

***Prevalence and treatment possibilities of numerical,
morphological dental anomalies and malposition during
childhood***

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1. Introduction and Goals

1.1. Introduction

Developmental dental anomalies are an important category of dental symptomatology. Their incidence and degree of expression can provide important information for phylogenetic and genetic studies and help the understanding of variations within and between populations.

The prevalence studies of the present work were evaluations of young patient groups of different ages who presented for paedodontic and/or orthodontic treatment at the Department for Paedodontics and Orthodontics, Semmelweis University Budapest. Chi-square tests were used for statistical analysis.

A majority of dental anomalies of developing dentition are numerical anomalies. Carabelli and talon type accessory cusps, considered also morphological characteristics, are expressed in varying degree and frequency in humans, thus being useful in comparing and characterizing populations. The aetiology of both remains unknown. Genetic and exogenous factors may combine to determine their phenotypical appearance. The Carabelli cusp is more common in Europeans than Mongoloids, while talon cusp is less common in Caucasians. In the present work the incidence and degree of expression of both Carabelli and talon cusps were studied in the contemporary Hungarian population. Their appearance and characteristics were evaluated from an anthropological point of view by comparison with the prevalence of the two cusp types on teeth from skulls dating from the 11th century.

Supernumerary teeth or hyperdontia describes an excess in tooth number. The prevalence of hyperdontia in permanent dentition is reported to lie between 1 and 3% and this form of anomaly is considerably rarer in the primary than permanent dentition. The aetiology of this anomaly is unknown, and several theories have been suggested.

The data on the prevalence of hypodontia or congenitally missing teeth (CMT) reveal great variations in both primary and permanent dentition. The aim of the present work is to fill the gap caused by the absence of data for the young Hungarian population by determining the prevalence of

hyperdontia and hypodontia in the permanent dentition of the 6- to 18-year-old age group.

Supernumerary teeth can cause clinical problems such as failure of eruption, displacement or rotation, crowding etc. The purpose of the case report related to the tuberculate and odontoma type supernumerary teeth shown in the present work was to describe the importance of early surgical and orthodontic treatment during mixed dentition in order to prevent or minimize further complications.

Hypodontia of primary and permanent dentition, associated with hypoplasia of the alveolar bone structures, is the second most frequently occurring oral symptom accompanying the large and complex nosological group of congenital diseases, such as ectodermal dysplasias (EDs). The number of missing teeth varies, with higher incidence in the lower jaw. In the present work the early prosthetic oral rehabilitation of 2 young male patients with a hypohydrotic form of ectodermal dysplasia (HED) is presented. Both cases are associated with severe anodontia in primary dentition. Prosthetic treatment contributes to a normal physiological development of the children, improves the function of the stomatognathic system, and helps HED children's integration into their social environment.

Canine agenesis is a rare form of dental anomaly. It occurs more often in Asiatic populations and has also occasionally been described in primary dentition. In the present work the prevalence and distribution of permanent canine agenesis (PCA) is analysed in 6- to 8-year-old healthy patients who presented for treatment over a period of 10 years. The unusual case of two sisters presenting isolated bilateral permanent canine agenesis is presented. It is the objective of the present work to provide new information concerning the prevalence of Carabelli and talon cusps, hypo- and hyperdontia, frequent malpositions like canine impaction and retention, and rare forms of CMT, like caries agenesis. Among tooth malpositions the impacted or retentioned upper canine shows a very high prevalence. In the present work data relating to 1858 11-18-year-old children, who presented for treatment at the Department for Paedodontics and Orthodontics, Semmelweis University Budapest, over a period of 10 years were analysed

to calculate the prevalence of impacted or retained permanent upper canines.

The aim is also to present treatment possibilities during the developing dentition period considering that developmental dental anomalies can be challenging to manage clinically and their effective solution requires careful multidisciplinary planning, with input from a paedodontist, orthodontist, restorative dentist, an oral surgeon and, occasionally, a speech therapist.

1.2. Goals

I. Our first aim was to determine the prevalence and degree of expression of both Carabelli and talon cusps in the contemporary Hungarian population and to evaluate their appearance from an anthropological point of view by comparison with the prevalence of these two dental characteristics on teeth from 11th century skulls.

II. Our second goal was to determine the prevalence of numerical dental anomalies such as hyperdontia and hypodontia in 6- to 18-year-old orthodontic patients in Hungary.

III. Our aim was also to determine the prevalence of congenitally missing permanent canines in 6- to 18-year-old orthodontic and paedodontic patients in Hungary.

IV. Further, the goal was to evaluate the prevalence of impacted upper permanent canine for orthodontic patients aged 11 to 18 years and to evaluate the principal treatment choices.

V. Our final goal was to present treatment possibilities for patients with special form of tooth abnormalities, such as tuberculate and odontoma type supernumerary teeth, talon cusps, permanent canine malposition and agenesis, and early treatment possibilities for hypodontia in ED patients.

2. Materials and Methods

2.1. Accessory cusps

The models of 600 children aged 7-18 years (304 males, 296 females) from the Department for Paedodontics and Orthodontics, Semmelweis University Budapest, and a total of 147 skulls from the Department of Anthropology of the Hungarian Natural History Museum dating from the 11th century were examined to determine the prevalence and distribution of Carabelli and talon accessory cusps in the permanent dentition of the contemporary and ancestral Hungarian populations. Carabelli cusps were examined according to Dahlberg's scale. The system used to determine talon cusps was developed by Hattab et al. (1996).

2.2. Numerical dental anomalies:

2.2.1. Hyperdontia and 2.2.2. Hypodontia

The orthopantomograms (OPGs) of 2219 6- to 18-year-old orthodontic patients (1293 girls and 926 boys) were examined for evidence of hyperdontia and hypodontia. For each case showing the presence of accessory teeth, these were identified as supplemental or supernumerary and charted accordingly. Patients with hypodontia were examined and their medical history was taken to exclude the possibility that the missing teeth had been extracted or traumatically avulsed. Children with systemic diseases were excluded from the survey.

2.2.3. Congenitally missing permanent canines

The OPGs and the medical history data of 4417 6- to 18-year-old children, with an average age of 11 years, male-to-female ratio 1:1, were examined. Patients with systemic disease were excluded from the survey. The radiographs were studied for evidence of permanent canine agenesis and other associated developmental dental anomalies.

Data were processed by means of the Statistical Package for Social Sciences (SPSS), version 10.0. Chi-square tests were conducted to examine the statistical significance at a level of .,05.

2.3. Impacted upper permanent canines

The dental records and orthopantomogram radiographs of 1858 patients, aged 11 to 18 years, who presented for orthodontic and/or paedodontic treatment over a period of 10 years (between 1990 and 2000) were analysed. The average age was 12 years. Patients suffering from systemic disease were excluded from the study. 1120 female and 756 male patients were examined for unilateral or bilateral upper permanent cuspid retention and the presence of persisting primary canines, then adequate therapy was considered.

2.4. Clinical reports

2.4.1. First patient – HED

A male patient, aged 3 years and 11 month presented to the Department for Paedodontics and Orthodontics, Semmelweis University Budapest for speech and masticatory difficulties due to several missing primary teeth. The child exhibited the classical features of HED including diffusely sparse hair, eyelashes and eyebrows, severe hypohidrosis, and subsequent problems with thermoregulations and dry skin. Intraoral examination revealed macroglossia, a slightly dry and sticky oral mucosa, and severe hypodontia.

Treatment planning: Considering the clinical situation and patient age, upper removable partial dentures and lower complete dentures were determined to be the treatment of choice.

2.4.2. Second patient – HED

A 3-year, 2-month-old male patient presented for examination, evaluation, and treatment. The patient presented thin, diffusely sparse blond hair, eyelashes, and eyebrows. Sever hypohidrosis and fingernail defects were

also detected. Two upper second primary molars and all lower teeth were absent. On the panoramic radiograph both maxillary second primary molars, the right upper canine, and all 4 first permanent molars were evident.

Treatment planning: Early removable prosthetic treatment, similar to the first HED patient was indicated.

2.4.3. Third patient – Tuberculate andodontoma type supernumerary teeth

An 8-year-old female patient presented with severe aesthetic problems. The maxillary second primary and first permanent molars had Carabelli cusps. Two permanent central incisors showed barrel-shaped form, and the permanent upper lateral incisor showed talon cusp Type 2 according to Hattab *et al.* (1994). OPGs were taken and they showed the two upper central incisors presumably with dente invaginati and two supernumerary teeth situated bilateral in anterior region. The hyperdontic teeth appeared to be tuberculate type. A year later, the new OPG showed the maxillary right first premolar located between the roots of the permanent lateral and central incisors. On the left side the two upper premolars were located on top of each other. The formation of a supernumerary tooth located in the lower left premolar area was also seen on the radiograph.

Treatment planning: The orthodontic diagnosis was Angle class III with severe anterior open bite. A combination of surgical and orthodontic treatment on conventional lines was suggested.

2.4.4. Fourth patient - Talon cusp, upper permanent canine ectopia

A 10 year old male patient presented to our clinic for diagnosis and treatment. Clinical findings showed Angle class I. occlusion. The upper permanent second incisor presented a Type 1. palatal talon cusp (Hattab *et al.* 1996). In the lower arch the left second primary molar was persisting. Radiological analysis revealed lower left second premolar agenesis and complete absence of permanent third molar germs (Fig. 5.3.1. and 5.3.2.). Family history revealed a 16-year-old brother with right upper permanent second incisor and left upper PCA.

Treatment planning: Step-wise grinding (1 mm/month) of the talon cusp to prevent occlusal interference in the anterior region; followed by Multibond

fixed orthodontic appliance in the maxilla after eruption of the ectopic upper canines.

2.4.5. Fifth patient - Permanent canine agenesis (PCA)

A 16-year-old patient presented for treatment with absence of right upper permanent second incisor. Clinical findings revealed diasthema medianum, left upper persisting primary canine and Angle class I. Radiological examination confirmed the right upper permanent second incisor aplasia and the left upper PCA (Fig. 5.4.1). Both lower third molar germs were present. The patient was the brother of the above described patient with bilateral upper permanent canine ectopia.

Treatment planning: Multibond upper fixed orthodontic appliance; Reconstruction of the crown of the persisting primary canine; and prosthetic treatment for replacement of the upper right permanent lateral incisor

3. Results

3.1. Accessory cusps

3.1.1. Carabelli cusps

The examination of the models of 600 orthodontic patients revealed 393 cases of Carabelli cusp on the upper first permanent molars. Prevalence was 65.34%. Of the 147 examined skulls, 51 presented Carabelli cusp, prevalence was 34%. The difference between the contemporary group and the skulls was significant ($p < 0.01$). The prevalence of Carabelli cusps “positive” presence (Dahlberg’s scale 5, 6 and 7) was 25.40% for the contemporary group, and 9.52% for the skulls of the Árpád-era.

3.1.2. Talon cusps

Talon cusps were found in 15 subjects in the present-day population, prevalence 2.5%, and in 60 of the examined 11th century skulls, prevalence 40.8%. The difference in the number of talon cusps between the contemporary group and the Árpád-era skulls was significant ($p < 0.001$).

3.2. Numerical dental anomalies

3.2.1. Hyperdontia

The OPGs of the 2219 orthodontic patients revealed a total of 34 cases of hyperdontia presenting a total of 40 permanent supernumerary teeth: 28 cases with one each, and 6 cases with two each. The recorded prevalence of hyperdontia was 1.35%. There was no significant difference between male and female patients.

3.2.2. Hypodontia

Excluding agenesis of third molars, in 326 cases of the total patient number one or more permanent tooth germs was found to be missing. Prevalence of hypodontia was 14.69%, with significant difference between male and female patients ($p < 0.001$). For the different tooth types the sequence of hypodontia was as follows:

Upper lateral incisor > lower second premolar > upper second premolar > lower first incisor.

3.2.3. Congenitally missing canines – unpublished results

The prevalence of permanent canine agenesis was 0.29%. The prevalence of PCA was 0.27 % in the maxilla, and 0.09% in the mandible. Statistical significance was noted between them with $p < 0.01$. Various complications of dental anomalies associated with permanent canine agenesis were found: 11 cases of persistent primary canines, 10 cases of other types of hypodontia of permanent germs, 1 case of primary supernumerary tooth, 1 case of supernumerary cusp, and nine cases of occlusal disturbances.

3.3. Impacted upper permanent canines

The OPGs of the 1858 orthodontic patients revealed a total of 101 cases of maxillary permanent canine impaction. Prevalence was 5.43%. The male:female ratio was approximately 46:55, with no significant difference between male and female occurrence ($p > 0.05$).

4. Clinical reports

4.1. First patient – HED

The accommodation to both upper and lower dentures occurred relatively rapidly, with considerable improvements in speech and masticatory function for our young patient. The dentures had to be remade 8 months later due to the growth of the jaws. Facial-height index measurements made after inserting the prostheses showed approximately normal values: 79%. The patient was monitored every 3 months.

4.2. Second patient – HED

Upper removable and lower complete dentures were inserted. The one notable exception in the procedures of denture fabrication used during the treatment of the first patient was the lingualized occlusion used to reduce lateral forces and to create intercuspal contact area with freedom of movement. The dentures contributed to the development of harmonious facial proportions. Significant speech and aesthetic improvements, and a general well-being, including a better social adaptation of the child were achieved.

4.3. Third patient - Tuberculate and odontoma type supernumerary teeth

The two erupted barrel-shaped central incisors were extracted. Two metal brackets were placed on the surgically exposed supernumerary teeth. After soft tissue healing, elastic forces were applied to the supernumerary incisors with the help of a removable appliance to align them into the upper arch. When secondary dentition was completed, the maxillary right first premolar was surgically removed. The upper left first premolar and both lower first bicuspids were extracted due to severe crowding. The odontoma type supernumerary tooth located at the lower left premolar area was also surgically removed. A fixed, multibond orthodontic appliance was applied to align the teeth.

4.4. Fourth patient - Talon cusp, upper permanent canine ectopia

The prevalence of talon cusp is in the Hungarian population 2.5% (Mavrodisz *et al.* 2003). It is more frequent in male patients (Mavrodisz *et*

al. 2003, Takashi *et al.* 1996). In the permanent dentition it occurs isolated or combined with other developmental tooth anomalies, like Carabelli cusp, hyperdontia (Hattab *et al.* 1996, Mavrodisz *et al.* 2003). In the presented case it was associated with permanent canine malposition and agenesis of the lower second premolar. One of the most frequent disturbances caused by the cusp morphology is the occlusal interference during intercuspitation, and/or reversible acute apical periodontitis of the opposing tooth (Segura-Egea *et al.* 2003, Bolan *et al.* 2006). This can be prevented by the step-wise grinding of the palatal cusp, 1 mm/month to allow secondary dentin formation. Because of the slow eruption of the lateral incisor in the presented case the application of Ca(OH)₂ on the exposed surface was not necessary (Andlaw and Rock 1996). After complete eruption of the ectopic upper canines, fixed orthodontic appliance was applied for 8 month, followed by a 1.5 year conventional retention phase

4.5. Fifth patient - Permanent canine agenesis (PCA)

Clinical implications of PCA are severe and early diagnosis is relevant. In young patients orthodontic therapy is preferred for space opening as preprosthetic therapy and also in cases of implant application (Leong and Calache 1999). In the presented case the management option was the most appropriate for the family at the time of presentation. The space opening with a coil spring made the aesthetical crown reconstruction with adhesive technique possible. The patient chose the prosthetic solution with resin bonded bridge (Maryland bridge) for replacement of the missing upper lateral incisor and was referred to the Prosthetic Department for further treatment.

6. Conclusions and new achievements of the present work

6.1. The findings of the present work related to accessory, Carabelli and talon, cusps prevalence are in agreement with the linguistic evidence that shows Hungarian ancestors belonged to the Finno-Ugrian family of people whose habitants extended from the Baltic to the middle Urals, and, from where, on the east-west migration route, they came to settle in the Carpatian Basin in 896 AD, mixing with people living there during the previous millennium (Szentpéteri 1996, Macartney 1962, Török 1962).

In the present work, for the first time in Hungary, the prevalence data of accessory tooth cusps in the contemporary population was compared with similar data from the ancestral population;

6.2. The majority of dental anomalies of developing dentition are numerical anomalies. Supernumerary teeth or hyperdontia describes an excess in tooth number. The prevalence of hyperdontia in permanent dentition is reported to lie between 1 and 3%.

The prevalence data of hyperdontia and hypodontia was determined and compared with international data for the first time in our country for 6- to 18-year-old patients;

6.3. Congenitally agenesis of permanent canines is uncommon and rare developmental anomaly of the human dentition. Its isolated or combined form can cause several problems such as: malocclusion, aesthetical and functional deficiencies. Further investigations are needed to help answering the questions raised by the distribution and racial differences in its occurrence.

For the first time the prevalence of congenitally missing permanent canines in young Hungarians was evaluated and compared with international data;

6.4. The maxillary permanent canine is second only to the lower third molar in its impaction prevalence. Even detected at early ages, it often requires a complex multidisciplinary treatment, involving surgery, orthodontic treatment, prosthetics and implantology.

For the first time in Hungary the prevalence of impacted permanent canine was evaluated in correlation with the following orthodontic treatment;

6.5. The results of early prosthetic treatment of young HED patients are: significant improvements in speech, masticatory function and facial aesthetics. These contribute to the development of normal dietary habits and the improved and more rapid social integration of the affected children.

During treatment of patients with HED, early prosthetic treatment consisting of oral rehabilitation of two 3 year old patients was successfully achieved by application for the first time of complete dentures at such a young age in our country.

Complex, surgical and orthodontic, treatments of a special case of permanent tooth agenesis and supernumerary permanent teeth, associated with accessory cusps were presented.

PUBLICATIONS RELATED TO THE THESIS

Journal articles:

- I. Gábris K, Tarján I, Csiki P, Konrád F, Szádeczky B, Rózsa N. *A maradó fogak csirahiányának előfordulási gyakorisága és a kezelés lehetőségei*. Fogorv.Szle. 94. 137. 2001.
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- VI. Gábris K, Fábrián G, Kaán M, Rózsa N, Tarján I. *Prevalence of hypodontia and hyperdontia in paedodontic and orthodontic patients in Budapest*. Comm Dent Health 2006; 23:80-82
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2. Tanikawa Y, Tarján I, Rózsa N, Tanase S. *Effect of Experimentally Induced Trauma to incisors in rats*. Abstract 50. XV. IAPD Congress, Göteborg, Sweden, 1995.
3. Gábris K, Tarján I, Rózsa N, Frang E, Konrád F. *A maradó fogak számbeli rendellenességei és a kezelés lehetőségei*. MFE XV. Gyermekfogászati és Fogszabályozási Konferencia, Dobogókő, 1999.
4. Rózsa N, Mavrodisz K, Budai M, Soós A, Pap I, Tarján I. *Számfeletti csücskök előfordulási gyakorisága Árpád-kori koponyákon és napjainkban*. Tudományos Továbbképző Konferencia és Fogorvostalálkozó, SZTE Tanulmányi és Információs Központ, Szeged 2007, április 20-22.