

Hypodontia - an overview of the particularities, etiologic factors and treatment

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Abstract

Background. Hypodontia is a common dental anomaly that concerns mostly the permanent dentition. Tooth absence can be observed in the frontal or lateral area of dental arch, in general being considered an evolutionary adaptation to the smaller sizes of the jaws. Environmental, genetic and epigenetic factors were mentioned as causes for hypodontia. Associations between hypodontia and tooth size and shape are a controversial issue among different authors. There are regional variations in the number of missing teeth. The severity of the disease is dependent on the number of absent teeth.

Aims. The study aims to analyze the general particularities of hypodontia, the causes, the signs and symptoms, the methods used for diagnostic and treatment options in order to optimize the management of this dental disorder.

Methods. Literature research was performed in PubMed based on specific keywords and the relevant articles were selected and then analyzed.

Results. Prevalence of tooth absence, clinical situation and associations to other conditions and symptoms were evaluated by different authors. Hypodontia was reported both in the primary and secondary teeth. Prevalence among females was found higher than in males. Certain teeth are absent more frequent in women, others in men. The last molars, lateral incisors and second premolars are the most reported missing teeth.

Conclusions. Early diagnostic and treatment can enhance the chances of a successful treatment in cases of congenitally tooth absence. It is essential that dental care practitioners inform patients and their families that management of this condition may require multi- and inter-disciplinary input.

Keywords: hypodontia, oligodontia, agenesis, aplasia, impacted teeth

Introduction

Hypodontia (congenital dental aplasia, oligodontia or dental agenesis), is defined as the congenital absence of different teeth, a common dental anomaly that concerns mostly the permanent dentition (Rakhshan, 2015). If the condition is found in primary dentition, it is in general accompanied by permanent missing teeth (Amini et al., 2012; Nunn et al., 2003; Polder et al., 2004).

There wasn't a certain correlation with either of the upper or lower jaws or anterior and posterior areas of the arches. Usually, the condition is accompanied by complications that are addressed to different dental specialties like orthodontics, prosthodontics or maxillofacial surgery, requiring sometimes complex rehabilitation and costly treatments (Rakhshan, 2015). Other dental anomalies (Wu et al., 2007; Goya et al., 2008) as well as some skeletal changes are also associated to dental agenesis (Hirukawa et al., 1999).

Regarding the number of missing teeth, there are variations among different populations, the maximum number of missing teeth being higher in continents like Asia and Europe, while in Australia and South America lower number of absent teeth was found (Rakhshan, 2015). In general, this dental anomaly is considered a consequence of evolutionary adaptation to the smaller dimension of the jaw sizes (Altug-Atac & Erdem, 2007; Shetty et al., 2012). Some authors also found associations between hypodontia and tooth size (Gungor & Turkkahraman, 2013; Lyngstadaas et al., 1996) and shapes (Chung et al., 2008; Forgie et al., 2005; Gomes et al., 2010) while other researchers are reticent about this issue (Wisth et al., 1974). Unilateral but also bilateral absence of teeth is possible (Aktan et al., 2010; Medina, 2012). The severity of the disease is given by the higher number of missing teeth and the complications (Rakhshan, 2015).

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Causes of hypodontia

From the literature, it is apparent that the causes of hypodontia are diverse, involving environmental, genetic, and epigenetic factors (Brook et al., 2009a; Brook et al., 2009b; Vastardis, 2000; Mostowska et al., 2003; Brook, 1984; Shimizu & Maeda, 2009; Rushmah, 1992; Stockton et al., 2000; Parkin et al., 2009; Townsend et al., 2009).

Like other conditions, missing teeth can be attributed to both general and local factors. General causes include genetic conditions like ectodermal dysplasia, Down syndrome, and cleft lip and palate. On the other hand, local factors leading to hypodontia include early exposure to radiation, hormonal and metabolic influences, trauma, osteomyelitis, and accidental removal of a tooth germ during primary tooth extraction.³ Various researchers have proposed models and theories on tooth agenesis, which have recently been consolidated into a comprehensive clinical model (Brook, 1984; Townsend et al., 2009; Butler, 1939; Dahlberg, 1945; Sofaer et al., 1971; Osborn, 1978; Sharpe, 1995; Mitsiadis & Smith, 2006).

Anodontia, the absence of one or more teeth, results from the failure of tooth buds to develop. This condition presents various signs and symptoms that can concern both parents and pedodontists from early childhood. It affects 2-10% of the population and can occur in both primary and permanent dentitions, with a higher incidence in permanent teeth. Anodontia is also referred to as hypodontia, agenesis, or oligodontia, although these terms have distinct meanings.

The exact causes of anodontia, the absence of tooth development, remain largely unknown. Researchers have proposed several theories to explain this condition.

Terminal reduction theory suggests that evolution has led to the gradual disappearance of the last tooth in each dental group—specifically, the lateral incisor, the second premolar, and the wisdom tooth—due to changes in living conditions, particularly diet.

Ontogenetic theory posits that certain factors affecting the embryo, either during intrauterine life or after birth, contribute to anodontia. Potential causal factors include lack of oxygen during pregnancy or at birth, infectious diseases (such as scarlet fever, mumps, rubella, and viral infections), nutritional deficiencies during pregnancy (lack of vitamins and minerals), use of forceps during birth, local infections of temporary teeth, trauma of the tooth buds, systemic diseases like ectodermal dysplasia, traumatic extractions of temporary teeth, jaw tumors, radiation exposure in early childhood, especially for head and neck tumors and orofacial clefts (e.g., cleft lip and palate).

An increasingly popular theory is the hereditary one which suggests that anodontia can be inherited, often observed in multiple family members.

The research hypothesis was to check if the gender distribution in our study meets the findings of recent literature.

Material and methods

Literature research among the latest articles published on this topic was performed in PubMed using related

keywords (hypodontia, oligodontia, agenesis, aplasia, impacted teeth).

Results

The prevalence of hypodontia in primary teeth ranges between 0.1-2.4% according to different authors (Wu et al., 2007; AlShahrani et al., 2013; Larmour et al., 2005) while the prevalence in secondary teeth was reported to be 0.15-16.2% (Amini et al., 2012; Goya et al., 2008; Altug-Atac & Erdem, 2007). Studies showed that hypodontia is more prevalent among women (Polder et al., 2004; Aktan et al., 2010; Fekonja, 2005) more than a half of the cases being found among females (Amini et al., 2012; Polder et al., 2004; Wu et al., 2007; Varela et al., 2009) maybe because of the smaller sizes of dental arches (Rakhshan, 2015). Though, the absence of the central incisors was found more frequent in males (Sisman et al., 2007; Silva Meza, 2003) while the missing lateral incisor was observed in females (Eidelman et al., 1973).

Researchers agree that in general, the most frequent missing teeth are in general the most posteriorly positioned teeth of a certain type (Amini et al., 2012; Fekonja, 2005; Sisman et al., 2007) like lateral incisors, second premolars, third molars, the other types of teeth being usually found on the dental arches, or they can be missing only if there are multiple teeth absent (Endo et al., 2006; Ajami et al., 2010). The reduced number of teeth can come in different forms: anodontia when there is a congenital absence of all teeth, hypodontia being the congenital absence of less than six teeth and oligodontia which is the congenital absence of six or more teeth (Dzemidzic et al., 2020).

It can be suspected a tooth of being absent if it has not erupted into the mouth and also is not visible on a radiograph at an expected time point.

Furthermore, some clinical situations suggest dental agenesis. For example, the failure of the contralateral lateral incisor or second premolar to erupt within four-to-six months of its homologue indicates a possible absence (Meade & Dreyer, 2023). Unilateral, bilateral tooth absence or even association with different dental anomalies and syndromes can be found by clinical and paraclinical evaluations (Fig. 1 and Fig. 2).



Fig. 1 – Case 1 - Bilateral agenesis of upper lateral incisors, in a case of narrow upper maxilla and unilateral crossbite.



Fig. 2 – Case 2 -Agenesis of upper lateral incisors associated with agenesis of lower lateral incisor in a cleft lip and palate patient.

Discussion

Signs and symptoms

The signs and symptoms of anodontia vary depending on the type and location of the missing teeth.

In cases of extensive anodontia, both the mandible and maxilla are affected, leading to a significantly underdeveloped lower facial structure, a concave facial profile, a prominent chin, a deepened groove between the lower lip and chin, and delayed physical development due to difficulties with chewing and speech.

For reduced anodontia, the changes are typically less severe and more manageable if detected early. Specific signs and symptoms include prolonged retention of temporary teeth without permanent successors (up to 18-20 years for upper lateral incisors, or 40-50 years for the second temporary molar), absence of permanent teeth at the expected age, aesthetic concerns, especially with missing permanent front teeth, inadequate bone development in the affected region, and altered bite, such as reverse occlusion.

Early detection and intervention can significantly mitigate the impacts of reduced anodontia.

Diagnosis

A complete diagnosis is usually determined by a radiological evaluation, taking into consideration the possible variations of the eruption period. Second, premolars can start to develop as late as 9 or 10 years of age. Nevertheless, all primary teeth should have erupted by 3 years of age and all permanent teeth (third permanent molars not included) should be erupted by the age of 13-14 years (Meade & Dreyer, 2023).

Congenital absence of teeth affects the nutritional status of the growing child and causes a psychological regress.

When prosthetic treatment is taken into consideration, the age, psychological and financial requirements of the patient must be respected. Removable and fixed prostheses can be fabricated at different phases of the treatment. The ultimate aim is to restore the function, improve the esthetics, and overall psychological amelioration (Kalavathy et al., 2022).

Treatment

Treatment options may vary from no intervention to comprehensive multi-disciplinary input from general dental dentists, orthodontists, prosthodontists, periodontists, oral surgeons, and psychologists (Meade & Dreyer, 2023).

Additionally, in more severe cases of hypodontia, the clinician may need to advise the patient, or his family that general medical investigations could be required to determine the presence of a possible undiagnosed syndrome.

In the early mixed dentition treatment options include the build-up of malformed deciduous and permanent teeth with composite resin, removable partial dentures or acrylic teeth attached to palatal arches can improve aesthetic and functional aspects.

In the late mixed and permanent dentition and by the age of 10 years it is recommended to have a provisional plan involving any necessary orthodontic and prosthodontic treatment (Meade & Dreyer, 2023).

The orthodontic assessment should include the general characteristics of the malocclusion and the specific complications associated with the reduced tooth number (Meade & Dreyer, 2023).

Management of the agenesis of maxillary lateral incisor(s)

The closer the malocclusion is to a Class I incisor, canine and molar relationship with a 'normal' overbite, the more prosthodontic replacement of the lateral incisor may be recommended.

Prosthodontic replacement of the agenic may be via a resin-bonded fixed partial denture, a conventional full-coverage fixed partial denture, a removable partial denture or an implant. Furthermore, auxiliary periodontal and surgical procedures like the alveolar ridge augmentation may be required to provide a successful biological, functional and aesthetic treatment (Meade & Dreyer, 2023).

However, in class II malocclusions space closure can be the preferred option (Meade & Dreyer, 2023), taking into consideration the aesthetic outcome. An evaluation of the color, morphology and gingival contour of the upper central incisor, upper canine, and upper premolar in association to the smile line is essential (Fig.3-4) (Meade & Dreyer, 2023).



Fig. 3 – Case 3 - Aspect after orthodontic treatment with the bilateral closure of upper lateral incisor space, and minor coronoplasty of the upper canines



Fig. 4 – Case 3 - Aspect after prosthetic treatment of the upper canines and first bicuspids with porcelain veneers, to improve the aesthetic and functional aspects.

Conclusions

1. Dental agenesis is a relatively common condition that is usually discovered in the permanent dentition.
2. Early diagnosis can enhance appropriate planning and management of the possible complications that can occur from developmentally absent teeth.
3. It is essential that dental care practitioners inform patients and their families that management of this condition may require multi- and inter-disciplinary input.

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