Gemination, Fusion or Confusion: A Tooth Nomenclature Enigma for Fusion, Gemination.

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ABSTRACT:

Objectives: Dental anomalies of number and forms may occur in the primary and permanent dentitions. The terms double teeth, double formations, joined teeth, fused teeth or dental twinning is often used to describe fusion or gemination, both of which are primary developmental abnormalities of the teeth. Dental anomalies involving alterations in number, size, and structure of teeth often present a major challenge for dental practitioners. One dilemma is whether the anomaly might be a transmitted trait or is associated with other clinical findings involved with craniofacial syndromes. Another dilemma is recognition of the dental anomaly and what, if any, dental treatment might be indicated. Brief overview of fusion or gemination pathogenesis has also been discussed.

Conclusions: It is always difficult to denote these anomaly with the tooth numbering systems which should be compatible with computer this article also propose a modified tooth nomenclature for fusion, gemination. The modification is all about to save time and confusion.

Key words: Dental anomalies, gemination, fusion, tooth nomenclature.

INTRODUCTION:

Dental anomalies of number and forms may occur in the primary and permanent dentitions. The terms double teeth, double formations, joined teeth, fused teeth or dental twinning is often used to describe fusion or gemination, both of which are primary developmental abnormalities of the teeth. Fusion is a single enlarged tooth or joined tooth in which the tooth count reveals a missing tooth when the anomalous tooth is counted as one. Gemination can be an attempt of a single tooth bud to divide, with the resultant formation of a teeth with a bifid crown and usually, a common root and root canal. Fusion of teeth results from alterations in the embryonic development of a non definitely clarified etiology. According to some authors fusion and gemination seem to be rather equivalent. Fused teeth seem to be more prevalent in deciduous dentition.
found in the anterior region of the dental arch, often affecting lateral incisors. The fusion of teeth influences the aesthetics of the dentition and may result in plaque accumulation.³

Fusion of the primary dentition is usually seen in the mandibular canine and lateral incisor regions. Among Asians generally, the prevalence of fusion in the primary dentition ranges from 1.2% to 5.2%.⁴

Dental anomalies involving alterations in number, size, and structure of teeth often present a major challenge for dental practitioners. One dilemma is whether the anomaly might be a transmitted trait or is associated with other clinical findings involved with craniofacial syndromes. Another dilemma is recognition of the dental anomaly and what, if any, dental treatment might be indicated.⁴

It is always difficult to denote these anomalies with the tooth numbering systems which should be compatible with computer. This article also proposes a modified tooth nomenclature for fusion, gemination which is much needed. Brief overview of fusion or gemination pathogenesis has also been discussed.

Pathogenesis

The etiology of fusion is not yet clear. Investigators consider a viral infection during pregnancy and use of thalidomide as the possible cause of the anomaly. An animal study has found hypervitaminosis A as the cause of fusion. Still others have considered the role of heredity in this condition.⁵ It has been thought that some forces or pressure produces impact of the developing tooth germs and subsequent union of enamel organ and the dental papilla resulting in fusion of teeth or genetic inheritance can be a possible etiology. If this contact occurs early, at least before calcification begins, the two teeth may be completely united to form a single large tooth.⁶ These anomalies may develop during tooth bud morpho-differentiation as a result of a developmental aberration of both the ectoderm and mesoderm. Fusion is commonly observed as the union of two distinct dental sprouts which occurs in any stage of the development joined by the dentine; pulp chambers and canals may be linked or separated depending on the developmental stage. The dentin however, is always confluent in cases of true fusion; the union of the teeth may be total or partial and may occur between a normal and a supernumerary tooth.⁶

Tooth numbering system for fusion, gemination.

Numbering systems have been developed to have a standard way of referring to particular teeth. Tooth numbering provides dentists with an essential shortcut in clinical record-keeping.

Today, three systems are favored worldwide.¹

1. The Zsigmondy/Palmer system
2. The universal system
3. FDI two-digit system

The Universal Numbering System has been adopted by the American Dental Association (ADA). Most general dentists use this system. The Palmer Notation Method is used by many orthodontists and oral surgeons.

Tooth numbering systems: FDI

FDI World Dental Federation Two-Digit Notation (International)

The system, developed by the Fédération Dentaire Internationale (FDI), World Dental Federation notation is also known as ISO-3950 notation.

The human teeth are symmetrically arranged in the mouth. Each quadrant of the mouth has 8 different teeth that are mirrored horizontally and vertically to the other quadrants.

In the FDI World Dental Federation notation each one of these 8 teeth is assigned a number from 1 to 8, starting from the center front tooth (central incisor) and moving backwards up to the third molar.

Each quadrant is also assigned a number, from 1 to 4 for the adult (permanent) teeth or 5 to 8 for the primary or deciduous teeth. The combination of these two numbers (Quadrant code number & Tooth code number) specifies how teeth are numbered. This tooth numbering system is called, the Two-Digit World Dental Federation Notation or FDI notation system.

The FDI two-digit system—used throughout the world. In 1996 ADA also adopted this system.¹

**Universal system**

Tooth letter A is the farthest back on the right side of the mouth in the maxillary jaw. The letters continue along the upper teeth towards the front and across to the tooth farthest back on the top left side letter J.

The letters continue by dropping down to the mandibular jaw. Letter K is the tooth farthest back on the left side of the mouth on the bottom.

Letters continue again towards the front and across to the tooth farthest back on the bottom right side of the mouth letter T. ADA recommended in 1968.⁷

The modification is all about to save time and confusion. If clinically two teeth are visible but not evident with radiograph the teeth is marked with underline and use of bold number of the single teeth suggestive of gemination.

If clinically two teeth are visible and evident with radiograph the teeth are marked with underline and use of bold number of the two teeth suggestive of teeth is fusion.

And this is very much acceptable to computer language.

**Modified Tooth numbering system for Fusion, Gemination**

**I. for FDI System**

Tooth numbering system for fusion permanent dentition

<table>
<thead>
<tr>
<th>18 17 16 15 14 13 12 11</th>
<th>21 22 23 24 25 26 27 28</th>
</tr>
</thead>
<tbody>
<tr>
<td>48 47 46 45 44 43 42 41</td>
<td>31 32 33 34 35 36 37 38</td>
</tr>
</tbody>
</table>

Example: 43 42: Fusions with mandibular lateral and canine the numbers are in bold and two teeth number is underlined: suggesting two teeth are involved.

23 24: Fusion with the canine and first premolar.

**Tooth numbering system for fusion primary dentition**

<table>
<thead>
<tr>
<th>55 54 53 52 51</th>
<th>61 62 63 64 65</th>
</tr>
</thead>
<tbody>
<tr>
<td>85 84 83 82 81</td>
<td>71 72 73 74 75</td>
</tr>
</tbody>
</table>

72 73: Mandibular left lateral and canine are fusion.

53 52: Maxillary right lateral and canine are fusion.

**Tooth numbering system for Gemination permanent dentition**

<table>
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<th>18 17 16 15 14 13 12 11</th>
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</table>

43: Clinically the mandibular canine appearing as the two teeth but it is gemination.

22: the numbers for maxillary left lateral incisor are in bold and only one teeth number is underlined: Suggesting one tooth involving though clinically two teeth are evident.

**Tooth numbering system for Gemination of primary dentition**

**II. for Universal system**

<table>
<thead>
<tr>
<th>55 54 53 52 51</th>
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<tbody>
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<td>71 72 73 74 75</td>
</tr>
</tbody>
</table>

52: Maxillary right lateral clinically two teeth are evident but only one teeth is bold and underlined suggestive gemination.

71: Mandibular left central incisor: gemination.

For Universal system of permanent dentition for germination

7: Maxillary right lateral clinically two teeth are evident but only one teeth is bold and underlined suggestive: gemination

24: Mandibular left central incisor gemination

Primary dentition

7: Maxillary right lateral clinically two teeth are evident but only one teeth is bold and underlined suggestive: gemination

Discussion: Fusion also termed as Synodontia, fusion and gemination are developmental anomalies with inherently bizarre anatomy. Fused teeth are usually asymptomatic and are the most common type of dental anomalies in the primary dentition. Both gemination and fusion are prevalent in primary dentition, with incisors being more affected, it is very difficult to distinguish the differences between these two kinds of anomalies. No difference is found regarding to gender or the side.

With the difficulty of deciding whether a tooth is fused or geminated it has been proposed that these anomalies be referred to in a neutral term, such as “double teeth”. The term “twinning” or “double tooth” has sometimes been used to designate the production of identical structures by division resulting in one normal and one supernumerary tooth. Several clinical and radiographic criteria are used to distinguish fusion from gemination. Fusion is the incomplete attempt of two tooth buds to fuse into one, whereas gemination is the incomplete attempt of one tooth bud to divide into two. Clinically when the joined teeth are counted as one, a full complement of teeth usually means that the phenomenon represents gemination; less than full complement of teeth usually indicates fusion. A radiographic consideration is the difference in the root configuration often seen between fusion and gemination. In case of fusion there are usually two separate canals, whereas in gemination there is usually one large common root canal, confusion still arose in classifying the anomalous tooth as to whether it is a case of gemination or fusion. In gemination, the two halves of the joined crown are usually mirror images. In spite of considerable number of cases reported in the literature, the differential diagnosis between fusion and gemination is difficult some authors use the terms as synonyms. In a study, children’s with dental anomalies in the primary dentition have found that 70% of double teeth involved the mandibular lateral incisor and cuspid. It has been reported an unusual case of a bilateral fusion of lower canines and lateral incisors followed by the same anomaly in permanent dentition.

The clinical importance is to identify the anomaly to organize a conservative individualized treatment but can cause a number of clinical problems like delayed exfoliation thereby deviating the path of eruption of permanent successors, may be because of delayed resorption of root due to greater root mass and increased area of root surface relative to the size of the permanent successor crown to avoid deviating the path of eruption of permanent successors extraction of the fused tooth is the best treatment option, caries in the grooves at the site of fusion can be restored easily but in cases of pulpal involvement the bizarre root anatomy makes pulp therapy difficult, proper oral hygiene should be encouraged to prevent caries. Other main periodontal complication in fusion cases occurs due to the presence of fissures or grooves in the union between the teeth involved if it is extended sub-
gingivally and causing accumulation of plaque. The child should be regularly monitored to ensure a normal eruption pattern of the permanent dentition.2,6

Tooth numbering provides dentists with an essential shortcut in clinical record-keeping.

CONCLUSION:

Dental anomalies in number, size, and structure of teeth often present a major challenge for dental practitioners. One dilemma is whether the anomaly might be a transmitted trait or is associated with other clinical findings involved with craniofacial syndromes. Another dilemma is recognition of the dental anomaly and what, if any, dental treatment might be indicated.

It is always difficult to denote this anomaly with the tooth numbering systems which should be compatible with computer. Fusion is defined as a single enlarged tooth or joined teeth in which the tooth count reveals a missing tooth when the anomalous tooth is counted as one. Gemination according to most authors usually presents with a single root canal. However, this does not hold true for all cases. It is not always possible to differentiate clinically between fusion and gemination. Though these are harmless anomalies, but they also can indicate future dental anomalies, especially hypodontia in permanent dentition. Thus a radiographic examination should be preceded in every case and recognizing the condition will facilitate the establishment of a right treatment and the proposed teeth nomenclature which will also save time for the referred clinicians and other specialized dental surgeons for treatment. Further genetic linkage and molecular biology studies will allow the identification of mutations responsible for some patterns of syndromic and non-syndromic fusion of tooth. The modification is all about to save time and confusion.

Conflict of interest: All authors declare no conflict of interests.

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7. Ash and Nelson wheeler’s dental anatomy, physiology and occlusion, eight editions, 2004; 4-6.