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Dental anomalies in orthodontic patients with and without skeletal discrepancies

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Abstract

Objective: To determine whether individuals with skeletal discrepancies of Class II or III display a higher frequency of dental anomalies in comparison with individuals with Class I malocclusion.
Design: A systematic search of the main electronic medical scientific literature databases was conducted. Observational studies were selected if mentioning dental anomalies in the different skeletal malocclusion patterns.
Results: A total of 4,768 studies were found and the duplicated studies (1,279) were removed, resulting in 3,489 papers to be analyzed. After screening by title, 138 were fit for screening by abstract. After that, a total of 13 papers were carefully read in full. Five studies included dental anomaly frequencies in orthodontic patients and included 7,679 participants. The frequency of dental anomalies ranged from 11.2% to 40.3%. It was observed that individuals with skeletal discrepancies of Class II and III had more dental anomalies when compared to individuals with Class I.
Conclusion: Individuals with skeletal malocclusion patterns have more dental anomalies and there is an association between dental anomalies and skeletal Class II or Class III malocclusion patterns.

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Introduction

Dental anomalies are clinical alterations resulting from disturbances during the tooth formation process.[1] They represent disturbances of number, size, shape, position and structure of the teeth.[1,2] The prevalence of dental anomalies can range from 5.46 to 74.7%,[1,3] due to different ethnicities and diagnostic criteria.[1,4,5] The etiology of dental anomalies includes genetic and environmental factors.[2,5,6]

Skeletal malocclusions are usually categorized and described by disturbances in the craniofacial and occlusal relationships[7] and often appear together with the dental anomalies, asserting their relation and complicating therapy.[8] It appears that dental anomalies may be more likely to occur if individuals have Class II or Class III relationships in comparison to Class I.[9] This sophisticated clinical definition is a base for phenotype-genotype correlation, that may contribute to more accurate treatment predictions and to genetic studies.[9] This systematic review aimed to confirm that evidence exists that individuals with Class I skeletal malocclusion are less likely to have dental anomalies.

Material and Methods

The present systematic review was registered at Prospective Register of Systematic Reviews (PROSPERO; Centre for Reviews and Dissemination, University of York; and the National Institute for Health Research) under the registry number

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CRD42016038916 and followed the Preferred Reporting Items for Systematic Review and Meta Analyses (PRISMA) checklist.[10]

Search Strategy

The following focused question was formulated: "Is there a difference in the frequency of dental anomalies in orthodontic patients with Class II or III versus Class I malocclusion?" To develop the focused question, a set of criteria for study eligibility was adopted, based on PECOS strategy (Population: orthodontic patients; Exposure: skeletal discrepancies; Comparator: standard of normality; and Outcome: dental anomalies), using MeSH, entry terms and key words (**Table 1**).

The main search was conducted in November 2016 and was updated on January 2019. Publications of potential relevance to this study were identified after searching the main electronic medical scientific literature databases, including PubMed, Scopus, LILACS, Web of Science, the Cochrane Library, and Google Scholar. Additional articles of potential relevance were identified by manual searches. Textbooks, dissertations, case reports, case series, review articles, and abstracts were excluded. Studies in populations presenting specific systemic diseases, conditions (history of trauma, cleft lip and/or palate, syndromes), endocrine imbalances and/or metabolic disorders (being these sporadic or hereditary), and no descriptions of the three skeletal malocclusions were excluded.

Two examiners (C.C.A.F. and M.G.M.) independently screened each paper by examining the title, abstract, and keywords. No restriction was applied regarding language or date of publication.

The selected studies were described in relation to the type of study, total sample, sex distribution, how the diagnosis of skeletal malocclusion and dental anomalies were performed, and the frequency of dental anomalies in each malocclusion. Dental anomalies were also grouped in anomalies of number, shape and position (**Table 2**).

Table 1. PECOS strategy (Population; Exposure; Comparator; and Outcome), using MeSH, entry terms and key words

	MeSH	Entry Terms	Key Words
P: **Mandible e Maxilla**	Maxilla (25648) + (15289)	Bone Maxillary (21502) Maxillae (1317)	Craniofacial Region (584) Bone (560528) Oral region (504)
	Jaw (92640) + (23972)	Jaws (10315)	Jawbone (465) Anatomic regions (798) Facial skeleton (1404)
	Mandible* (48910) + (33401)		
E: **Skeletal Discrepancies**	Malocclusion, Angle Class II (5272) + (03)	Angle Class II (408)	Class II (49045) Skeletal Class II Malocclusion (140)
	Malocclusion, Angle Class III (2961) + (134)	Prognathism, Mandibular (1604)	Class III (17141) Skeletal Class III Malocclusion (377)
		Angle Class III (142)	
		Underbite (14)	
	Prognathism (3102) + (1845)		Craniofacial Abnormalities (786)
C: Standard Pattern	Malocclusion, Angle Class I (1267) + (207)	Angle Class I (260)	Class I (51655)
O: Dental Anomalies			

Search String:

(Maxilla[MeSH Terms]) OR Maxilla[Title/Abstract]) OR Bone Maxillary[Title/Abstract]) OR Maxillae[Title/Abstract]) OR Craniofacial Region[Title/Abstract]) OR Bone[Title/Abstract]) OR Oral Region[Title/Abstract]) OR Jawbone[Title/Abstract]) OR Anatomic regions[Title/Abstract]) OR Facial skeleton[Title/Abstract]) OR Jaw[MeSH Terms]) OR Jaw[Title/Abstract]) OR Jaws[Title/Abstract]) OR Mandible[MeSH Terms]) OR Mandible*[Title/Abstract])) AND ((((((((((((((Malocclusion, Angle Class II[MeSH Terms]) OR Malocclusion Angle Class II[Title/Abstract]) OR Angle Class II[Title/Abstract]) OR Class II[Title/Abstract]) OR Skeletal Class II Malocclusion[Title/Abstract]) OR Malocclusion, Angle Class III[MeSH Terms]) OR Malocclusion Angle Class III[Title/Abstract]) OR Prognathism Mandibular[Title/Abstract]) OR Angle Class III[Title/Abstract]) OR Underbite[Title/Abstract]) OR Class III[Title/Abstract]) OR Skeletal Class III Malocclusion[Title/Abstract]) OR Prognathism[MeSH Terms]) OR Prognathism[Title/Abstract]) OR Craniofacial Abnormalities[Title/Abstract])) AND ((((Malocclusion, Angle Class I[MeSH Terms]) OR Malocclusion Angle Class I[Title/Abstract]) OR Angle Class I[Title/Abstract]) OR Class I[Title/Abstract])

Results and Discussion

Observational studies were included because they mentioned dental anomalies in the different skeletal malocclusion patterns, enabling comparison between groups (Classe I, II and III) and different populations. **Figure 1** shows the flow diagram of the search results from the databases. After search, a total of 4,768 records were found: 750 from Cochrane Library, 1,616 from PubMed, 911 from Scopus, 323 from Scopus-Med, 1,158 from Web of Science, four from LILACS and BBO, and six from Google Scholar.

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Table 2. Data extracted from the five selected studies.

Studies	Type of study	Sample	Males N (%)	Females N (%)	Skeletal malocclusion diagnosis method	Dental anomalies diagnosis method	Prevalence of dental anomalies N (%)
Chung et al., 2008	Observational	1793	611(37.7)	1011 (62.3)	cephalometric tracing	Panoramic radiographs, and dental models	182 (11.2)
Uslu et al., 2009	Observational	900	352 (39.1)	548 (60.9)	cephalometric tracing	Panoramic/periapical radiographs, photos, records and dental models	363 (40.3)
Young, 2010	Observational	3055	1205 (39.5)	1850 (60.5)	not reported	Panoramic and periapical radiographs, and dental models	344 (11.3)
Celicoglu and Kamak, 2012	Observational	146	449 (42.9)	597 (57.1)	cephalometric tracing	Panoramic radiographs and records	237 (22.7)
Fernandez et al., 2018	Observational	1047	453 (43.3)	594 (56.7)	cephalometric tracing	Panoramic and periapical radiographs, photos, records and dental models	127 (15.7)

Studies	Class I – no dental anomalies (N)	Class II – no dental anomalies (N)	Class III – no dental anomalies (N)	Class I – with dental anomalies (N)	Class II – with dental anomalies (N)	Class III – with dental anomalies (N)
Chung et al., 2008	979	256	376	103	19	60
Uslu et al., 2009	202	221	99	156	155	67
Young, 2010	862	985	864	123	117	104
Celicoglu and Kamak, 2012	290	290	229	74	72	91
Fernandez et al., 2018	158	136	28	152	113	43

Studies	Class I – with dental anomalies of number (N)	Class II – with dental anomalies of number (N)	Class III – with dental anomalies or number (N)	Class I – with dental anomalies of shape (N)	Class II – with dental anomalies of shape (N)	Class III – with dental anomalies of shape (N)
Chung et al., 2008	103	19	60	-----	-----	-----
Uslu et al., 2009	83	73	41	163	73	31
Young, 2010	123	117	104	-----	-----	-----
Celicoglu and Kamak, 2012	72	74	91	-----	-----	-----
Fernandez et al., 2018	58	38	13	21	15	12

Studies	Class I – with dental anomalies of position (N)	Class II – with dental anomalies of position (N)	Class III – with dental anomalies of position (N)	Study conclusion
Chung et al., 2008	-----	-----	-----	Hypodontia was associated with third molar agenesis and skeletal Class III malocclusion.
Uslu et al., 2009	17	6	8	A remarkably high rate of dental anomalies was recorded in orthodontic patients.
Young, 2010	-----	-----	-----	The prevalence of hypodontia in Koreans is relatively high.
Celicoglu and Kamak, 2012	-----	-----	-----	Third molar agenesis depends on sagital skeletal malocclusions.
Fernandez et al., 2018	73	60	18	Microdontia was associated with the skeletal Class III malocclusion pattern, and tooth agenesis was associated with the hypodivergent growth pattern.

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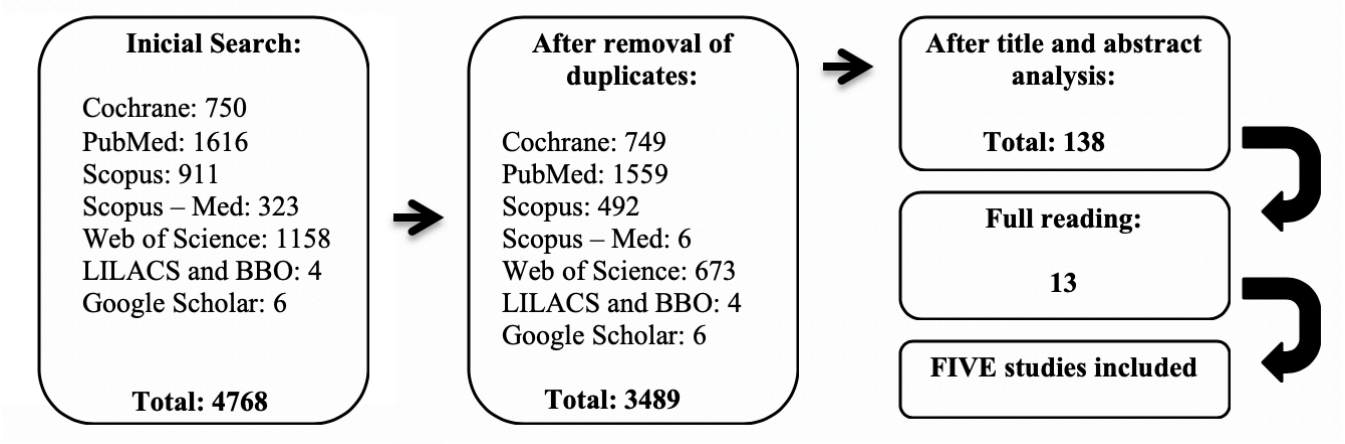
Figure 1. Flow diagram of the literature search and selection process implemented.



The duplicated studies (1,279) were removed, resulting in 3,489 records to be analyzed. After screening by title, 138 were fit for screening by abstract. After that, a total of 13 records were carefully read in full and five studies containing 7,679 participants were selected. The eight studies were excluded because they did not have the classification of skeletal malocclusions patterns.

Table 2 shows the extraction of the data from the selected studies. The frequency of dental anomalies ranged from 11.2% to 40.3%.[1,9,11,12,13] It was observed that individuals with skeletal discrepancies (Class II and III) had more dental anomalies when compared to individuals with no skeletal discrepancies (Class I).[1,9,12,13] The same was observed for dental anomalies of number,[1,12,13] shape, and position.[10] Three studies only made the diagnosis of tooth agenesis[11,13] and/or third molar agenesis.[11,12]

The studies included in this systematic review had a frequency of dental anomalies raging from 11.2% to 40.3%. Celicoglu and Kamak (2012)[12] reported a frequency of 22.7% of dental anomalies whereas Fernandez et al. (2018)[9] reported a frequency of 15.7% of dental anomalies of number, shape and position. Uslu et al. (2009)[1] had the highest frequency of dental anomalies among orthodontic patients of the five studies selected (40.3%), having tooth agenesis, evagination, and invagination as the most common dental anomalies. The studies that found the lowest frequency of dental anomalies in orthodontic patients were of Young (2010)[5] and Chung et al. (2008),[11] with a frequency of 11.3% and 11.2%, respectively. It is likely that these differences are due to the different populations studied (Turkish, Brazilian, and Korean) and different dental anomaly definitions.

Conclusion

In summary, individuals with skeletal Class II or Class III malocclusion patterns have more dental anomalies than individuals who are Class I. In addition, there is an association between dental anomalies and skeletal Class II or Class III malocclusion patterns.

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