Review Article

Congenitally missing teeth (hypodontia): A review of the literature concerning the etiology, prevalence, risk factors, patterns and treatment

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ABSTRACT

Congenitally missing teeth (CMT), or as usually called hypodontia, is a highly prevalent and costly dental anomaly. Besides an unfavorable appearance, patients with missing teeth may suffer from malocclusion, periodontal damage, insufficient alveolar bone growth, reduced chewing ability, inarticulate pronunciation and other problems. Treatment might be usually expensive and multidisciplinary. This highly frequent and yet expensive anomaly is of interest to numerous clinical, basic science and public health fields such as orthodontics, pediatric dentistry, prosthodontics, periodontics, maxillofacial surgery, anatomy, anthropology and even the insurance industry. This essay reviews the findings on the etiology, prevalence, risk factors, occurrence patterns, skeletal changes and treatments of congenitally missing teeth. It seems that CMT usually appears in females and in the permanent dentition. It is not conclusive whether it tends to occur more in the maxilla or mandible and also in the anterior versus posterior segments. It can accompany various complications and should be attended by expert teams as soon as possible.

Key Words: Complications, etiology, hypodontia, prevalence, risk factors, tooth abnormalities, treatment

INTRODUCTION

Oral health plays a crucial role in public health. Dental treatments are rather expensive health services and the combination of different modalities such as orthodontic, prosthodontic and surgical treatments can put a heavy burden on the average family’s health budget. Some frequent dental anomalies need quite expensive treatments. One of them is congenitally missing teeth (CMT), congenital absence of teeth, congenital dental aplasia, or dental agenesis. It is one of the most common dental anomalies.\(^\text{[1-5]}\) It might negatively affect both the esthetics and function.\(^\text{[3,6-8]}\)

Esthetics itself is an important factor and its problems might affect patients’ self-esteem, communication behavior, professional performance and quality of life.\(^\text{[9-11]}\) Patients with missing permanent teeth may suffer from complications such as malocclusion (which itself can lead to mastication problems),\(^\text{[12]}\) periodontal damage, lack of alveolar bone growth, reduced chewing ability, inarticulate pronunciation, changes in skeletal relationships and an unfavorable appearance,\(^\text{[9,12-16]}\) most of which need rather costly and challenging multidisciplinary treatments.\(^\text{[9,17-19]}\)

ETIOLOGY OF DENTAL AGENESIS

CMT is a result of disturbances during the early stages of development\(^\text{[15]}\) and is suggested as a mild dysplastic expression of the ectoderm.\(^\text{[20-23]}\) When a primary tooth is congenitally absent, its permanent counterpart might also be missing.\(^\text{[22,24]}\) Genetics plays a crucial role in congenital dental aplasia,\(^\text{[4]}\) as confirmed by studies on monozygotic twins.\(^\text{[22,25-27]}\)
Interestingly, the pattern of CMT can differ between monozygotic twins, possibly pointing to additional underlying mechanisms,[25] such as epigenetic factors which might be implied by simultaneous occurrence of two anomalies.[4] This multifactorial etiology can include environmental factors as well, since a combination of environmental and genetic factors might contribute to the occurrence of dental agenesis.[3,6,19,22,29,35] These include infection, trauma and drugs, as well as genes associated with about 120 syndromes,[2,3,6,19,22,29,35] such as cleft lip, cleft palate or both,[36] ectodermal dysplasia[9,27,37] and Down, Rieger and Book syndromes.[9,22] A possible general explanation is that except in hereditary cases, CMT has greater occurrence likelihood when the dental germ is developing after the surrounding tissues have closed the space needed for the tooth development.[3,38] Other investigations demonstrated that delays in tooth development and reductions in tooth size correlate with advanced CMT.[3,39,41] Both of these might accord with the terminal reduction theory.[3,42] Furthermore, it is suggested that anterior agenesis may depend more on genes while posterior missing might be sporadic.[23]

The most supported etiological theory suggests a polygenic mode of inheritance, with epistatic genes and environmental factors exerting some influence on the phenotypic expression of the genes involved,[29,43,44] which this can disturb the tooth germ during the initial stages of formation, i.e., the initiation and proliferation.[22] The exact genetic mechanism is not known.[3,7,9,21] Separate mechanisms might as well account for missing of each tooth.[3]

CMT can form in isolation as well. Isolated cases are more common than syndromic type[17] and might be familiar or sporadic.[22] The isolated condition can follow autosomal dominant,[45-47] autosomal recessive[48,49] or X-linked[50] patterns of inheritance, with remarkable variation in both penetrance and expressivity.[17,20,22,25] Different subphenotypes of dental agenesis might be probably caused by various genes.[52-57] Mutations in genes such as MSX, PAX9 or TGFA might cause CMT in different racial groups.[19,43,30,31,47,56,58-60] Among the homeobox genes, MSX1 and MSX2 play an important role in mediating direct epithelial-mesenchymal interactions during craniofacial bone and tooth development.[14,17,61] The autosomal-dominant CMT might be correlated with a mutation in the MSX1 and PAX9 genes.[9,17,31,47,58,59,62] MSX1 mutations affect predominantly the second premolars and third molars, sometimes in combination with other types of teeth like the first molars.[17] On the other hand, in more common cases of incisor-premolar type of dental agenesis, MSX1 is less likely to play a role as the causative locus for this type of CMT.[17,53] In addition, PAX9 and TGFA are associated with congenital missing by interacting between MSX1 and PAX9.[14,56] A recent study showed a novel mutation in MSX1 gene responsible for CMT of the second premolars and third molars only.[63]

**DIAGNOSIS AND CLASSIFICATION OF CONGENITALLY MISSING TEETH**

Dental aplasia is classified based on the number of missing teeth.[22,35,64] Mild and moderate cases have usually less than three and less than six teeth missing, respectively.[35] The definitions of hypodontia, oligodontia and anodontia differ in the number of missing teeth, on which there is no clear agreement.[3,15,22,29,64] This can account for some of the variation observed.[66] An ideal CMT diagnosis requires radiographic, clinical and dental cast examinations,[65] but in any case, radiographic examination is a must.[3,8,66] Since radiographic evidence of tooth germs needs certain level of calcification to appear, inclusion of too young individuals might enter insufficiently calcified tooth buds into the sample, which can be mistakenly diagnosed as missing teeth on the radiograph.[64] It can be of a greater concern for the mandibular premolars[3,7,34,67,68] and boys, both with more delayed eruption odds.[8,65,69,71] Therefore scientists should take into consideration the late development of the lower second premolars in boys; and should not include subjects without the canines and premolars neither erupting nor fully erupted,[65] or at least under 6.[3] Some authors have recommended the exclusion of children younger than 9 or 10 or even 12 years old.[8,34,60,64,69-72] The third molar bud calcification begins at the age of about 7.5 only in very few people; however, the average age for the initiation of its calcification is about the age 9.5.[73,74] Therefore, by including patients younger than 9, or even 11 (as the 85th percentile for initiation of calcification),[74] researchers might considerably overestimate the third molar missing rate. This might explain the very high prevalence reported by some studies (34.8%).[60] It should be noted that even the initiation of calcification does not guarantee well detection in radiographs; and older ages might be needed for some cases, in order to make sure calcification has reached a detectable minimum.
Rakhshan: Congenitally missing teeth

THE PREVALENCE OF DENTAL AGENESIS

In the primary dentition, the CMT is not frequent, being between 0.1% and 2.4%. [30,33,35,75,76] However, primary dental aphasis is usually followed by permanent tooth missing. [8,19,34] The prevalence of CMT in the permanent dentition excluding the third molars ranges between 0.15% and 16.2% [Table 1] in studies varying in size from about 200 subjects to about +100,000 ones. [1,3,5-7,9,14,15,17,22,23,29,32,34,38,42,51,57,60,64-72,75,77-156] Japanese people showed the highest rates both in deciduous and permanent dentitions. [17,30,35,64] The CMT prevalence was found to differ between continents and races, but unlikely over time. [34] The CMT prevalence in third molars has been reported over a rather broad range, between 5% and 37%. [22] For example, Ghaznawi et al. [134] reported 5.5% of wisdom tooth missing in Saudi Arabia, while Varela et al. [29] observed that 11.5% of a population from Spain had missing of third molars. Other rates might be much greater. For instance, Afiy and Zawawi [155] and Silva Meza [141] reported 24% third molar absence rates in Saudi Arabia and Mexicans, respectively. Sheikhi et al. [60] have reported 34.8% missing prevalence of Iranians’ third molars. Australian aborigines and perhaps African Blacks might have a low chance of dental agenesis. [8,19] Indians have shown very small prevalence rates, as two out of three studies in India had rates less than 1% and the other one had about 4% prevalence. [77,151,152] The different rates reported could be explained by different measurement approaches or other methodologies [2,3,8,34,70] and ethnic backgrounds. [4,8,19,33,34,115] In contrast, X-ray is a carcinogen factor and cannot be prescribed without any treatment needs. [1,8,64,157-159] Thus, researchers need to use previously taken radiographic images. In very rare cases, such images have been taken from randomly selected subjects (epidemiological samples such as patients attending mandatory public health protocols that oblige periodic dental radiographs be taken from healthy people). [148] However, in almost all recent assessments, dental radiographs have been taken from dental patients. It is possible, however, that dental patients include more cases of dental anomalies which might bias the result. [64]

The CMT prevalence may be increasing, perhaps due to evolutionary changes. [2,8,15,70,160-162] or because of increases in the diagnosis. [2,8,163] not necessarily the evolution. [65,163] Nevertheless, some authors suggest that it might be evolutionary [1,152,161] to adapt with the gradually shrinking size of the jaws. [1,152,161] Some researchers state that evolution needs much more time to happen, [163] whereas some account for the rapid environmental changes as the causes of CMT. [160,163] However meta-analyses have not confirmed such an increase in the previous decades. [34,64,163]

THE ASSOCIATION OF CMT WITH OTHER DENTAL ANOMALIES

CMT can accompany other conditions such as delayed eruption of other teeth, reductions in coronal or radical dimensions, retained primary teeth, ectopic canine eruption and abnormal dental morphologies such as taurodontism and peg-shaped maxillary lateral incisors. [2-4,8,20,31,33] While some researchers have reported that the size of teeth and the width of the dental arch are not related to dental agenesis, [68] some others reported conflicting results indicating that CMT is associated with dental anomalies such as microdontia and decreases in the size of the incisors and canines as well as conical or tapered teeth such as peg lateral. [14,28,31,164,165] However, some investigators did not find a link between tooth agenesis and microdontia but with peg laterals. [14] They concluded that CMT was not associated with changes in the overall tooth size, while changes in tooth morphology especially in the maxillary lateral incisors might still be possible. [14] This might be in line with other studies finding correlations between severe CMT and taurodontism [57,166] especially in boys, [166] or between CMT and taurodontism. [31] It might also be in agreement with studies that could not associate CMT with microodontia of contralateral teeth. [57] Some authors found links between CMT with size anomalies and taurodontism. [31] Therefore, the literature is not conclusive. Both CMT and taurodontism seem to be a part of syndromes characterized by decreased mitotic

Table 1: The minimum and maximum prevalence of congenitally missing teeth/hypodontia in different continents

| Continent        | Minimum | Maximum |
|------------------|---------|---------|
| Asia             | 0.2     | 16.2    |
| Australia        | 5.9     | 6.4     |
| Europe           | 2.3     | 15.7    |
| North America    | 2.7     | 7.8     |
| South America    | 4.8     | 6.3     |

Africa: 6.34% reported by only one study
cellular activity which might also affect dental germ development.[4] On the other hand, some other studies found clear associations between both mild and severe CMT and reduced tooth size,[21,32,160,165,167] especially in the upper laterals (in the mesiodistal dimension) and the lower canines (the labiolingual dimension).[165] The latter agrees with the synergism and allelism of major genes possibly affecting CMT.[21]

ASSOCIATIONS WITH SKELETAL CHANGES IN THE HORIZONTAL PLANE

The results pertaining to skeletal changes are controversial. Some authors did not find a significant correlation between malocclusions and CMT prevalence, although suggested a link between CMT and Class II division 2.[65] While according to others, there could be significant links. CMT might accompany reduced intercanine and intermolar widths.[147] Anterior missing can accompany retrognathic maxillae, prognathic mandibles and smaller lengths of posterior cranial base.[16] It also might be more common in the skeletal Class III malocclusion due to smaller or retrognathic maxillae.[14,22,30,71,168,169] In some studies, Class III was associated merely with severe CMT.[169,170] CMT might be also significantly less frequent in Class II cases,[147] although a study reported non-significant results for this decrease (possibly due to small sample of Class II cases).[65] On the contrary, Cua-Benward et al.[128] found the greatest prevalence of CMT in Class II patients and observed a significant number of missing maxillary teeth in Class III patients. However, it might depend on the most common missing teeth, as it appears that the missing tooth affects its own jaw. A study by Hirukawa et al.[135] concluded that Class III might be the most common malocclusion observed among the subjects who had missing teeth only in the maxilla, while when teeth were missing only in the mandible, it was frequently associated with Class II malocclusion.[135] Perhaps the tendency towards a Class III relationship is caused by decreased maxillary and mandibular angular prognathism and the effect might be greater on the maxilla than on the mandible.[170]

ASSOCIATIONS WITH VERTICAL SKELETAL CHANGES

According to some studies, dental aplasia is not correlated with the vertical relationship of the jaws.[14,147] However some investigators have found significant associations between the CMT occurrence with reduced anterior lower facial height[16,30,168,171] and increased overbite,[22] which intensifies by increasing the severity of CMT,[169,170] or less severe deep bite in CMT patients[135] and decreased maxillary-to-mandibular-planes angle, which was clinically relevant only in severe CMT.[170] Furthermore anterior CMT might have a significant effect on the vertical skeletal relationships with increasing severity of CMT.[170] It also might contribute to a more acute mandibular angle and flatter chin.[16]

SEX DIMORPHISM

Gender might act as a dental agenesis risk factor.[8,33,34] Women are usually more affected[7,15,22,34,67,141,160] and the male-to-female ratio is about 2:3;[8,29,33,34,172] Some authors studied the teeth individually and found significant gender dimorphism only for certain teeth,[70,104,141] such as the upper incisors and upper first premolars, all on the right side only.[70] Of these teeth, only the missing of the upper right central incisor was more prevalent in males and the other ones were more prevalent in females. Silva Meza[141] have reported significant intersex differences only for the lateral incisors and third molars (without indicating the predominant gender). Eidelman et al.[104] reported significant differences only for the lateral incisor missing cases, being more common in females. Some studies found a non-significant predominance of CMT in males.[29,70,148,151] A very large study on six districts of Turkey showed that in five regions, females had a significantly higher CMT prevalence, while in one of them males had a significantly greater prevalence.[15] Male-to-female ratios were previously summarized as 1:1.37 and 1:1.4 in literature reviews.[8,33,34] The higher rates observed in females might be associated with biological differences such as smaller jaws which might trigger environmental factors. This might be confirmed by the suggestion that teeth might be absent also when the development of dental germ is delayed and thus the needed space has been compromised by the surrounding tissues.[78] As well, another factor can contribute to the higher rates of CMT in females: The existence of a probable higher orthodontic treatment need in females with the tooth missing due to their higher concern regarding the appearance[8] and the higher value that society gives to esthetics in females.[29] Nevertheless, the latter might not be the case, since most of studies on schoolchildren as well showed a higher rate in females. Moreover, some other studies did not find such a difference.
in orthodontic patients,[8,14] or even reported higher prevalence rates in male orthodontic patients[69,70] and male patients of the public health services.[148] Furthermore, since males tend to have lower rates of CMT, studies enrolling more males, might show lower total CMT prevalence rates.[64]

A possible reason for the controverses is that different teeth might vary in terms of sex dimorphism. Küchler et al.[57] showed that the M:F ratio of incisor agenesis was 1.4:1, while in the case of the upper lateral incisors, this ratio was 2:1 and for the lower incisors, the M:F ratio was 1:1. On the other hand, the M:F ratio of premolar missing was 0.5:1 (0.3:1 for the upper second premolar ratio and 0.5:1 for the lower second premolar ratio).[57] Thus a combination of various M:F ratios for different teeth can disallow to easily identify significant differences in the whole dentition. Based on the differences in sex ratios depending on the specific tooth types affected, Küchler et al.[57] suggested a continuous variable, “liability,” with a threshold value, beyond which individuals might be affected. This system is called multifactorial because both genetics and environmental factors determine liability.[57] Based on this concept, they concluded two possibilities: Either the same genetic model might have different thresholds for males and females, or each gender is in influenced by an independent genetic model, each having its own threshold.[57] Another factor contributing to the controversy might be the ethnicity.

There is no consistent finding as to which sex is predominant in regard to having more missing teeth per child.[4,5,7,8,15,51,67-69,72,81,93-99,100,106,109,110,113,173] In one research, each male had an average of missing teeth per person higher than that of each female (2.32 compared to 1.40).[8] However, in another one, the average numbers of missing per person dentition were almost similar for both genders with a slight increase in boys (2.5 for boys, 2.4 for girls)[9] and in some others, girls had a higher chance for having more missing teeth per person.[15,23,68,109] From information reported in a study on Swedish schoolchildren,[4] these ratios were calculated and showed 1.46 missing teeth in each boy in comparison to 1.74/girl. Evaluation of six regions of Turkey showed that in five of them, females had a significantly greater chance of having more missing teeth per individual and in one of them, males had a greater chance of having more missing teeth in each person.[15] Some other studies as well showed that females might have oligodontia much more likely than males might do.[144,147,148] However, another study found the opposite[71] and another one found similarity between the two.[9]

THE MOST FREQUENTLY MISSING TEETH

Clinicians could be assisted by knowing the CMT risk factors and its pattern of occurrence.[6,8,141] As a general rule, if only a few teeth are missing, the absent tooth would be the most distal tooth of any given type.[8,22,70,162,174] This applies to the maxillary laterals and the mandibular second premolars. On the other hand, it is suggested that the permanent maxillary first premolars, canines and first molars, which are likely to be more stable, have a relatively greater rate of CMT in children with five or more teeth missing.[5,146]

UNILATERAL VERSUS BILATERAL DENTAL AGENESIS

Most authors observed predominance of bilateral CMT to extents such as about as twice as unilateral missing[1,4,5,8,15,51,67,69,81,95-99,110,112,141,144,161] or even as trice as unilateral missing.[1,3,141] Even Endo et al.[5] have reported that in 89% of patients, the teeth were bilaterally missing. However, few studies failed to find a significant difference[4,100,112,115,140] or reported non-significant[60] or significant predominance of unilateral missing.[60] In studies on Koreans and Iranians, these were almost similar.[65,146] Nevertheless, a careful examination of presented information by Kim[65] implied that that article has compared “patients” with bilateral or unilateral missing teeth, not the number of missing teeth. This author further evaluated the values and it was implied that many patients had more than only a pair of bilaterally missing teeth and that if the number of teeth was to be compared, bilateral missing would be as double as unilateral missing in their study. In another Korean study, 70.9% of sample had unilateral missing.[14] On this subject, a review shows that overall, unilateral missing is more common, but bilateral missing is seen mostly in the maxillary lateral incisors.[34] Furthermore, it is suggested that unilateral agenesis might be more common in the case of the upper and lower second premolars, whereas, bilateral missing might be more common in the maxillary laterals.[15] Except for the first molars in both jaws and the maxillary centrals, bilateral agenesis was significantly more common than unilateral aplasia.[15]
WHICH TEETH ARE MOSTLY SYMMETRICALLY MISSING?

This question is not assessed thoroughly. Medina[172] stated that while symmetrical dental missing affects the maxilla, the mandible shows mostly unilateral agenesis. According to other reports, the most common symmetric missing tooth could be the mandibular second premolar or maxillary lateral incisor. According to a meta-analysis, the maxillary lateral incisor might be the most common bilateral missing tooth.[34,60] Endo et al.[5] found a similar pattern in children other than those with two missing teeth. However, in children with two missing teeth, the mandibular lateral incisor agenesis had a higher prevalence rate.[5]

THE RIGHT VERSUS THE LEFT SIDES

No studies so far have found a significant difference between missing teeth located in the left and right sides. For example, Sisman et al.[70] did not find any significant right-left differences for the whole CMT prevalence and for any of teeth assessed individually. Even a study on more than 100,000 dental patients showed that the number of missing teeth on the left and right sides was almost identical (1574 vs. 1573).[15] According to Fekonja,[22] the missing teeth were more commonly absent on the right side (26 teeth, 54.2%) than on the left side (22, 45.8%). However, their comparison was not statistically substantiated. Statistical comparison was carried out by this author using the Chi-square goodness-of-fit test, which did not detect a significant difference (\( P = 0.564 \)).

THE OCCURRENCE OF CMT ACROSS THE ANTERIOR/POSTERIOR REGIONS

Few studies have evaluated the difference between CMT rates in the anterior and posterior segments and this should be considered in future studies. Most studies showed higher prevalence in the anterior segment and the few remaining researches found no significant differences.[5] Some investigators suggest that in mild cases of CMT, the anterior segment might be more involved while the posterior segment might be predominant in severe cases.[5] Many studies did not calculate or report the anterior versus posterior missing and many of them did not present raw data.[3-5,8,9,22,31,57,66,70,71,144,146,148-150,176,177] Their raw data were recovered from their tables, graphs and/or texts. The anterior/posterior occurrence was calculated and statistically analyzed using the Chi-square goodness-of-fit test, after making sure that the third molars were excluded. Some of these differences analyzed by this author were statistically significant (\( P < 0.01 \)). Endo et al.[5] found a similar pattern in children other than those with two missing teeth. In children with two missing teeth, the mandibular lateral incisor agenesis had a higher prevalence rate.[5]

THE OCCURRENCE OF CMT ACROSS THE ARCHES

The results as which arch is predominant are not conclusive.[5,8,34] Some investigators found that congenital tooth agenesis was more common in the maxilla and some others reported a higher rate of missing teeth in the mandible. The following studies did not analyze/report maxillary/mandibular missing. However, their data were recovered and analyzed by this author. Some studies showed significant differences (\( P = 0.09 \)), (\( P = 0.063 \)), (\( P = 0.054 \)), (\( P = 0.000 \)), (\( P = 0.000 \)), (\( P = 0.003 \)), (\( P = 0.000 \)), and some did not demonstrate significant or marginally significant differences (\( P > 0.1 \)).

TREATMENT OF CONGENITALLY MISSING TEETH

CMT has direct clinical implications. The treatment is comprehensive and expensive, costing in some countries from about $3000 to $15,000/patient for minor prosthodontic interventions like a fixed partial denture in mild cases with only one or two missing permanent teeth, to $60,000 for comprehensive interdisciplinary treatments. The
management of tooth agenesis. Treatment would be usually difficult. Another interdisciplinary challenge for specialists in oral and maxillofacial surgery, operative dentistry, pediatric dentistry, orthodontics and prosthodontics. General or pediatric dentists can facilitate multidisciplinary treatments by diagnosing congenital absence of primary teeth and then through early referrals of patients; as the absence of primary teeth highly associates with missing of permanent successors. They might also ensure the retention of reduced number of teeth in cases such as palatal impaction of the maxillary canines caused by the missing laterals, in which early extraction of deciduous canines might guide the eruption of the permanent ones into the correct position. This necessitates the early evaluation of the number of missing teeth and the consideration of the CMT risk factors, as well as the size and number of teeth remaining in both arches in planning and managing treatment. The type of malocclusion, severity of crowding and facial profile are of major concern in determining the final treatment plan.

Bone volume is related to facial esthetics such as smile, and should be considered in treatment planning as well. During treatment planning, possible changes in the craniofacial morphology associated with CMT should be as well borne in mind.

Another therapeutic challenge is the need to carry out treatment in the growing young patient. While treatment should be initiated during adolescence, interim treatment should begin in around 7-9 years of age before the affected children realize they are different from other children. The edentulous space can be either left open for prosthetic restoration, or closed by orthodontic means. Other treatment modalities might include autotransplantation  or protraction of the third molars, which are otherwise extracted, in order to substitute for the edentulous region or to increase the number of occluding teeth. In orthodontic treatments, transplantation is a better choice than implanting, since osseointegrated implants are contraindicated in the growing alveolar bone. Successful autotransplantation of teeth ensures the stability of alveolar bone volume due to physiological stimulation of the periodontal ligament. Implant treatment is postponed until the jaws have stopped growing in adolescence. It is also possible to close the lateral space in crowded maxillae and recontour the canine into the lateral’s shape. In an aligned maxillary arch, the distributed excess space can be localized and then restored using prosthetic approaches. Absent lower incisors need esthetic and functional camouflage regarding the relationship between the maxillary and mandibular anterior teeth. In crowded jaws, the missing premolar spaces can be used as one of the extraction spaces for arch alignment. In uncrowded jaws with missing permanent premolars, the primary second molar might be left in situ. However, since, there is the risk of infra-occlusion or progressive root resorption, it might be eventually extracted and replaced with an implant or and autotransplanted tooth. The treatment of severe cases is complex and should be performed in centers such as “Hypodontia Clinics” with access to pediatric dentistry, orthodontics, prosthodontics and oral and maxillofacial surgery. It should be noted that orthodontic/prosthodontic treatments might compromise esthetics and periodontal health.

CONCLUSION

CMT is a prevalent multifactorial dental anomaly, usually appearing in females and in the permanent dentition. It is not conclusive whether it tends to occur more in the maxilla or mandible and also in the anterior versus posterior segments. It can accompany various dentoskeletal deformities, anomalies, or simply complications. Thus it should be attended by expert teams at the earliest possibility.

Although the CMT prevalence has been investigated thoroughly, no or few quasi-experimental (case-control or cohort) studies have assessed CMT risk factors. Besides, the number of studies assessing the severity of CMT is very small as well. It is recommended to evaluate within quasi-experimental designs the effect of gender on the prevalence of CMT and also its effect on the severity of CMT. Another problem which should be avoided in future research is the lack of proper report of every finding in many studies. Future studies are recommended to report not only the prevalence of CMT, but also the prevalence of cases with different numbers of missing teeth (for example how many subjects had two, three, or more missing teeth? etc.). This is valuable, since definitions of hypodontia might differ from study to study. This approach would allow the standardization of the results. Another suggestion might be a global consensus on the definitions. Furthermore, it would be helpful if each study clearly defines hypodontia.
Many studies have used the term hypodontia to refer to congenitally absent teeth in general. Perhaps it would be better to distinguish CMT and hypodontia in each report, by clearly defining the hypodontia (for example congenital missing of six teeth or more) or oligodontia terminologies (for example congenital missing of 10 teeth or more) in each study. Another limitation of most previous studies is that they have not reported the number of the affected patients with bilateral CMT, unilateral CMT and both simultaneously.[64]

Future studies are warranted to state the severity of CMT in both genders, both arches, both sides (left/right) and across other possible variable levels. The data can be simply summarized within a couple of tables and/or figures. Therefore, it is highly recommended to state all the numbers of all the missing teeth according to tooth types, jaws and sides, etc., in each study.

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