



Systematic Review

Prevalence of Dental Anomalies in Adult Orthodontic Patients with Oral Radiological Point: A Systematic Review

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Abstract

Background: Dental rosy anomalies, although not a disease, can impact a person's quality of life. This study investigates irregularities in the teeth, the degree of opening of the edge of the upper and lower teeth, and pink dental anomalies in the studied population.

Methods: The study reviewed 61 articles with keywords "dental anomalies," "orthodontics," "dental problems," and "internal diseases" in the Web of Science, PsycInfo, PubMed, and Scopus and published between January 2010 and September 2024.

Results: Dental abnormalities noticeably affect the appearance of teeth. In dental anomalies, deviations are the origin of dental tissue, and can occur in tooth enamel, dentin, or cementum of dental tissues.

Conclusion: Abnormalities can be drastic changes or minor deviations. They have various causes. Some abnormalities are caused by intrinsic factors such as heredity, metabolic disorder, or genetic mutation. Other external causes include physical or chemical trauma, biological agents, nutritional deficiencies, stress, habits, or adverse environmental conditions. True anodontia is the congenital absence of teeth, including the teeth, baby teeth, or both. Congenital loss of milk teeth prevents permanent replacement.

Keywords: dental anomalies, orthodontics, radiology, adult

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1. Introduction

The rationale behind the emphasis on maintaining healthy gums in adults undergoing orthodontic treatment is that the tooth is subjected to minimal forces during the process, facilitating its movement through the adjacent bone [1]. If the applicant has active gum disease and the gums are not healthy enough, it will cause the jawbone to weaken and disappear over time. This problem can eventually compromise the teeth's structural integrity and cause their fragility [2]. Therefore, before commencing treatment, periodontal diseases should be addressed. One must maintain oral hygiene regularly to maintain periodontal health during the treatment [3]. A study concluded that apical movements of the root (intrusive) are among the decisive factors of external root resorption [4].

Another study investigated the role of intrusion as an effective factor in the root analysis of maxillary anterior teeth. After treatment, these patients with deep bites showed root resorption of 0.6 mm compared to the control group [5]. The study investigated root resorption in people with anterior open bites and found that people with open bites, compared to people with deep bites, had less root length of maxillary anterior teeth and more root resorption at the tip of the root before starting the treatment. In these patients, two-thirds of the open bites were with CI II malocclusion and one-third were with CI III malocclusion, but in the deep bite group, most were with CI II Div 1 and a few were with CI I [6]. After the treatment, root resorption was observed in both groups; however, it was more observed in the open bite group.

Contrary to the studies' results regarding the effect of vertical problems on the rate of root resorption, it was found that the vertical movements of teeth during the treatment of CI I and

CI II patients, with extraction to remove crowding, had a significant relationship with the resorption rate [7]. Additionally, it was observed that there is no relationship between the amount of overbite at the start of treatment and the amount of root resorption. Thus, neither open-bite nor deep-bite individuals demonstrated more root analysis [8].

Root resorption in open-bite patients treated by the intrusion of molar teeth showed that the mesial roots of these teeth had more root resorption than the same control group, without the technique. The intrusion was done on the molars, similar to the study, which stated that intrusion to treat a deep bite or intrusion of posterior teeth to treat an open bite is among the riskiest orthodontic movements that cause root resorption [9]. One study reported that correcting an open bite may elevate the likelihood of root resorption. This condition can be ascribed to the jiggling of teeth resulting from elevated tongue dysfunction among affected individuals [10]. An array of distinct orthodontic treatment options is available to correct abnormalities in the teeth and mandible of an adult. Various orthodontic methods for adults are old metal brackets, ceramic brackets, linear or dental back orthodontics, and Damon orthodontics [11].

If the patient presents with a moderate jaw deformity and maintains sufficient gum health, compensatory orthodontics or camouflage may be used to initiate treatment without resorting to jaw surgery [12].

This is done to check the face's growth, especially the jaws' development. Later, the dentist will provide long- and short-term plans to address the individual's needs as the teeth grow. This study aimed to investigate irregularities in the teeth, the degree of opening of the edges of the upper

and lower teeth, and pink-dental anomalies in the studied population.

2. Materials and Methods

In this study, 61 articles with keywords “dental anomalies,” “orthodontics,” “dental problems,” and “internal diseases” from the Web of Science, PsycINFO, PubMed, and Scopus published between January 2010 and September 2024 were reviewed. Then a systematic investigation of the prevalence of dental anomalies in adult orthodontic patients was done (Figure 1). Information about elongated teeth, crowding, spacing, diastema, the most irregular upper and lower anterior teeth, overjet and negative overjet, the amount of openness between the upper and lower anterior teeth, and the relationship of anterior-posterior molars were collected through a questionnaire.

2.1. Jaw, face, and dental abnormalities

2.1.1. Maxillary deficiency

If the upper jaw is small, it is possible to it transversely with movable screw plates. The patient is instructed on the procedure to open the movable screw plate during its insertion, which typically occurs every five days. In some cases, Hyrax screws, which are slightly larger, can be used to open the middle palate seam. It should be noted that the type of screw used depends on the kind of deformity [13]. Occasionally, inadequate anterior–posterior growth may be observed in the upper mandible, in addition to its diminutive size [14]. In other words, it may be behind its correct position, in which case, extra-oral devices are used on the face, which relate to elastics to the mobile plate of the upper jaw and guide the

upper jaw forward. The extra-oral devices used for this purpose are a Face mask or a Reverse chin cap. Undoubtedly, alternative orthodontic devices comprising movable plates within the oral cavity and front rods can facilitate the advancement of the upper mandible. In these devices, with the tongue pressure applied to these bars, it is possible to compensate for the decrease in the growth of the upper jaw with the help of the force of the tongue [15]. Alternatively, by affixing a stretcher and a mobile or fixed device to the upper mandible while a Mini screw is positioned in the lower jaw, it is possible to promote the expansion of the upper jaw. In another way, it is possible to help increase the growth of the upper jaw by placing a Mini plate in the lower jaw along with a mobile or fixed device in the upper jaw [16]. These treatments should be administered before puberty; surgery will be required if the patient presents after puberty and growth has reached its conclusion [17].

2.1.2. Smallness of the lower jaw (Maxillary deficiency)

In cases where the lower mandible of the patient is comparatively small or exhibits stunted growth, a condition known as maxillary deficiency, functional devices should be utilized to guide the lower jaw forward. These treatments are considered part of orthopedic treatments [17]. In other words, facial correction is done with these functional devices. Functional devices are large mobile devices that stimulate the growth of the lower jaw so that the lower jaw reaches its natural size and position. It is optimal for the patient to undergo these treatments before puberty for optimal results. Potential complications may necessitate future jaw surgery if these remedies are not administered promptly [18].

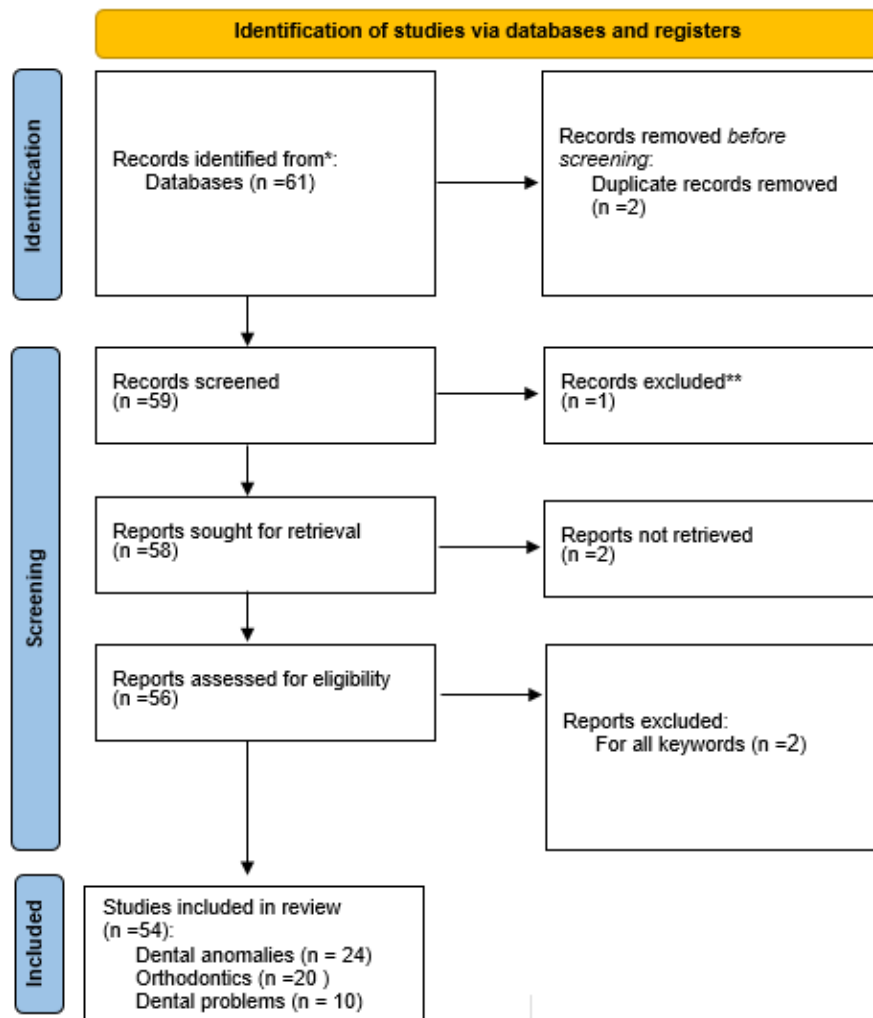


Figure 1: PRISMA 2020 flow diagram.

2.1.3. The size of the upper jaw (Maxillary protrusion)

In some cases, the upper jaw may be large and placed forward, a condition called maxillary protrusion [19]. To move the upper jaw back, extra-oral devices known as headgear are required to move the upper jaw back. Elastics situated on the head or back of the neck can prevent the headgear from expanding excessively. Different types of headgear devices can be used depending on the type of abnormality.

2.1.4. Mandibular prognathism

This abnormality, called the most challenging jaw problem, does not respond much to mobile treatments that usually include a chin strap [20]. It is widely acknowledged in the authoritative orthodontic literature that using a chin strap is ineffective in preventing excessive growth of the lower mandible [21]. These instruments elongate the patient's visage by merely rotating the lower jaw back and down. Usually, these patients have a genetic background of overgrowth of the lower jaw in the family. The definitive treatment for this

abnormality is jaw surgery to move the lower jaw back, which is called mandibular setback [22].

2.1.5. Class 3 malformation (CI III)

It is a state in which the upper and lower jaws are not aligned, that is, either the upper jaw is back, the lower jaw is forward, or a combination of these two states is seen. In this anomaly, the mesiobuccally cusp of the upper first molar is behind the buccal groove of the lower first molar; the lower molars are placed further than usual [23]. The lower jaw is further than the upper jaw, and the molar-canine relationship is CI III. The face profile of these people is concave. The mandibular teeth are retro-lined in these people to compensate for the reverse overjet. Due to the reduced arch size, crowding results from migrating the mandibular anterior teeth to the lingual [24]. The incisor relationship in the CI III patient can vary from edge to edge between the incisors to a reverse overjet. In some patients, the skeletal relationship may be CI III, but the dental relationship may not be CI III due to overjet compensation, in mandibular prognathism, the lower jawbone grows more than the upper jaw. This type of malocclusion has a more complex treatment and may require orthognathic surgery and orthodontic treatment [25]. In maxillary deficiencies, if the patient comes before puberty and during the appropriate growth period, moving the upper jaw forward with extraoral devices such as a face mask or reverse chin cup devices is possible [26]. Pseudo-CI III is an alternative compound of CI III. These individuals' forward contact causes a forward jaw displacement. The patient moves their jaw forward to create a proper occlusion [27]. These people are not true CI III, but if left untreated, they will become true CI III. To distinguish the false CI III from the real one, the lower jaw should be moved back to create

an edge-to-edge relationship or normal overjet. If the lower mandible retracts, then a false CI III is present. Because, in actual CI III, there is no means to retract the jaw [28].

2.2. Crowding of teeth

Disorganized and congested teeth constitute the prevailing rationale behind patients seeking orthodontic treatment. This effect arises from the jaw and dentition being incompatible. An instance where the disease of the small jaw is inherited from the mother and the condition affecting the large teeth is inherited from the father results in an irregular fit of the large teeth within the small jaw and an irregular crowding of the teeth. Additionally, factors such as premature extraction of milk teeth without sufficient space between them or the existence of dummy teeth, mixing the eruption order of permanent teeth, finger and tongue sucking, and mouth breathing can contribute to the development of irregular teeth. In addition to causing the patient cosmetic issues, improperly maintained disordered teeth contribute to tooth decay, periodontal disease, and plaque accumulation. Generally, the buccal cavity, the initial segment of the digestive system, is exposed to potential hazards to its health [29]. If the patient's teeth are irregular and there are no jaw problems, the patient can be treated at any age, granted there are no gum problems. However, if there is a jaw problem, the patient should be referred before puberty. In other words, jaw treatment should be done with mobile or even extra-oral devices to place the jaws correctly, and the teeth should be regularized with fixed orthodontics [30]. If the patient comes at an age older than puberty and has no gum problems, the teeth can be adjusted. However, to correct the jaws after

puberty, orthodontics and jaw surgery are needed to place them in the correct position [31].

2.3. Inconsistency of the middle line of the teeth (midline)

The middle line of the upper and lower teeth arch is called the midline. First, the midline of the upper jaw should be aligned with the midline of the face and the midline of the lower jaw with the midline of the face. Second, the midline of the upper and lower teeth should be in line with each other. Misalignment of the midline or middle line of the teeth may result from dental issues such as crowding of teeth, one-sided extraction of permanent or milk teeth, or the absence of one or more teeth [32]. It may also be caused by jaw-skeletal problems or jaw deviation. If the midline mismatch is due to jaw deviation and the patient comes before puberty, the patient's problem can be easily treated with mobile orthodontic devices. If the patient comes after puberty and has jaw-skeletal issues [33], they will need jaw surgery along with orthodontics. As a result, early treatment and nonsurgical orthodontics are given precedence. Consistent treatment is necessary for patients with dental issues, and the timing of such treatment can vary depending on the condition of the patient's tissues [34].

3. Results

Magnesium oxide nanoparticles have advantages such as antibacterial properties, biocompatibility, and suitable color. Although their use in orthodontics has not been studied, studies can investigate their potential in dental materials. The information extracted from the tooth mimics was analyzed to check how the tooth moves in Abaqus.

3.1. A gap between the teeth (generalized spacing)

In this type of malformation, a prominent jaw is usually inherited from the father and small teeth from the mother. In this case, there are gaps between the teeth due to the smallness of the teeth and the extra space in the jaw arch. Among other factors that cause gaps between teeth are the absence of one or several teeth, protruding anterior teeth, and a large tongue. The presence of spaces between teeth results in the following complications: periodontal disease, plaque accumulation, food becoming lodged between the teeth, diminished dental function, and an unsightly appearance that requires professional treatment. In most cases, a fixed orthodontic appliance is sufficient to close the space between the teeth. However, when the patient also presents with a jaw problem, the oral appliance should be adjusted before the gap is addressed. This adjustment must be completed before puberty. In some patients, there may be a gap between the teeth due to missing one or two teeth. Here, two treatment methods can be applied based on the patient's condition. One method is bringing the rear teeth forward, which closes the space between them and the front teeth. If the patient's condition permits, space closure should be implemented as a treatment method. Otherwise, an implant should be placed in the space of the missing teeth. In most cases, there is an agreement to close the missing space before placing an implant for the patient. However, the final treatment plan should be based on the patient's condition, the presence or absence of crowded teeth, the profile of the patient, the amount of protrusion of the anterior teeth and radiographic images [35].

3.2. Common dental problems in people with developmental disabilities

People with developmental disabilities often face a higher prevalence of dental problems. Here are some of the common dental issues you may encounter:

- (i) **Tooth decay:** Tooth decay is prevalent in people with developmental disabilities. This can be due to problems in maintaining oral hygiene, or because certain medications commonly prescribed to these people cause dry mouth and thus lead to tooth decay.
- (ii) **Gum disease:** Gum disease occurs more often and at a younger age in people with developmental disabilities. This is probably due to difficulties with effective brushing and flossing, which is very important for gum health.
- (iii) **Malocclusion:** Misalignment of the teeth, or malocclusion, is prevalent in individuals with developmental disabilities. It increases the risk of gum disease, dental decay, and oral injuries, and can cause difficulty chewing and speaking [36].
- (iv) **Oral health problems caused by chronic health conditions:** People with developmental disabilities often suffer from chronic health problems such as diabetes, which can cause oral health problems. For example, diabetes can increase the risk of developing gum disease [37].
- (v) **Oral and dental health problems caused by damage to oral habits:** Disorders can result from injury to oral habits, including, but not limited to, mouth breathing, tongue thrusting, and teeth grinding and clenching. These

behaviors can significantly impact individuals with developmental disabilities. Consistent dental hygiene, such as regular brushing, flossing, and attending dental appointments, is critical for managing these issues [38].

4. Discussion

Some patients find orthodontic treatment and mandible surgery terrifying [39]. This matter suggests that the current body of knowledge in this domain is insufficient. The most critical issue in these patients is to inform and specify the benefits and harms of each treatment for each patient [40]. Suppose the patient has a jaw abnormality and presents before puberty. In that case, the patient's abnormality can be treated with orthodontics alone without surgery [41]. Otherwise, surgery will be required. Informing and elucidating the benefits and risks associated with each treatment for each patient is paramount in managing these patients [41]. Surgical intervention may not be necessary if a patient presents with jaw problems after puberty; however, orthodontic treatment may be sufficient to correct the abnormality if the patient presents with jaw problems before puberty [42]. Orthognathic patients are those referred to an orthodontic specialist after puberty due to jaw disorders. These patients should first undergo orthodontic treatment before being referred to a maxillofacial surgeon for surgery and undergoing orthodontic treatment thereafter [43]. Orthodontics before surgery will solve the problem of crowding and regularize the teeth. The maxillofacial surgeon cannot operate on the jaw unless the teeth are regular [44]. Therefore, the prerequisite for surgery will be orthodontics. After surgery, orthodontics will be used to coordinate the two operated jaws and order the teeth [44] better, correct any rotation of

the teeth, and stabilize the surgical treatment. This surgery is performed under general anesthesia [45]. The condition where the upper mandible is retracted is called maxillary deficiency [46]. In this situation, the patient must undertake maxillary advancement surgery, which involves advancing the upper jaw. If the upper jaw is forward, or in other words, the patient has a maxillary protrusion, the upper jaw must be moved back, which is called maxillary setback surgery. If the patient has a posterior mandible, in other words, mandibular deficiency, the mandible must be brought forward through a mandibular advancement surgery. If the patient has a lower front jaw or mandibular prognathism, they undergo mandibular setback surgery [47]. If the patient has a deep or open bite, they will undergo Lefort surgery. It should be noted that this treatment is a team treatment between the orthodontist and the maxillofacial surgeon. Accurate execution of treatment procedures is imperative [48, 49]. After that, attaining the desired outcomes will prove exceedingly challenging. These procedures, which typically necessitate a single day of hospitalization, are classified as uncomplicated surgical procedures that include jaw and facial surgery. An orthodontist performs a preliminary examination of the teeth, jaw, and visage [50]. If you have a dental jaw malformation, the orthodontist should check the pairing of teeth more carefully.

Observing different aspects of the teeth, jaw, and face is necessary to do this. This is usually done by taking photos of the teeth and face, radiographs of the teeth and head, and a mold of the teeth [51]. Notably, every single one of these procedures is uncomplicated. During a more comprehensive examination of the oral cavity, a mold of the individual may be created. Plaster is then used to cast this mold to replicate the

condition of dentition precisely. This plaster model is an essential tool for orthodontic specialists. Because it records the condition of teeth before starting orthodontic treatment. A photograph of teeth, face, and profile helps the specialist design a treatment for the patient and monitor progress. The orthodontist will use all these devices and tools to improve the treatment plan, which is only suitable for treating deformity [36]. There are various classifications for abnormalities, with most issues falling into one of three primary categories according to the relationship of the first large molars or the jaw. This classification system is called Angle's classification after an American specialist. Table 1 shows the prevalence of dental anomalies in adults orthodontic patients.

5. Conclusion

Overall, 91% of the subjects had not lost their upper anterior teeth and 80.3% of their lower anterior teeth; 39% were without crowding and 41% were without space between teeth. The average presence of diastema among people was 0.36 mm. The average of the highest irregularity in the anterior teeth of the upper jaw was 1.01 mm and 0.87 mm in the lower jaw. The average overjet was 1.8 and the average negative overjet was 0.04 mm. The average opening between the edge of the upper and lower teeth was 0.31 mm, and in 48.15% of people, the relationship of the molars was normal. The average dental beauty index was 41.2, with the lowest value being 13 and the highest being 60. Based on these results, dental-pink abnormalities in more than one-third (43.16%) of the studied population required various degrees of treatment. Anomalies are unique and difficult to classify into a single category. The prevalence

Table 1: Prevalence of dental anomalies in adults orthodontic patients.

Raw	Study	Year		Proportion	Weight 98%	Weight%
1	Abdolrezaei <i>et al.</i> [36]	2024		0.92	[0.90–1.06]	3.02
2	Magdi <i>et al.</i> [37]	2022		0.87	[0.14–1.02]	2.41
3	Chan <i>et al.</i> [38]	2022		0.88	[0.13–1.31]	2.25
4	Hejlesen <i>et al.</i> [35]	2020		0.6	[0.25–1.30]	5.45
Heterogeneity $t^2 = 0.04$, $I^2 = 0.02$, $H^2 = 1.2$				0.95	[0.22–1.07]	
Test of $\theta = \theta$, $Q (4) = 3.45$, $P = 0.44$						
1	Abdolrezaei <i>et al.</i> [36]	2024		0.84	[0.27–1.05]	4.3
2	Magdi <i>et al.</i> [37]	2022		0.76	[0.32–0.42]	4.05
3	Chan <i>et al.</i> [38]	2022		0.11	[0.34–0.95]	2.04
4	Hejlesen <i>et al.</i> [35]	2020		0.39	[0.32–0.91]	5.04
Heterogeneity $t^2 = 0.1$, $I^2 = 0.11$, $H^2 = 0.22$				0.77	[0.49–1.01]	
Test of $\theta = \theta$, $Q (4) = 3.15$, $P = 0.4$						
1	Abdolrezaei <i>et al.</i> [36]	2024		0.92	[0.59–1.01]	2.6
2	Magdi <i>et al.</i> [37]	2022		0.87	[0.54–1.02]	5.3
3	Chan <i>et al.</i> [38]	2022		0.99	[0.63–1.11]	6.2
4	Hejlesen <i>et al.</i> [35]	2020		0.68	[0.25–1.18]	3.2
Heterogeneity $t^2 = 0.4$, $I^2 = 0.00$, $H^2 = 1.00$				0.87	[0.22–1.17]	
Test of $\theta = \theta$, $Q (4) = 3.5$, $P = 0.2$						

of anomalies in classes one, two, and three was 47.4%, 14.7%, and 1.2%, respectively.

Although dental anomalies may not cause symptoms, they can lead to several clinical issues. Early detection of dental anomalies prevents complications, increases complexity, ensures proper treatment planning, and can identify possible orthodontic problems. The fact that different populations have different dental anomaly types and frequencies lends credence to the idea that racial factors contribute to the prevalence of dental anomalies. The prevalence and types of dental anomalies vary within and between populations. In addition to understanding the types of anomalies, practitioners may be better able to diagnose dental abnormalities early if they consider the patient's age, gender, and jaw prevalence as essential factors in their diagnosis.

Declarations

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None.

Ethical Considerations

Ethical clearance was obtained from the Scientific Research and Publishing Unit of Islamic Azad University Tehran, Dental Branch.

Competing Interests

None.

Availability of Data and Material

All data presented in this article or any additional information shall be available on request.

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None.

Abbreviations and Symbols

CI I: Class 1

CI II: Class 2

CI III: Class 3

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