

CORRELATIONS BETWEEN ATAVISTIC AND PROTEROGENETIC PHENOMENA EXPRESSED AT THE DENTO-MAXILLARY SYSTEM LEVEL

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Received May 13, 2009

The status of the dento-maxillary system of the modern man is the result also of the manifestation of phylogenetic trends, either progressive (known as proterogenetic) or regressive (known as atavistic). Even if logical constraints generated by phylogenetic principles would drive us to conclude that in an individual may only be expressed one type of phenomena – progressive or atavistic –, day to day clinical practice proves that an association of these two is frequently encountered.

The most representative for this paradox is the third molar (wisdom tooth), end of the dental series. In a sample of 1100 selected patients we analyzed eventual correlations between third molar hypodontia or microdontia – as proterogenetic phenomena – with hypodontia or microdontia of other teeth or with atavistic phenomena like supernumerary teeth, macrodontia. We noted a 10.6% prevalence of third molar hypodontia, while for supernumerary teeth in the retro-molar area prevalence was 0.18%. Also, third molar hypodontia increases the risk for hypodontia of other teeth in the same patient.

Atavistic phenomena like supernumerary molars may be accompanied by proterogenetic phenomena like hypodontia or microdontia of other teeth. Proterogenetic phenomena like hypodontia and microdontia of the third molar can be associated with atavistic phenomena of the other teeth like macrodontia or supernumerary teeth.

Key words: Dento-maxillary system.

INTRODUCTION

Somatic development of each human organism, implicitly of the dento-maxillary system, is the result of the 3.5 billion years of phylogenetic evolution and of the 65–75 (on the average) years of ontogenetic evolution of the human being. Growth and development characteristics of the dento-maxillary system are the expression of the genetic code established during phylogenetics and inherited through ontogenesis by descendants of the same species, overlapped by changes induced by the interaction with environmental factors.

The evolution of the dento-maxillary system, occurred in vertebrates 400 millions years ago, is an important ontogenetic and phylogenetic marker. More than 2000 years ago, Aristotle¹, through his observations, substantiated comparative odontology:

“Animals differ amongst themselves and from men also in many ways as regards their teeth. Provided with teeth are all blood carrying and live bearing four footed animals, and these may or may not have complete tooth rows in both jaws. ... Tusks and horns together, occur in no animal, and neither is there an animal with carnassials that possess at the same time one of those two parts.”

Important aspects of the dento-maxillary pathology, involving general dentistry (decays, periodontal disease) or orthodontics (dento-maxillary disorders) have a phylogenetic explanation. There are two directions:

- 1) paradoxical, as a result of the phylogenetic evolution of the human species, therefore of the progressive (proterogenetic) phenomena expressed also at the dento-maxillary system.

As regards this aspect, Bertrand³ observed that “*the evolution of the human dentition is, actually, an involution*”.

- 2) as a result of the stagnation in a previous phylogenetic developmental stage, predecessor to the modern human, respectively atavistic phenomena.

The most significant representative for proterogenetic or atavistic expressions at the dento-maxillary system's level is the third molar, tooth displaying the most variations as regards the shape, dimensions and eruption patterns^{4,5}.

But how is phylogenetics at the level of the third molar?

As proterogenetic aspects the following can be observed:

- 1) During the hominization process the tooth erupts more and more later, hence the third molar has a late eruption, between 18.5 and 24 years⁶.
- 2) The human dentition evolves towards a diminution of the teeth number, dimensions and form – some authors consider the third molar as the tooth most frequently absent due to hypodontia⁷. The upper third molar is, usually, the smallest of the molars⁴: its crown is dimensionally reduced, with 3 cusps, the masticator surface becoming triangular, roots are shorter and with a tendency to fusion; undersized third molars are observed, especially upper.
- 3) There is a phylogenetic tendency to dimensional reduction of the upper and lower jaws – the third molar, especially the lower one, has the highest rate of impaction, most often due to the lack of necessary alveolar space. The third molar is a frequent source of dental crowding.
- 4) Muscular activity is highly diminished in the modern man, expressed through a diminution of the number of teeth involved in mastication:
 - hence, the third molar rarely presents signs of wear due to mastication like attrition;
 - a reduced muscular dynamics is unfavorable to self-cleaning, making the molar more prone to dental decay.

The following atavistic phenomena can be observed in relation to the third molar:

- 1) Supernumerary roots;
- 2) The lower third molars' crowns frequently are oversized, with five or six cusps instead of four (as was encountered in the prehistoric man);

- 3) Supernumerary teeth in the molar area: especially in the upper jaw⁴, representing a return to the dental formula of the first mammals, which included four molars²;
- 4) Bolk tubercle – present on the mesiobuccal surface of the third molars, more often on the upper ones.

The existence of proterogenetic/atavistic phenomena, with potential pathological consequences within the dento-maxillary system is indisputable. Significant for the phylogenetic evolution is the likelihood of observing proterogenetic and atavistic phenomena not only in the same individual, but also on the same tooth. Firu² observes a mesiobuccal Bolk tubercle on an undersized upper third molar of on a skull belonging to the collection of the „Francisc I. Rainer” Institute of Anthropology. Taylor⁸ also remarks the possibility to discover additional formations on undersized third molars, clearly different entities than Bolk or Carabelli cusps (as they are placed on any area of the respective tooth).

In this study an attempt was made to analyze the eventual correlations between atavistic or proterogenetic phenomena on the third molar and regressive or progressive phenomena manifested within the dento-maxillary system.

MATERIALS AND METHOD

We selected a sample of 1100 patients, representative for the contemporary Romanian population, people who requested treatment for Orthodontic or General Dentistry problems in the Orthodontics and Dentofacial Orthopedics Department of the “Carol Davila” University of Medicine and Pharmacy in Bucharest, over a period of 10 academic years, between 1998 and 2008.

The phenomena investigated on the selected sample were:

- incidence of tooth number abnormalities (hypodontia/hyperdontia) at the level of the four wisdom teeth (third molars, numbered as follows: 18 – upper right third molar, 28 – upper left third molar, 38 – lower left third molar, 48 – lower right third molar);
- potential correlations between tooth number abnormalities at third molar site and similar abnormalities at the level of the other teeth more frequently affected by hypodontia/hyperdontia: lower central incisors (ICI), upper lateral incisors (ILS), second upper premolars (Pm₂S), lower second premolars (Pm₂I), second molars (M₂);
- potential correlations between number abnormalities of the third molars and form abnormalities of other teeth: isolated or generalized microdontia / macrodontia.

For each case, third molar investigation was performed by intraoral clinical examination and by examining orthopantomograms and dental casts.

RESULTS AND DISCUSSIONS

1. Frequency of third molar hypodontia:

Calculated for each third molar, the frequency of hypodontia is:

18	11.41%	28	7.94%
48	10%	38	10.42%

Overall third molar hypodontia is 10.6%.

Third molar hypodontia frequently affects one, two or three of the teeth in this series. We analyzed the simultaneity of each third molar's hypodontia with other third molar hypodontia, observing that:

<ul style="list-style-type: none"> Hypodontia of 18 is associated with hypodontia of: 28-69.56 % cases 38-50 % cases 48-50 % cases 	<ul style="list-style-type: none"> Hypodontia of 28 is associated with hypodontia of: 18-72.72 % cases 38-63.63 % cases 48-63.63 % cases
<ul style="list-style-type: none"> Hypodontia of 48 is associated with hypodontia of: 18-55.81 % cases 28-65.11 % cases 38-74.41 % cases 	<ul style="list-style-type: none"> Hypodontia of 38 is associated with hypodontia of: 18-57.14% cases 28-66.66 % cases 48-76.19 % cases

These percentage correlations of hypodontia, examined for each third molar separately, proves that, in cases with hypodontia of minimum two third molars, hypodontia of homologous third molars occurs most often.

2. Correlations between third molar hypodontia and hypodontia of other teeth

Association of third molar hypodontia with other hypodontia was assessed separately for each third molar. Comparisons were made with hypodontia of upper lateral incisor, lower central incisor, upper and lower second premolars, third molars and second molars.

The following results were obtained:

<ul style="list-style-type: none"> Hypodontia of 18 is associated with hypodontia of: Pm2S-4.34 % Pm2I-17.39 % ILS-2.17 % ICI-2.17 % M3S-76.08 % M3I-45.65 % M2-6.52 % 	<ul style="list-style-type: none"> Hypodontia of 28 is associated with hypodontia of: Pm2S-6.81 % Pm2I-20.45 % ILS-2.27 % ICI-2.27 % M3S-84.44 % M3I-56.81 % M2-4.54 %
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<ul style="list-style-type: none"> Hypodontia of 48 is associated with hypodontia of: Pm2S-6.97 % Pm2I-16.27 % ILS-4.65 % ICI-5.6 % M3S-52.53 % M3I-67.44 % M2-6.97 % 	<ul style="list-style-type: none"> Hypodontia of 38 is associated with hypodontia of: Pm2S-4.76 % Pm2I-14.28 % ILS-4.87 % ICI-2.38 % M3S-61.90 % M3I-66.66 % M2-7.14 %
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For a comparative assessment of our results, we list below the existing literature data on the frequency of third molar hypodontia.

Goblirsch ⁹ , 1930	5.2 %
Banks ⁹ , 1934	10 %
Thomsen ⁹ , 1952	21 %
Nanda ⁹ , 1954	3.6 %
Garn and Lewis ⁷ , 1963	20.08 %
Gravelly ⁹ , 1965	10-15 %
Shoko Baba ¹⁰ , 2000	20.8 %
Firu ² , 1983	20-25 %
Ionescu ¹¹ , 2000	25.62 %

Garn and Lewis⁷ analyzed the correlation between third molar hypodontia and hypodontia of other teeth and found that individuals with one or more third molar hypodontia will have:

- upper lateral incisor hypodontia in 12 % of cases;
- lower and upper second premolar hypodontia in 11 % of cases.

Garn and Lewis⁷ found that this correlation of third molar hypodontia with hypodontia of other teeth affects even "stable" teeth: upper central incisor, canine, first premolar.

In the literature there is no correlation between third molar hypodontia and second molar hypodontia.

3. Frequency of supernumerary teeth (hyperdontia)

In the 1,100 cases investigated, we found only two cases of supernumerary teeth in the molar area, representing thus a rate of 0.18%.

4. Microdontia of the third molar

It was also interesting to evaluate cases with microdontia of the third molar (Fig. 1). These

situations represent a rate of 2.72% of total 1100 cases examined. We noticed a greater frequency of third molar microdontia in the maxilla compared to the mandible (95% of third molars with microdontia are upper). Although a particular aspect of some lower third molars buds could have suggested the occurrence of third molar microdontia in those situations, that hypothesis was not confirmed by subsequent complementary examinations of the patients concerned.



Fig. 1. 28 with microdontia, erupted and aligned on the dental arch.

5. We verified the existence of a correlation of any atavistic or proterogenetic events at the third molar level with other progressive or regressive phenomena present in the dento-maxillary apparatus of the same individual.

Thus:

Hypodontia of the third molar as proterogenetic phenomenon has been associated with:

- *Other proterogenetic phenomena:*
 - 6% with other hypodontia (Fig. 2)
 - 1.98 % with generalized microdontia
 - 5.70 % with isolated microdontia
- *Atavistic phenomena:*
 - 4.2 % with supernumerary teeth
 - 5.70 % with generalized macrodontia
 - 0.49 % with isolated macrodontia.



Fig. 2. I.A., ♂, 12 years old – Hypodontia of lower second and third molars associated with macrodontia of the upper central incisors and other localized dental abnormalities (impacted 35,13, 23).

In the two cases of supernumerary teeth in molar area, the following was found as atavistic phenomenon:

- In one case the impaction in grave malpositions of all four third molars is observed (Fig. 3);



Fig. 3. Para-molar tooth erupted on the dental arch in the second quadrant, between teeth 26 (erupt) and 27, impacted. All four third molars are impacted, in various malpositions.

- In the second case, all four third molars are erupted, aligned and with occlusal relationships, but there is an impaction of one premolar and a conglomerate of supernumerary teeth in the lower premolar area, near the impacted tooth (Fig. 4).



Fig. 4. Supernumerary distomolar tooth in the first quadrant. Intra-osseous conglomerate of supernumerary undersized teeth in the area of the impacted tooth 34.

CONCLUSIONS

As regards the phylogenetic status of the third molar, proterogenetic phenomena prevail –hypodontia was diagnosed in 10.6% of the investigated sample – comparing to atavistic phenomena, as supernumerary teeth (0.18%). Within patients with 2 or more missing third molars, hypodontia of homologous third molars is most frequent.

Third molar hypodontia increases the risk of other hypodontia within the same patient.

Within the dento-maxillary system of the same individual atavistic and proterogenetic expressions can be associated, as an expression of extreme phylogenetic tendencies.

Atavistic phenomena like supernumerary molars may be accompanied by proterogenetic phenomena like hypodontia or microdontia of other

teeth. Proterogenetic phenomena like hypodontia and microdontia of the third molar can be associated with atavistic phenomena of the other teeth like macrodontia or supernumerary teeth.

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