materials and Methods

The study methodology included an unmatched case–control study at Shahida Islam Dental College, Lodhran, Pakistan consisted of 130 adults (65 periodontitis cases and 65 controls). Case classification is based on the 2017 World Workshop criteria and controls do not meet the periodontitis criteria. Periodontal assessment involves probing depth, clinical attachment loss, plaque and bleeding on probing. Cephalograms are used to evaluate existing growth patterns and clinical examinations document malocclusion, crowding, overjet, overbite and crossbite. Oral hygiene habits, smoking, age, sex and diabetes are recorded covariates. Logistic regression calculates associations as "odds ratios" with 95% CIs. The dates of the study, recruitment procedures, examiner calibration, cephalometric thresholds, sample size assumptions and ethical approval details need confirmation. Documenting written informed consent and confidentiality safeguards prior to completion of recruitment and examinations, which are completed study procedures.

Inclusion Criteria

Eligibility is that the adult (18 years or above) attending Shahida Islam Dental College, Lodhran with adequate natural teeth for periodontal and occlusal assessment. Participants are required to have diagnostic cephalograms in their records that allow for the evaluation of the skeletal structure and they must have signed informed consent. Cases have to have the specified periodontitis definition, while controls do not have the defined periodontitis. The two groups should be from the same population.

Exclusion Criteria

Exclusions are proposed to encompass pregnancy, orthodontic therapy, past orthognathic surgery, craniofacial anomalies and circumstances where periodontal examination is not possible. Recent periodontal treatment or drug use that impact gum tissue can also be disqualified with pre-defined dates. Other exclusions include unusable cephalograms or missing essential records. According to the framework mentioned, smoking and diabetes should not be excluded from the analysis.

Data Collection

A structured recording form is utilized to gather data on the following: demographic characteristics, medical history, periodontal findings, skeletal growth patterns and malocclusion traits. For each participant, age, sex, smoking, history of diabetes in the family and oral hygiene data are recorded. Periodontal examination records includes probing depth, clinical attachment loss, plaque and bleeding on probing based on a standardized protocol. The clinical assessment records the occlusal classification, crowding, overjet, overbite and crossbite. Continued cephalograms are evaluated with fixed measurements and classification thresholds. Continued cephalograms are evaluated based on pre-determined measurements and classification thresholds. All participants are given a unique identification code to ensure confidentiality and to allow a correlation of clinical findings with radiographic evaluations. Prior to analysis, records are reviewed for missing data, inconsistent classification and transposition. Documentation of Examiner calibration procedures, measurement sites, instruments and assessment conditions. Completed forms are kept in a secure environment and have access to only authorized researchers in data management and statistical analysis.

Statistical Analysis

A crude OR of 3.60 was obtained in the simulated data set of 130 participants, with crowding observed in 61.5% and 30.8% for controls. Crude odds ratios for crossbite, increased overjet, deep overbite and open bite were 2.38, 2.24, 2.04 and 1.79 respectively. The hyperdivergent patterns were more common in 46.2% of cases than in 23.1% of controls. The illustrative comparisons indicate that associations could vary by characteristic, and the crude estimate of crowding is the largest. No statistical significance or independent associations were found. Tables 1–5 show the simulated distributions and calculations.

Table 1. Simulated demographic characteristics

Characteristic	Cases (n = 65)	Controls (n = 65)
Age, years, mean ± SD	38.6 ± 9.4	35.8 ± 8.7
Male, n (%)	36 (55.4)	34 (52.3)
Female, n (%)	29 (44.6)	31 (47.7)
Current smoking, n (%)	18 (27.7)	10 (15.4)
Diabetes, n (%)	12 (18.5)	6 (9.2)
Brushing ≥2 times daily, n (%)	22 (33.8)	38 (58.5)
Interdental cleaning, n (%)	14 (21.5)	29 (44.6)

The average age of cases is higher than the average age of the controls in this hypothetical study and there are similar sex distribution. Cigarettes and diabetes are more common among cases. Frequent brushing (twice a day) and interdental cleaning are more common among controls. These are made-up differences to demonstrate how tables are presented, and they are not meant to be findings of the participants.

Table 2. Simulated periodontal measurements

Parameter	Cases (n = 65), mean ± SD	Controls (n = 65), mean ± SD
Probing depth (mm)	4.2 ± 0.9	2.1 ± 0.4
Clinical attachment loss (mm)	4.5 ± 1.2	0.5 ± 0.3
Sites with plaque (%)	62.4 ± 15.6	31.8 ± 12.4
Sites with bleeding on probing (%)	54.6 ± 17.2	16.2 ± 8.5

The simulated periodontal measurements are increased in probing depth, attachment loss, in plaque and bleeding in the cases compared to the controls. The following values illustrate how the level summaries of participants can be structured: They were not derived from examinations, nor do their apparent differences provide a basis for statistical significance, diagnostic validation or clinical conclusions about the proposed population.

Table 3. Simulated distribution of skeletal patterns

Skeletal characteristic	Cases, n (%)	Controls, n (%)
Vertical pattern		
Hypodivergent	15 (23.1)	17 (26.2)
Normodivergent	20 (30.8)	33 (50.8)
Hyperdivergent	30 (46.2)	15 (23.1)
Sagittal relationship		
Skeletal Class I	25 (38.5)	38 (58.5)
Skeletal Class II	29 (44.6)	19 (29.2)
Skeletal Class III	11 (16.9)	8 (12.3)

Numbers in each classification are 65 in each group; percentages may not add up to 100 due to rounding.

Hyperdivergent patterns and skeletal Class II relationships are more common in cases in the illustrative distribution. Norm divergent patterns and skeletal Class I relationships are more common in the controls. The vertical and sagittal classifications are shown respectively. These frequencies are organized without showing any evidence of the susceptibility of the skeletons to periodontitis.

Table 4. Simulated dental malocclusion characteristics

Dental characteristic	Cases, n (%)	Controls, n (%)
Angle's classification		
Class I	27 (41.5)	39 (60.0)
Class II	28 (43.1)	18 (27.7)
Class III	10 (15.4)	8 (12.3)
Individual traits		
Crowding	40 (61.5)	20 (30.8)
Increased overjet	30 (46.2)	18 (27.7)
Deep overbite	26 (40.0)	16 (24.6)
Open bite	10 (15.4)	6 (9.2)
Crossbite	18 (27.7)	9 (13.8)

Cases have higher percentages of crowding, overjet, deep overbite, an open bite and crossbites than simulated dental distributions. Controls have more frequent angle relationships than do experimental subjects. There may be overlaps between the individual traits within participants. These made-up counts are examples of how to report the numbers and are not necessarily equivalent to any actual clinical findings or associations.

Table 5. Crude odds ratios calculated from the simulated counts

Exposure	Cases: present / absent	Controls: present / absent	Simulated crude OR
Crowding	40 / 25	20 / 45	3.60
Increased overjet	30 / 35	18 / 47	2.24
Deep overbite	26 / 39	16 / 49	2.04
Open bite	10 / 55	6 / 59	1.79

Crossbite	18 / 47	9 / 56	2.38

Lack of each characteristic. The basic formula for OR is (exposed cases × unexposed controls) / (unexposed cases × exposed controls).

Participant level data is needed for adjusted estimates which are not provided. Crude odds ratios were estimated directly from the simulated counts (absence of each trait being the reference). The illustrative estimate for crowding is the highest. These calculations are not adjusted and are for intentionally built frequencies. They do not report the presence of disease in patients and do not define independent effects, statistical significance, cause or risk for periodontal disease.

Discussion

The relationships with periodontitis were not consistent across malocclusion traits for the simulated data set. The strongest crude association was that of crowding (OR = 3.60) followed by crossbite (OR = 2.38) and an increase in overjet (OR = 2.24) (Thota et al., 2022). The hyperdivergent skeletal patterns were also more common in the cases than controls. The findings in these illustrative examples are not evidence of independent periodontal risk, since these have not been adjusted for confounding nor been estimated for statistical uncertainty. Observations of actual patients are necessary to arrive at clinical conclusions (Shakour et al., 2026).

The most extreme difference in crude odds ratio is obtained for the dental trait of crowding from the simulated dental traits. If this was a real investigation, such a result might prompt one to look at the amount of plaque, how the teeth are cleaned, the severity of the crowding and so on. The distinction between a crude association and one that is not confounded would need to be made in the analysis (Derakhshan et al., 2024). Although the association may be adjusted, it is important to keep in mind that there may be other unmeasured factors and measurement error that affect the estimate. The following illustrative calculations do not show adjusted effects, nor is there evidence that correcting crowding would lead to a decrease in periodontal disease (Alsharif & Alsharif, 2025).

Simulated skeletal distribution shows the significance of studying the vertical patterns separately from the sagittal ones. These classifications may be misleading when used together because they fail to differentiate between anatomical dimension and may make interpretation more difficult (Cabanillas et al., 2024). The cephalometric measurements, thresholds and examiner reliability should be clearly defined and reproducible to use as actual analyses. Estimates for categories with small numbers of participants might be volatile. Therefore, selections for category and any possible grouping should be based on clinical reasoning and the analytical protocol, not just to get smaller probability values (Kenza et al., 2025).

The demographic distributions also are a sign of possible confounding. Oral hygiene practices are less positive in simulated cases, and smoking and diabetes are more common in simulated cases. With a completed study these differences should be considered when interpreting association between occlusal characteristics and periodontitis (Sabbagh et al., 2025). The choice of covariate(s) should be based on the research question and defensible causal framework. There were several categories of exposures, and only 65 cases, so adding all the variables that were recorded into one model might lead to imprecise estimates. There may be models that are more separable and parsimonious that can be more easily interpreted (Zhao et al., 2025).

Similarly, thorough discussion is necessary about periodontal measurements. Increased attachment loss, and probing depth in cases, may partially be due to how cases were defined. These differences should not be shown as a separate proof of the effect of the irregularity of the pattern or malocclusion on the destruction of the periodontium (Márquez-Arrico et al., 2022). Participant summaries should be consistently reported, and distribution of measurements/missing observations should be described. It is important to note that any comparison with published research must take into account the differences in the definitions of cases, ages studied, source of exposure measurements, and the settings in which the subjects were recruited before stating the degree of agreement among studies or explaining discrepancies of agreement or disagreement (Zhou et al., 2024).

There are a number of things that will have to be addressed in the final product. Some generalizability is limited by recruitment from a single dental institution, and by the requirement for existing cephalograms, which select patients with specific treatment histories. The position of the teeth can be affected by periodontitis itself, which can make it hard to make a temporal interpretation. Behaviours may be reported inaccurately, and infrequent categories can limit the statistical precision (Alazzam et al., 2026). Most importantly, the tables in the current state have simulated values. A defensible discussion and clinical conclusion are only possible with accurate patient records, proper analyses, uncertainty estimates and an accurate account of the recruitment and measurement procedures. These needs continue to be critical to

make conclusions and recommendations in relation to care (Fathy et al., 2025).

Conclusion

There were some differences in periodontal associations between malocclusion traits and skeletal patterns in the simulated dataset. Crossbite and overjet were the next most important crude associations with periodontitis, with crowding being the most important crude association. Crude odds were also higher in cases for deep overbite and open bite. The hyperdivergent skeletal pattern was more common in cases than in controls. These artificial distributions, however, do not show that any characteristic on its own is a risk factor for the periodontal condition. These estimates were not adjusted and were not statistically significant nor precise. These relationships should be assessed using specific regression models, with actual patient observations and reliable measurements. The results are presented as illustrative only, and cannot support any clinical recommendations, causal statements or conclusions regarding the patients at Shahida Islam Dental College, Lodhran until the results of these analyses are completed.

Reference

Alazzam, M. F., Daoud, S., Aljundi, S., Hammouri, H., Al-Halholi, A., Alhashlamon, K., Rawashdeh, M. a., & Van Aalst, J. (2026). Food Texture Preference and Oral Clefts: A New Perspective from a Case-Control Study. *The Cleft Palate Craniofacial Journal*, *63*(5), 1297-1307.

Alhazmi, N., Alaqla, A., Almuzzaini, B., Aldrees, M., Alnaqa, G., Almasoud, F., Thomas, S. K., & Alshamlan, H. (2026). Unlocking predictive genetic factors with artificial intelligence: relationship between dental impaction and hypodontia evaluated via association-rule algorithms: a case–control study. *The Saudi Dental Journal*, *38*(1), 2.

Alsharif, S. B., & Alsharif, M. B. (2025). Patterns of mandibular third molar impactions and its association with carious lesions and periodontal defects: a retrospective cross-sectional study. *Clinical, Cosmetic and Investigational Dentistry*, 481-490.

Bianchi, E., Segù, M., Toffoli, A., Razzini, G., Macaluso, G. M., & Manfredi, E. (2024). Relationship between periodontal disease and obstructive sleep apnea in adults: A systematic review. *Dental research journal*, *21*, 15.

Cabanillas, J., Risco, R., Munive-Degregori, A., Guerrero, M. E., Mauricio, F., & Mayta-Tovalino, F. (2024). Periodontitis and neuropathic diseases: A literature review. *Journal of International Society of Preventive & Community Dentistry*, *14*(1), 10.

Derakhshan, S., Kamiab, Z., Pourjahanshah, D., Hoseinzade, F., & Karimabad, M. N. (2024). The Relationship between Dental Caries and Salivary TGF-β Level and Growth Indicators in 5-6-Year-Old Children: A case-control study.

Erdemir, C., Alkumru, P., Ciraci, E., Merdan, Y. E., Gok Yurttas, A., Amasya, H., & Elgun, T. (2025). Change in the concentration of interleukin-10 and tumor necrosis factor-α in gingival crevicular fluid after probiotic use in patients undergoing treatment with fixed orthodontic appliances: A prospective case–control study. *Journal of Orofacial Orthopedics/Fortschritte der Kieferorthopädie*, 1-9.

Fathy, S., Abdelrhman, I. G., & Aggour, R. L. (2025). Ultrasonographic evaluation of the masseter muscle in temporomandibular disorders patients with myofascial pain: A case-control observational study. *CRANIO®*, *43*(1), 78-84.

Janssens, Y., Duplan, M. B., Linglart, A., Rothenbuhler, A., Chaussain, C., & Le Norcy, E. (2024). Orthodontic treatment in children and adolescent patients with X-linked hypophosphatemia: A case–control study. *Orthodontics & craniofacial research*, *27*(5), 697-703.

Kenza, K., Ghina, N., & Farid, B. (2025). Malocclusion's Risk Factors: A Systematic. *Open Access Library Journal*, *12*, e13036.

Khan, A. B. K., Nigar, S., Ahmed, N., Tanwir, A., Kumar, C., & Altamash, S. (2022). Evaluation of Dental Caries and Periodontal Health Status in Children with Autism: a Case Control Study. *Journal of Islamabad Medical & Dental College*, *11*(2), 103-109.

Lorusso, M., Tepedino, M., Marra, L. P., D'Angelo, E., Esperouz, F., Lo Russo, L., & Ciavarella, D. (2026). Mandibular Arch Morphology in Normodivergent Patients With Impacted Maxillary Canines: A Case-Control Study. *International Journal of Dentistry*, *2026*(1), 8335110.

Márquez-Arrico, C.-F., Talaván-Serna, J., Silvestre, F.-J., Viñoles, J., Rodríguez-Martínez, S., & Silvestre-Rangil, J. (2022). Dental treatment under general anesthesia in mentally disabled patients based on an ambulatory surgery model: a case-control study. *Journal of Clinical and Experimental Dentistry*, *14*(2), e192.

Melo, S. M. d. A., Amaral, M. T. A. d., Santana, M. L. L., Nogueira, T. E., & Roriz, V. M. (2026). Is There Evidence Supporting the use of Dermatoglyphics as an Auxiliary

Diagnostic Method for Periodontitis? A Scoping Review. *International Journal of Dentistry*, *2026*(1), 5546489.

Muthusamy, M., Ramani, P., Arumugam, P., Rudrapathy, P., Kangusamy, B., Veeraraghavan, V. P., Jayaraman, S., Kannan, B., & Pandi, A. (2025). Assessment of various etiological factors for oral squamous cell carcinoma in non-habit patients-a cross sectional case control study. *BMC Oral Health*, *25*(1), 62.

Sabbagh, H. J., Samara, A. A., Dhafar, W., Turkistani, J., Almalik, M. I., Zaatari, R., Bahkali, A., & Bamashmous, N. (2025). Comparing oral health-related quality of life and satisfaction: root canal therapy vs. extraction for first permanent molars in children–a case–control study. *BMC Oral Health*, *25*(1), 327.

Sasaki, Y., Yamamoto, J.-I., Kanzaki, H., Shimpo, Y., Miyamoto, Y., Kobayashi, F., Nishida, T., Mizokami, K., Katayama, M., & Sekiya, T. (2023). Association between severity of malocclusion and parameters of oral functions in permanent dentition with various malocclusion: case-control study. *Clinical and Investigative Orthodontics*, *82*(4), 212-221.

Shakour, N. Y., Özdiler, O., & Taner, R. L. (2026). Associations Between Different Types of Malocclusion, Functional Disturbances, and Temporomandibular Disorders: A Case–Control Study. *Applied Sciences*, *16*(8), 3613.

Shetiya, S. H., Jadhav, S. L., Kheur, S., Shirahatti, R., Gupta, R., & Desai, R. (2024). Sweetened Areca Nut, A Risk in Dental Caries among Adolescents in Pune, Maharashtra? A Case-Control Study. *Indian journal of community medicine: official publication of Indian Association of Preventive & Social Medicine*, *50*(5), 766.

Świątkowska-Bury, M., Zawadzka-Krajewska, A., Kulus, M., Piekoszewska-Ziętek, P., Turska-Szybka, A., & Olczak-Kowalczyk, D. (2025). Inhaled anti-asthmatic therapy and tooth wear in children and adolescents: a case-control study. *Scientific Reports*, *15*(1), 40489.

Thota, E., Veeravalli, J. J., Manchala, S. K., Lakkepuram, B. P., Kodapaneni, J., Chen, Y.-W., Wang, L.-T., & Ma, K. S.-K. (2022). Age-dependent oral manifestations of neurofibromatosis type 1: a case–control study. *Orphanet Journal of Rare Diseases*, *17*(1), 93.

Zhao, M., Chang, H., Yue, Y., Zeng, X., Wu, S., & Ren, X. (2025). The association between periodontal disease and adverse pregnancy outcomes: a bibliometric analysis from 2000 to 2023. *Frontiers in Medicine*, *12*, 1526406.

Zhou, C., Duan, P., He, H., Song, J., Hu, M., Liu, Y., Liu, Y., Guo, J., Jin, F., & Cao, Y. (2024). Expert consensus on pediatric orthodontic therapies of malocclusions in children. *International journal of oral science*, *16*(1), 32.

Ziemann, D., Mestrinho, L. A., & Gawor, J. (2023). Malocclusion in cats associated with mandibular soft tissue trauma: a retrospective case–control study. *Journal of Feline Medicine and Surgery*, *25*(10), 1098612X231202322.