HYPODONTIA OF PERMANENT TEETH IN A GROUP OF YOUNG PATIENTS FROM THE NORTH-EASTERN REGION OF ROMANIA

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Abstract

The present study deals with the statistical evaluation of the number of congenitally missing teeth, of the affected dental groups, of the clinical forms and of hypodontia topography, performed on a group of patients from the North-Eastern region of Romania, examined in the Ambulatory of the “Sf. Spiridon” Universitary Emergency Hospital of Iași, between 1990-2012. 111 patients (51 boys and 60 girls), with ages between 5 and 28 years, have been diagnosed with hypodontia of the permanent teeth (third molars excepted), by interview and by clinical and orthopantomographic examinations. Statistical analysis made use of a SPSS 20.0 software. Four categories of hypodontia were discovered on the congenitally missing teeth, a high prevalence of the premolar (mandibular and maxillary) and maxillary incisor groups, as well as the predominant presence of the mono- and unidental clinical forms of hypodontia. Hypodontia was localized both unilaterally and bilaterally, on the four dental quadrants. Statistically significant correlations have been established among the number of teeth, the dental groups with agenesis and the clinical forms of hypodontia (p=0.000).

Keywords: agenesis, hypodontia, orthopantomography, bootstrapping method, Chi-square test.

INTRODUCTION

Development of human dentition is a complex process, initiated very early, in the prenatal period, through cell proliferation from the oral epidermis and the subadjacent mezenchyma derived from the cells of the neural crest [1–3]. Regulation of the dental pattern is generated by the combined expression of the HOX genes from the mezenchyma of the neural crest cells [4,5]. Genetic studies attempted at explaining the mutation of the genes involved in dental agenesis, yet no unanimoulsy-accepted conclusion could be reached [6,7]. Mutation of Msx1, Msx2 and Pax9 genes was associated to agenesis, as well as to other congenital anomalies [8,9].

The literature provides several terms for this dental anomaly. Agenesis represents the absence of all dental buds. Anodontia represents the congenital absence of all teeth. Oligodontia represents the congenital absence of more than 6 teeth. Hypodontia represents the congenital absence of 1-6 teeth (third molars excepted) [10,11].

Populational studies on the normal evolution of human permanent dentition considered hypodontia as the most common development anomaly. According to the population under study, the global prevalence reported for hypodontia was between 2.6–11.3% [12,13], while the value recorded for the European population ranged between 4.6 and 6.3% [14].

The variable expression of hypodontia in different populations generated two questions on its genetic origin – still not elucidated – and on the normal numeric evolution of human permanent dentition, as a reflection of the contemporary world. In this respect, the present investigation aims at elucidating the statistical aspects of permanent teeth hypodontia, with the exception of third molars, on a group of young patients from the North-Eastern region of Romania. Hypodontia is evaluated by the parameters which define the number of congenitally missing teeth, the affected dental groups, the clinical forms and the topography on groups of patients and also on sexes, comparatively with previous studies performed on other populations.

MATERIALS AND METHOD

The experimental group was formed of 111 patients with ages between 5 and 28 years (mean
value: 11.09±4.289 years), 51 boys (mean value: 10.41±2.954 years) and 60 girls (mean value 11.67±5.115 years), diagnosed with hypodontia (third molars excepted) in the Ambulatory of the “Sf. Spiridon” University Emergency Hospital of Iași, between 1990 and 2012. The patients with genetic syndromes, oligodontia and lip and/or palate clefts were excluded. All patients included in the study gave their informed consent.

The diagnosis of hypodontia was established by the interview method (absence of eruption of certain permanent teeth after exfoliation of the deciduous teeth), clinical examination (absence of some permanent teeth from the dental arches) and orthopantomographic evaluation (agenesis of some permanent dental buds).

Statistical analysis was performed in SPSS 20.0, the frequency distributions for the variables included in the study and the parameters of descriptive statistics being calculated. The variables were numerically coded, as scale-type variables. The confidence intervals for the calculated frequencies were determined by the bootstrapping method [15] while, for establishing the statistical correlations among the parameters, the Chi-square test ($c^2$, p), with a level of standard signification of 0.05, was employed. The graphs were realized in MS Office Excel 2012.

RESULTS

As a function of the number of congenitally missing teeth, 4 categories of hypodontia were established, as follows: 54 patients with 1 tooth-hypodontia (48.6%), 47 patients with 2 teeth-hypodontia (42.3%), 6 patients with 4 teeth-hypodontia (7.2%) and 2 patients with 3 teeth-hypodontia (1.8%) (fig. 1). No statistically significant differences were found between sexes ($c^2=2.474$, $p=0.480$) (tab. 1).

Table 1. Ratio of congenitally missing teeth, for the whole sample group and separately on sexes

<table>
<thead>
<tr>
<th>Number of congenitally missing teeth</th>
<th>Males</th>
<th>Females</th>
<th>Total</th>
<th>95% Confidence interval</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 tooth</td>
<td>21</td>
<td>33</td>
<td>54</td>
<td>48.6%</td>
</tr>
<tr>
<td>2 teeth</td>
<td>24</td>
<td>38.3</td>
<td>42</td>
<td>33.3%</td>
</tr>
<tr>
<td>3 teeth</td>
<td>1</td>
<td>1.7</td>
<td>2</td>
<td>0.0%</td>
</tr>
<tr>
<td>4 teeth</td>
<td>5</td>
<td>5.0</td>
<td>8</td>
<td>2.7%</td>
</tr>
</tbody>
</table>

Table 2. Ratio of individual dental groups with hypodontia

<table>
<thead>
<tr>
<th>Dental groups with hypodontia</th>
<th>Males</th>
<th>Females</th>
<th>Total</th>
<th>95% Confidence interval</th>
</tr>
</thead>
<tbody>
<tr>
<td>Upper incisors</td>
<td>15</td>
<td>25</td>
<td>40</td>
<td>36.0%</td>
</tr>
<tr>
<td>Lower incisors</td>
<td>4</td>
<td>7.8</td>
<td>8</td>
<td>2.7%</td>
</tr>
<tr>
<td>Upper premolars</td>
<td>4</td>
<td>7.8</td>
<td>7</td>
<td>6.3%</td>
</tr>
<tr>
<td>Lower premolars</td>
<td>19</td>
<td>37.3</td>
<td>42</td>
<td>29.7%</td>
</tr>
<tr>
<td>Lower molars</td>
<td>3</td>
<td>5.9</td>
<td>5</td>
<td>4.5%</td>
</tr>
<tr>
<td>Combined groups</td>
<td>6</td>
<td>11.7</td>
<td>9</td>
<td>0.9%</td>
</tr>
</tbody>
</table>

The hypodontia of the dental groups registered an individual prevalence of 37.8% (n=42 patients) for the mandibular premolar series, of 36.0% (n=40 patients) for the maxillary incisor series, of 7.2% (n=8 patients) for the mandibular incisor teeth, of 6.3% (n=7 patients) for the maxillary premolar series and of 4.5% (n=5 patients), respectively, for the mandibular first molar (tab. 2). No statistically significant differences were observed between the two sexes ($c^2=6.537$, $p=0.587$) (fig. 2).
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Figure 2. Frequency distribution of hypodontia on sexes

Afferent to the 9 patients with hypodontia present in several dental groups (8.1%), the following combinations were registered: 3.6% (n=4 patients) hypodontia of the mandibular premolar and maxillary incisor groups; 1.8% (n=2 patients) hypodontia of the mandibular premolar, maxillary premolar and maxillary incisor groups; 1.8% (n=2 patients) hypodontia of the mandibulary and maxillary premolar groups; 0.9% (n=1 patients) hypodontia of the mandibular premolar and mandibular molar groups (tab. 3).

Table 3. Ratio of the combination of dental groups with hypodontia

<table>
<thead>
<tr>
<th>Combination of dental groups with hypodontia</th>
<th>Males</th>
<th>Females</th>
<th>Total</th>
<th>95% Confidence interval</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lower premolars and upper incisors</td>
<td>3</td>
<td>5.9</td>
<td>1</td>
<td>1.7</td>
</tr>
<tr>
<td>Premolars and upper incisors</td>
<td>2</td>
<td>3.9</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Lower and upper premolars</td>
<td>1</td>
<td>2.0</td>
<td>1</td>
<td>1.7</td>
</tr>
<tr>
<td>Lower premolar and lower molar</td>
<td>-</td>
<td>-</td>
<td>1</td>
<td>1.7</td>
</tr>
<tr>
<td>Total</td>
<td>6</td>
<td>-</td>
<td>3</td>
<td>-</td>
</tr>
</tbody>
</table>

As a function of the clinical froms of hypodontia, 3 main patterns have been established: 54 patients with monodental hypodontia (48.6%), 50 patients with unidental hypodontia (45.0%) and 7 patients with bidental hypodontia (6.3%) (fig. 3). Once again, no statistically significant differences have been observed between sexes ($c^2=3.244$, $p=0.198$) (tab. 4).

Figure 3. Frequency distribution of the clinical types of hypodontia

Table 4. Ratio of clinical types of hypodontia

<table>
<thead>
<tr>
<th>Clinical types of hypodontia</th>
<th>Males</th>
<th>Females</th>
<th>Total</th>
<th>95% Confidence interval</th>
</tr>
</thead>
<tbody>
<tr>
<td>No.</td>
<td>%</td>
<td>No.</td>
<td>%</td>
<td>No.</td>
</tr>
<tr>
<td>1 tooth</td>
<td>21</td>
<td>41.2</td>
<td>33</td>
<td>55.0</td>
</tr>
<tr>
<td>1 tooth bilateral</td>
<td>25</td>
<td>49.0</td>
<td>25</td>
<td>41.7</td>
</tr>
<tr>
<td>2 teeth bilateral</td>
<td>5</td>
<td>9.8</td>
<td>2</td>
<td>3.3</td>
</tr>
<tr>
<td>Total</td>
<td>51</td>
<td>100.0</td>
<td>60</td>
<td>100.0</td>
</tr>
</tbody>
</table>

In the experimental group, unilateral hypodontia was observed in 55 patients (49.5%), the bilateral one - in 51 patients (45.9%), and the association of unilateral hypodontia with the bilateral one - in 5 patients (4.5%) (fig. 4). No statistically significant differences were noticed between sexes ($c^2=4.190$, $p=0.123$) (tab. 5).

Figure 4. Frequency distribution of hypodontia symmetry
Most frequently, hypodontia affected quadrant 3, in a 50.45% ratio (n=56 patients), followed by quadrant 1, in a 38.73% ratio (n=43 patients), quadrant 2 – 36.03% (n=40 patients) and quadrant 4, respectively, in a 35.13% ratio (n=39 patients). In most of the cases, according to the FDI numbering system, the patients had 1 congenitally missing tooth, in the following order: 35 (42.3%), 12 (31.5%), 22 (29.7%) and 45 (26.1%) (tab. 6).

A comparative statistical analysis of the number of congenitally missing teeth vs the clinical forms of hypodontia was performed, and the statistically significant differences among them were identified (c²=188.105, p=0.000). In this way, the observation was made that all patients with 2 congenitally missing teeth (n=47 patients) belonged to the unidental clinical form of hypodontia, while those with 3 congenitally missing teeth (n=2 patients) showed the bidental clinical form of hypodontia. Out of the 8 patients with 4 congenitally missing teeth, 5 showed the bidental clinical form, and the other 3 - the unidental form of hypodontia (fig. 5).

Statistically significant differences were observed between the dental groups of the congenitally missing teeth and the clinical forms of hypodontia (c²=115.564, p=0.000). Thus, the superior incisive, the inferior incisive, the superior premolar and the inferior premolar groups evidenced approximately equal distributions between the mono- and unidental clinical forms of hypodontia; the inferior molar group was significantly associated with the monodental clinical form of hypodontia (80%), while the combined dental groups were associated with the bidental clinical form of hypodontia (77.8%) (fig. 6).
DISCUSSION

Hypodontia of permanent teeth is an increasingly studied anomaly in different populations and ethnicities. In Europe, the prevalence of hypodontia differs in the various populations under investigation. Consequently, a prevalence of the permanent teeth hypodontia of 11.3% was registered for the population of Germany and Slovenia [16,17], of 7.25% for that of Spain [18], of 4.5% for the population of Norway [19] and of 4.3%, respectively, for that of Turkey [20], while the ratio between sexes was of 1:1.4 male vs female [14].

The genetic or environmental factors intervene in variable ratios in the occurrence of such dental anomalies. Two categories of authors support the etiopathogenic hypotheses of hypodontia [21]. The anatomical theories demonstrate that teeth development is produced under a strict genetic control, while hypodontia is the phenotypical expression of the mutation of the genes involved in the development process [22,23]. The evolutionist theories explain agenesis as a numerical reduction of the permanent teeth, as due to the reduction of the maxillary arches through diminution of mastication, as a result of aliments’ processing [24,25].

Several authors attempted at establishing a diagnosis classification of hypodontia, according to its severity, describing mild hypodontia as the congenital absence of 1-2 teeth, moderate hypodontia – as the congenital absence of 3-5 teeth and severe hypodontia (or, as stated by other authors, oligodontia) as a congenital absence of 6 or more teeth [26,27].

In our experimental group, the most frequent form of hypodontia was the mild one, involving the congenital absence of 1-2 teeth, as related in previous studies, developed on other populations.

The present study, mainly focused on the analysis of the dental groups of hypodontia, evidenced another order of the individual frequency of the congenitally absent teeth: the mandibular premolar series, the maxillary incisor series, the mandibular incisor series, the maxillary premolar and the mandibular molar series, without significant differences between sexes. A novelty was the analysis of the association frequency of the dental groups affected with hypodontia, most frequently occurring being the combination of the hypodontia of the mandibular premolar groups with the maxillary incisor one.

According to its clinical forms, hypodontia may be unidental – when a congenital bilateral absence of 1 tooth from 1 dental group is recorded, bidental – namely the congenital bilateral absence of 1 tooth from 2 dental groups, pluridental – when a congenital bilateral absence of 1 tooth from several dental groups is noticed, or monodental, when there is only 1 congenitally absent tooth from the dental arches.

The present study, unilateral hypodontia registered a slightly higher ratio than the bilateral one, differences being observed among the dental quadrants affected with hypodontia. Previous studies devoted to hypodontia mentioned no difference among unilateral vs bilateral affectations or maxillary vs mandibulary ones, respectively [14,28,29].

The authors agreed upon the following sequence of the individual frequency of the congenitally missing teeth: the second mandibular premolar (41.0%), the lateral maxillary incisor (22.9%), the second maxillary premolar (21.2%), the central mandibular incisor (3.5%), the prime maxillary molar (2.8%) and the lateral mandibular incisor (2.5%) [30].

In the analyzed group, the highest individual frequency of the congenitally missing teeth was registered for 35, 12, 22 and 45 (FDI marking).

For a better approximation of the results, the frequency distributions were validated by the bootstrapping method, a re-sampling procedure being used for determining the confidence intervals of the statistics calculated inside a sample group, permitting extrapolation of the obtained data to the level of the whole population, in a scientifically-ascertained manner [31]. Practically, the bootstrapping method permits the distribution of the values of a studied parameter at
the level of the origin population, starting from the investigated sample group. The confidence interval was defined by the procedure known in literature as “the bootstrap percentile method”, according to which, out of the series of obtained values, arranged in order, a 5% ratio should be eliminated, 2.5% from the inferior extremity of the variation interval and 2.5%, respectively, from the superior one, so that the remaining values form the 95% confidence interval of the considered parameter [32]. Comparatively with the previous studies dedicated to hypodontia, this highly efficient and robust calculation method appears as an improved version of the standard statistical procedure.

The Chi-square test was applied for putting into evidence the correlations between the number of congenitally missing teeth and the dental groups of hypodontia with its clinical forms, which permitted to estimate their distribution on the clinical forms of hypodontia.

It is generally ascertained that – as a function of its localization - hypodontia produces serious local, skeletal, functional and aesthetic complications, its treatment being an interdisciplinary one [33]. The Index of Orthodontic Treatment Need (IOTN), using a 5-point scale, indicates the highest need of treatment in cases of mild or moderate hypodontia from any quadrant (category 5) [34,35], as it has a high impact upon the dental status [36].

Even if the distribution of the congenitally missing teeth and the clinical forms are not serious in the group of population here under investigation, the therapeutical implications are quite severe – according to the IOTN index and to the intervention of a team of specialists expected to solve the subsequent complications brought about by hypodontia.

CONCLUSIONS

In the group of patients from the population under study, a high frequency was recorded for the mild form of hypodontia, by the congenital absence of 1-2 teeth, and also affectation of the premolar (upper and lower) and upper incisor groups and the combination of these dental series. The mono- and unidental forms, the unilateral and bidental hypodontia were of majority, and differences were observed among the dental quadrants affected with hypodontia. The differences between sexes were insignificant.

The bootstrapping method was applied as an improved procedure of standard statistical analysis on hypodontia, while the Chi-square test evidenced the statistically significant differences among the clinical forms of hypodontia as to the behaviour of some specific parameters (number of absent teeth and the affected dental groups).

The prejudices of a congenital absence of teeth upon the maxillary arches and also upon dental and facial aesthetics call for an early tracing of hypodontia by dentists, for achieving an as cheap as possible therapeutical management for the patients.

References

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