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Dental notation for primary teeth: a review and suggestion of a novel system

ABSTRACT

Background *Tooth designation systems are routinely used in dental practice, for identification of teeth, recording dental data and communication among dental professionals. There are various dental notations systems for the primary and permanent dentition. The most popular are the Zsigmondy-Palmer system, the Universal Numbering System, and the FDI system. Others includes the Victor Haderup system, the Woelfel system, and the MICAP system. The majority of dental notations are focused on permanent teeth and are modified for primary teeth, even though the latter erupt before the permanent dentition.*

Conclusion *Advantages and disadvantages of notations for primary dentition are discussed and compared to a new alphanumeric system for primary teeth which is considered simple and convenient.*

Keywords *Dental notation; FDI system; Universal Numbering System; Zsigmondy-Palmer system.*

Introduction

Ever since dentistry started, teeth notations also have began for identification, recording, printing and ease of communications purposes. Several hundred years ago, in Europe, the notation of teeth was based on Latin and German [Peck and Peck, 1993], and the names were very lengthy. An example of Latin notation is Mol.II Scup.Sin, the abbreviated form for Molaris Secundus Superior Sinister. Later in 1861 Adolf Zsigmondy introduced a new dental coding system by preparing four sets of eight numbers with the Zsigmondy grid used for permanent dentition only. Years later this system was modified and used for the primary dentition [Harris, 2005]. The dental notation or coding should accurately identify the type, arch, quadrant and name of the tooth in an easy way. To accomplish this, several methods of dental notation systems were evolved and modified to overcome the limitations associated with each notation These includes numbers, alphabetical letters, Roman numerals, Quadrant symbols [angles (┘└┐┌), +, -], two digit systems, ANAASEA letters, TOT digits etc.

The various methods of dental notation systems are routinely used in day to day dental practice. Among the popular systems are: Zsigmondy-Palmer system, Universal Numbering System, FDI system. The simplified new digit letter dental notation for primary dentition proposed here aims at overcoming the drawbacks of the existing systems for primary/deciduous teeth notations.

Review of ancient and recent dental notations

A review of the literature reveals that though primary teeth develop and erupt before permanent teeth, they are given less attention. This may be due to the fact that they function for a short time [Harris, 2005]. On this basis most of the 'dental short hand'/dental notations are basically employed for permanent dentition only. Later these were adopted for primary dentition [Peck and Peck, 1993]. In most systems, numerals are designated for permanent teeth, and alphabet letters (upper case, lower case), and Roman numerals are used for primary dentition.

The Zsigmondy-Palmer system [Zsigmondy, 1861; Palmer, 1891], called "eight numerical quadrant system" (1 through 8), is meant for permanent dentition only. Initially it was not designed for primary teeth, but in 1874 it was adopted for the primary dentition [Ash and Stanley, 2005]. Zsigmondy used the "Zsigmondy cross (grid)" to record quadrants of tooth positions, where primary teeth are coded by means of Roman numerals I, II, III, IV, V (Table 1) from the midline to distally [Huszar, 1989], while Palmer changed and substituted this by upper case letters A, B, C, D, E (Table 1). This is one of the oldest and most widely used systems of dental notation, which simulates the anatomy of the oral cavity, and the presence of tooth type. It recognises quadrants in a more logical way [Peck and Peck, 1993]. It is easy to understand, record on paper and user-friendly, but the main disadvantage is that it is difficult to dictate and digital encoding of non numerical symbols, such as crosses or corners and angles, can be a problem. These technical issues in quadrant recording make the system inconvenient [Peck and Peck, 1996], as it requires a special software, a private processing editor (PCE), Microsoft

access, and a specific font (palmer type) [Ferguson, 2005]. The Hillischer system [Hillischer, 1885] of notation (Table 1) refers to the tooth type, it is more logical but very confusing because of the use of colons and semi colons to distinguish primary and permanent teeth. Moreover it requires keen observation to differentiate the right side and the left side, drawing horizontal lines above the number and below the number which represents upper teeth and lower teeth respectively. Therefore, it is more cumbersome and difficult to communicate, write and type, and requires much concentration and patience. It is confusing using the same teeth numbers 6 and 7 in primary as well as in permanent teeth in a mixed dentition stage. The change found in the Mons Dubois system [How, 1890] is the use of even numbers and odd numbers, which represent the right and left quadrant respectively (Table 1). However it also creates confusion regarding the use of horizontal lines in the lower arch and not in upper one; moreover, the use of decimals requires concentration and time to dictate, write, type.

The universal numbering system [Parreidt, 1882; Cunningham, 1883] is the official tooth designation system in the USA (Table 1), adopted by the American Dental Association since 1975 [Schwartz and Stege, 1977]. It includes a sequence of Arabic numbers (1-32) for permanent and the alphabet system (A-T) for deciduous teeth, moving clockwise around the dentition. As specific numbers are employed for each tooth, it reduces the risk of mistakes [G. Belok, 2003]. Data can also be easily entered in the computer, but there is no anatomic reference in this system and matching the specific teeth and quadrants can be confusing. So it is difficult to follow for beginners, and needs extra training to practice. It is easy to communicate [Harris, 2005; Ferguson, 2005]. The Woelfel system (Table 1) is similar to the universal numbering system. Here, instead of continuous sequencing of upper case letters to denote primary teeth, suffix upper case letter "D" alone to sequential numerals [Scheid, 2007]. There is no anatomic reference in this system, it is difficult to learn and match the specific teeth, there can be confusion of quadrants, it requires much concentration while recording the mixed dentition stage.

V IV III II I	I II III IV V
V IV III II I	I II III IV V

E D C B A	A B C D E
E D C B A	A B C D E

Zsigmondy-Palmers System.

Upper right					Upper left				
A ⌋	B ⌋	C ⌋	D ⌋	E ⌋	⌊ F	⌊ G	⌊ H	⌊ I	⌊ J
T ⌝	S ⌝	R ⌝	Q ⌝	P ⌝	⌜ O	⌜ N	⌜ M	⌜ L	⌜ K
Lower right					Lower left				

Zsigmondy (1861) - Palmers(1870).

Upper right					Upper left				
A	B	C	D	E	F	G	H	I	J
T	S	R	Q	P	O	N	M	L	K
Lower right					Lower left				

Universal System Parreidt J. (1882), Cunningham G (1883).

7:,	6:,	3:,	2:,	,1:	:1,	:2,	:3,	:4,	:5,
7:,	6:,	3:,	2:,	,1:	:1,	:2,	:3,	:4,	:5,

H.Th Hillischer (1885).

right					left					
.10	.8	.6	.4	.2	.1	.3	.5	.7	.9	upper
.10	.8	.6	.4	.2	.1	.3	.5	.7	.9	lower
right					left					

Mons. Dubois (1890).

Upper right					Upper left				
05+	04+	03+	02+	01+	+01	+02	+03	+04	+05
05-	04-	03-	02-	01-	-01	-02	-03	-04	-05
Lower right					Lower left				

Victor Haderup (1891).

Upper right					Upper left				
1D	2D	3D	4D	5D	6D	7D	8D	9D	10D
20D	19D	18D	17D	16D	15D	14D	13D	12D	11D
Lower right					Lower left				

Woelfel.

TABLE 1 Various primary (deciduous) dentition's dental notations.

5m,	4m,	3m,	2m,	1m	1m	2m,	3m,	4m,	5m,
5m,	4m,	3m,	2m,	1m	1m	2m,	3m,	4m,	5m,

Frykolhm and Lysell (1962)

Upper right					Upper left				
55	54	53	52	51	61	62	63	64	65
85	84	83	82	81	71	72	73	74	75
Lower right					Upper left				

FDI System Viohl, J. (1966).

URE(55) URD(54) URC(53) URB(52) URA(51) ULA(61) ULB(62) ULC(63) ULC(64) ULE(65)

LRE(55) LRD(54) LRC(53) LRB(52) LRA(51) LLA(61) LLB(62) LLC(63) LLC(64) LLE(65)

Palmer's and FDI together (2000).

Permanent teeth	21 12 # I 21 12	1 1 # C 1 1	21 12 # P 21 12	321 123 # M 321 123
Deciduous teeth	21 12 #d I 21 12	1 1 #d C 1 1	-	21 12 #d M 21 12

MICAP System Akram et al. (2011)

Upper right					Upper left				
1e	1d	1c	1b	1a	2a	2b	2c	2d	2e
4e	4d	4c	4b	4a	3a	3b	3c	3d	3e
Lower right					Upper left				

New Proposed system.

The Victor Haderup system [Haderup, 1891] is similar to the Zsigmondy-Palmer's notation. Here for primary dentition, zero is added (prefix) to the left side of the numerals. The upper and lower quadrants are denoted with plus (+) and minus (-) signs, respectively. The right and left quadrants are shown with a "+" or "–" sign placed on the right side for the right quadrant, and on the left side for the left quadrant (Table 1). This system is computer-friendly, and easy to understand but for recording mixed dentitions it can be very confusing, as it requires concentration, and it is difficult to dictate, therefore it cannot be used routinely. The Frykolhm and Lysell system [Frykholm and Lysell, 1962] is a variant of the Palmer notation (Table 1), where the 'suffix 'm' (lower case letter) is added to the numerals to denote milk teeth. This will not be confusing while recording the mixed dentition, but besides this advantages and disadvantages are similar to those of the Zsigmondy-Palmer's notation. The MICAP Notation [Akram et al., 2011] is a recently developed system (Table 1) which denotes the deciduous dentition, with the lower case letter 'd' always written on the left side, after the sign #, of each ANAASEA letter (dI, dC, dM.). The TOT digits (1,2,3) are mentioned on both sides of a particular ANAASEA letter with a superscript (upper corner) and subscript (lower corner) number. The right/left and upper/lower corner numbers (ToT digits) indicate quadrants, tooth type, and arches respectively. Since in the deciduous dentition there are no premolars or third molars the ANAASEA letter P and the TOT digit (3) are absent (see example below).

$$\#\,{}^{321}_{321}\mathrm{M}^{123}_{123}$$

This system is not lengthy, and known abbreviation are to be used, the mid-saggital line is difficult to enter in the computer without a special software, and its dictation is time consuming, the symbols are very difficult to write on paper, it looks more complicated to understand for a beginner. Letters do not indicate directly permanent or primary teeth, again the prefix "d" has to be added.

The Federation Dentaire Internationale (FDI) system [Viohl, 1966] is a two-digit system (Table1), the first digit indicates the quadrant (1 through 4 for permanent and 5 through 8 for deciduous teeth) and the second digit indicates the tooth type (1 through 8 or 1 through 5). It has been accepted and adopted in 1970 by the FDI and in October 1994 by the International Standard Organization (ISO) [American Dental Association current policies (A and B), 1994]. This dental notation meet all the basic requirements set by a FDI special committee [Keiser-Nielsen, 1971]. It is very simple, accurate, it is easy to memorise in the visual and cognitive sense, it is user friendly, and prevents errors in differentiating left and right, upper and lower arches, and tooth type [Peck and Peck, 1993; Harris, 2005; Peck and Peck, 1996]. However, in the case of deciduous teeth, there can be confusion and it is difficult to memorise. For specialists other than paedodontists, it can be difficult to understand or to define teeth, as in the case for example of 64, 85. The combined use of the Palmer and the FDI systems (Table 1) may be accurate and creates no confusion [Grace, 2000], but it is time consuming, needs much concentration, it is difficult to enter multiple teeth in different arches and it would be too long to use routinely [Akram, 2011].

Difficulties in all previous notations led us to develop a new notation system which will aid dentist to note the primary teeth in an easier and more precise way.

Novel "Havale's Alphanumeric dental notation" system for primary teeth

Up to the beginning of the 19th century, deciduous teeth and their treatment aspects were not taken into consideration, because usage of primary teeth for chewing is only 6% over a lifetime of 70 years [Scheid, 2007]. The primary teeth visibility in the oral cavity starts from the 7th month of age (incisors) and are completely replaced by the age of 12 (primary second molars) [Tanguay et al.,1984; Moorrees et al.,1963]. To the 20 primary teeth, that are exfoliated and replaced by "succedaneous" permanent ones [Hurme, 1949], 12 permanent molars must be added, for a total of 32 permanent teeth, with notation of quadrants 1 through 4 for permanent dentition and 5 through 8 for primary dentition [Keiser-Nielsen, 1971].

Currently great importance is given to preservation of primary teeth for a pleasant smile, in order to preserve the space for the permanent dentition, and also for general health benefits for the child. The novel dental notation for primary dentition is an alphanumeric system, where numbers indicate the quadrant, while low case letters designate the tooth type. A representation of the new primary dentition notation is shown in table 1.

Dentist in the world have been accustomed for decades to use quadrant 1 through 4, this is a common and logical way to communicate in day to day dental practice. So same quadrant coding can be used instead of 5 through 8 as in the FDI system. The letters used in this system are low case letters mimicking the sub-adult nature of the deciduous teeth. The letters "a" through "e" are easy to remember and reproduce. The system maintains a mid-sagittal plane as in the FDI system. When compared with various dental notation systems for primary dentition the new system has the advantages summarised in Table 2. This current alphanumeric dental notation is user-friendly, there is no confusion of quadrant and tooth type, it is more precise, requires less time to be understood and to convert teeth into descriptive terms and vice versa. It is likely to produce less mistakes and does not need more practice for a quick correct notation. This primary dentition language is computer-friendly, does not require any special software or special fonts to record the data. It does not require much concentration to understand and record, can be used routinely and does not need extra training. In the mixed dentition stage, this alphanumeric dental notation can be used together with the FDI notation. An example of this can be: 11, 12, 1c, 1d, 1e, 16, 21 2b, 2c, 2d, 2e, 26. This combination is easy to use,

Salient features		Various dental notation systems										
		Z-P	UNI	HTH	MD	VHU	WO	FL	FDI	FDI+-ZP	MICAP	NEW
1	This notation is present for deciduous and permanent dentition?	Yes	Yes	Yes	Yes	Yes	No (For Deciduous Only)	No (For Deciduous Only)	Yes	Yes	Yes	No (For Deciduous Only)
2	Is the anatomical midline maintained?	Yes	No	Yes	Yes	Yes	No	Yes	Yes	Yes	No	Yes
3	Can be easily readable?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
4	Can be easily understandable?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
5	Can be easily written	Yes	Yes	No	No	Yes	Yes	Yes	Yes	Yes	No	Yes
6	Can be easily typed?	No	Yes	No	No	Yes	Yes	No	Yes	Yes	No	Yes
7	Does it require extra concentration?	No	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	No
8	Can it make easy conversation vice versa (Speed of recall)?	No	Yes	No	No	No	Yes	No	Yes (For Permanent) No (For Deciduous)	Yes	No	Yes
9	Can be followed by beginners?	Yes	No	Yes	Yes	No	No	Yes	Yes	No	No	Yes
10	Does it require extra training?	No	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	No
11	Can be used routinely?	Yes	Yes	No	No	No	Yes	Yes	Yes	No	No	Yes
12	When used together with mixed dentition will it become too long and lead to confusion?	No	No	Yes	Yes	Yes	Yes	No	No	Yes (Too Long) No Confusion	Yes	No

TABLE 2 Comparison of dental notation systems in primary teeth.

and does not generate confusion regarding quadrant and permanent and primary teeth, early speed of recall, and entering data in a computer is an easy and fast process. It is also compatible with the new proposed Leo Toureno system [Toureno, 2012] for designation of supernumerary teeth. It does not lead to any confusion of supernumerary teeth in reading, writing or having conversation when adopted, in our new system of dental notation.

Conclusion

This novel alphanumeric dental notation system for primary dentition is simple to use, more convenient to record and type, and easy to understand. It reduces miscommunications, and does not need extra training for technician and insurance administrators. This system can be used routinely by paediatric dentists, as well as general dentists worldwide.

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