

The use and understanding of dental notation systems in UK and Irish dental hospitals

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In brief

Describes the history and use of dental notation systems in hospitals in the UK and Ireland.

Describes the advantages and disadvantages of these systems as perceived by those who use them.

Describes the growing use of Alphanumeric notation in written communication.

Aim To identify the types of dental notation systems used in dental hospitals, and their perceived advantages and disadvantages. In addition, to record the dental notation used in patient referral letters. **Method** A self-completed questionnaire survey asking about the use of dental notation systems was distributed to 16 dental hospitals in the UK and Ireland in the summer of 2016. In addition, dentist referrals to the Restorative Dentistry department of the University Dental Hospital of Manchester were sequentially assessed for the dental notation used. **Results** Twelve hospitals replied. In order of frequency, the notation systems in use were the Alphanumeric, the Palmer, and the Federation Dentaire Internationale system. No hospital used the Universal system. Perceived advantages and disadvantages of each of the different systems were volunteered. One hundred and twenty-four referral letters were assessed and 100 were identified where dental notation was used. The majority used Alphanumeric notation. **Conclusion** A variety of dental notation systems remain in use in dental hospitals. The move to electronic recording and communication of information regarding teeth is encouraging the use of the Alphanumeric system. General dental practitioners are predominantly using the Alphanumeric system as their notation of choice in referral letters to the Restorative Dentistry department in Manchester.

Introduction

Dentists have always been able to use full words to identify teeth for both their own records and in communication with other dentists, although using longhand wording to identify teeth is not always the most convenient way of recording and communicating. As such, dental notation systems have been developed to facilitate these functions. The oldest notation system in common use was developed by the Viennese dentist Dr Zsigmondy in 1861.¹ A few years later Dr Palmer in the USA, described a dental notation system based on the same principles.² The Palmer system (or historically more correctly the Zsigmondy/Palmer system) has since been widely used.

Multiple other systems of dental notation

have subsequently been described each with the aim of improvement. With each development of a new system however, the availability of multiple notation systems increases the risk of miscommunication unless all dentists are familiar with the system being used. This has been identified as a significant risk factor for wrong tooth extraction.³ The advent of computing and word processing has significantly stimulated development of new dental notation systems. Those that appear to be in widespread use include the Federation Dentaire International (FDI) system, the 'Universal' system, and more recently the Alphanumeric system.

The various notations used to identify the upper left first molar tooth are as follows:

Long-hand	Upper left first molar
Palmer	/6
FDI	26
Universal	14
Alphanumeric	UL6.

Little has been written about the relative advantages and disadvantages of these different systems, nor about which systems are used in hospital and primary dental care. To obtain further information, we undertook two

investigations. The first was a survey of dental hospitals in the UK and Ireland. The second was an assessment of dental referral letters.

Method

In the summer of 2016, a self-completed structured questionnaire (Appendix 1) was distributed to the clinical director (or equivalent) of 16 dental hospitals associated with undergraduate or postgraduate dental schools in the UK and Ireland asking about the use of dental notations systems in their hospital. The closed sections of the questionnaire sought specific information on the use of dental notation in both handwritten and electronic notes, specifically the use of longhand, Palmer, FDI, and Alphanumeric notation. The questionnaire also included an open section on what the hospitals perceived the advantages and disadvantages to be of the different systems offered. The questionnaire also asked about the notation used for supernumerary teeth.

In addition, consecutive written referrals from primary care dental practitioners to the Restorative Dentistry department of the University Dental Hospital of Manchester were analysed for the dental notation used by the referring practitioner, until 100 referral letters

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using dental notation had been reviewed.

The outcomes of the questionnaire survey and written referral analysis were presented to, and discussed by, attendees at the Association of Dental Hospitals Patient Safety meeting in Manchester in October 2016.

Results

The questionnaire was completed and returned by 12 dental hospitals. Four hospitals did not reply.

Six hospitals stated that they had a written policy for dental notation, and six did not. Of the six hospitals that have a written policy, three hospitals stated they had a policy of using one dental notation system, either throughout the hospital or in specific areas.

The notation used in these three hospitals with a policy of using one dental notation system were stated as:

- One hospital uses longhand and Zsigmondy-Palmer throughout the hospital
- One hospital uses Alphanumeric notation for all letters
- One hospital uses Zsigmondy-Palmer and one other notation (from longhand, FDI and Alphanumeric) for dental extractions

All 12 hospitals had some patient consultations where handwritten notes were taken. The varieties of dental notation systems used in the written case notes in the 12 hospitals are stated in Table 1.

Seven hospitals stated that they also used electronic case notes and five hospitals did not. Of the seven hospitals using electronic case notes however, one stated that they only scan written paperwork into the electronic notes, and hence the same dental notation systems are used as in written case notes. The use of dental notation systems in electronic case notes in the remaining six hospitals is stated in Table 2. Of these hospitals, three hospitals

only use Alphanumeric notation in electronic notes, one hospital only uses FDI notation in electronic case notes, and two hospitals use a mixture of notations.

The Alphanumeric and Palmer notation systems were the most popular for use in written case notes (11 hospitals each) and the Alphanumeric notation was the most popular in electronic case notes (five out of six hospitals). No hospital used the Universal system.

Hospitals volunteered their perceptions of the advantages and disadvantages of the dental notation systems (longhand, Zsigmondy-Palmer, FDI, Universal and Alphanumeric) and the replies are summated and themed in Boxes 1, 2, 3, 4 and 5.

For supernumerary teeth a variety of notations were stated as being used:

- Seven hospitals use the sign '\$'. Of these seven, two hospitals volunteered that they did not use an 'S' as it can be confused with a '5'. One hospital commented that in addition to the use of an \$, different departments in the hospital used an additional notation as well
- Three hospitals used longhand
- One hospital used Alphanumeric notation
- One hospital used 'S' and either FDI or Alphanumeric notation as well.

Various free text comments were volunteered. These included:

- The need to use upper case letters for all deciduous teeth notation (eg B not b) in relevant notation
- Different specialties seem to prefer different notation systems within the same hospital
- Alphanumeric was useful for letters (volunteered by two hospitals)
- One hospital commented that they had previously moved from the Palmer notation to FDI but were planning to move back soon.

One hundred and twenty-four consecutive written referral letters to the Restorative Dentistry department of the University Dental Hospital of Manchester were analysed for the dental notation used by the referring dental practitioner, to achieve a total of 100 letters containing notation. The letters assessed were all received from general dental practitioners, with those from specialist and hospital colleagues excluded from the study. The sample contained 54 word processed letters, with no handwriting at all, 43 referral proformas, with handwritten content and only three handwritten letters. Three letters contained two methods for identifying the tooth under consideration, with all the other letters only using a single notation method. The notations that were used are shown in Table 3.

Discussion

The Palmer notation uses a cross structure (+) to denote the four quadrants of the mouth and the position of the teeth within them. Permanent teeth are numbered 1 to 8 commencing in the midline, and deciduous teeth are lettered as A to E. The system has several advantages as identified here. It's most useful advantage is that it can produce an intuitive map-like representation of the dentition including the ability to graphically show edentulous spaces and teeth transpositions. It continues to be recognised and it has been identified as the dental notation of choice in the National Safety Standards for Invasive Procedures (NatSSIPs) documentation, published by NHS England in 2015.⁴ The reproduction of this notation in computerised records and word processing however is frequently not straightforward. Various solutions to this problem have been suggested including the use of a 'bordered table' and bespoke fonts.⁵⁻⁷

Partly in response to a growing use of

Table 1 The use of dental notation systems in written case notes in dental hospitals (n = 12)

Notation	Yes	No
Longhand	8	4
Zsigmondy-Palmer	11	1
FDI	7	5
Universal	0	12
Alphanumeric	11	1

Table 2 The use of dental notation systems in electronic case notes in dental hospitals (n = 6)

Notation	Yes	No
Longhand	3	3
Zsigmondy-Palmer	2	4
FDI	2	4
Universal	0	6
Alphanumeric	5	1

Table 3 The use of dental notation in 100 referral letters (n = 103)

Notation	Frequency
Longhand	13
Zsigmondy-Palmer	9
FDI	2
Universal	0
Alphanumeric	79

computer based electronic patient records and word processing, a committee of the Federation Dentaire Internationale at the 58th meeting of the association in Romania in 1970 decided that a global tooth notation system that would be easy to translate into computer input was necessary. The system they felt that was most suitable was a two digit system developed in Germany.⁸ In this system the first number represents a tooth quadrant and the second number represents the number of the tooth counting laterally from the midline of the face. The FDI adopted this system and its use has been promoted.^{9,10}

The Universal notation system is also known as the 'national' or 'American' system and is most commonly used in the United States of America. The numbers 1-32 are used for permanent teeth, with the maxillary right third molar being designated number 1, and the count continuing along the upper teeth to the maxillary left third molar (16), before recommencing at the mandibular left third molar (17) and counting along the bottom teeth to the mandibular right third molar (32). The system was adopted by the American Dental Association and has been popular with insurance companies due to its simplicity with respect to billing purposes.¹¹ The system has both its supporters and critics, however the risk of confusion by the use of a two digit notation in both the Universal and FDI systems are self-evident.^{12,13}

The Alphanumeric system is an adaption of the Palmer system to create a format that is more computer friendly. By 2000, the traditional Palmer form of notation was creating problems not only with word processing but also in converting to HTML, the programming language of the internet.¹⁴ The *British Dental Journal* elected to use the Alphanumeric notation with the letters being shorthand for the four quadrants of the mouth. (UR= upper right, UL= upper left, LR= lower right, LL= lower left), followed by the tooth number as assigned under the Palmer notation. This form of notation has gained widespread use as indicated by this survey of dental hospitals and its frequency of use in referral letters.

Deciduous teeth have been represented in all the dental notation systems. In Palmer and Alphanumeric they are represented by the letters A to E commencing in the midline. In the FDI notation they are represented by the first digit reading 5, 6, 7, 8 in place of 1, 2, 3, 4 as used for each quadrant in permanent teeth. In the Universal system they are

Box 1 Advantages and disadvantages of using longhand dental notation

Advantages

- Accurate
 - Especially helpful in notes where confusion possible. For example when a molar tooth is missing, or when describing the position of a supernumerary
 - When communicating with other dentists, for example when requesting a tooth extraction
- Consent forms (allows patients to understand tooth requiring treatment)

Disadvantages

- Time consuming (especially with multiple teeth)
- Legibility when hand written

Box 2 Advantages and disadvantages of using Zsigmondy-Palmer dental notation

Advantages

- Quick
- Widely recognised and understood by dentists
- Intuitive as to quadrant involved
- Allows multiple teeth to be notated quickly
- Allows for extra molar teeth (9's etc), without confusion

Disadvantages

- Electronic format unfriendly (difficult to use for example in letters)
- Legibility when handwritten (eg /_b or /_6)
- Laterality error (misinterpretation by non-dental staff, for example secretaries, which may cause right/left confusion)

Box 3 Advantages and disadvantages of using FDI dental notation

Advantages

- Quick
- Electronic format friendly

Disadvantages

- Not intuitive
- Confusion with Universal (both use numbers)
- Confusion with quadrant/tooth and risk of transcription error as both are represented by numbers (for example 13 is not the same tooth as 31)
- Confusion worsens with multiple teeth/mixed dentition

represented by the letters A to T, commencing with the upper right second deciduous molar tooth (A). Alternative notation systems for paediatric teeth have been suggested but none have become widely used or were volunteered in this survey.¹⁵

Supernumerary teeth may occur singly, unilaterally, in multiples or bilaterally and in one or both jaws. The designation of a supernumerary tooth in dental notation form has not been explicitly developed in the Palmer,

FDI, Universal or Alphanumeric systems and no consensus has been reached about how to incorporate them. Some dentists have used the letter 'S' as a shorthand for 'supernumerary'. While this is intuitive, it is recognised that an 'S' maybe mistaken for a '5', especially when handwritten and hence many hospitals have elected to add a single vertical line through the 'S' to signify a supernumerary (\$), which is also the dollar symbol readily available on the standard computer keyboard. Supernumerary teeth can

Box 4 Advantages and disadvantages of using Universal notation**Advantages**

- Quick
- Electronic format friendly

Disadvantages

- Unfamiliarity in UK (US system)
- Not intuitive
- Confusion with FDI (both use two numbers to identify teeth)
- Confusion with tooth number and risk of transcription error (for example 23 is not the same tooth as 32)

Box 5 Advantages and disadvantages of using Alphanumeric notation**Advantages**

- Fairly quick
- Easy to understand
- Self-explanatory
- Electronic format friendly
- Permits greater transcription error without loss of tooth identification (for example UR6 is the same tooth as U6R)

Disadvantages

- Requires understanding (for example 'LL' means 'lower left')
- Legibility when handwritten (for example, LL6 or LLb)

occur singly and in this situation they can be identified by adding an \$ to the adjacent tooth identifier in all notations. Complexity however can occur when multiple supernumeraries are present, and this can be further complicated by a mixture of hypodontia of normal teeth at the same time. In view of the lack of consensus regarding dental notation for supernumerary teeth, specific proposals have been made for their notation but none have been volunteered as in use in this survey.^{16,17} The complexity of supernumerary notation means that some hospitals prefer to use longhand to describe the site of the supernumerary rather than any form of notation.

Supernumerary dental notation remains a problem, particularly as these teeth are frequently listed for extraction. Other situations where potential problems with dental notation may occur, irrespective of the system used, include where teeth have been removed and the identity of the remaining adjacent teeth is unclear. These situations include where a premolar tooth or lower incisor has been removed. By the supplemental use of terms such as 'right tooth of three incisors', 'middle tooth of three incisors' and 'left tooth of three incisors', teeth can be identified with clarity.

Identifying specific teeth can be particularly difficult where dental notation is applied to remaining molar teeth in a quadrant where one molar tooth has been removed and two molar teeth remain standing. In all of these situations, the supplemental use of longhand to denote the remaining teeth can be of significant benefit. By the use of terms such as 'lone-standing molar tooth...', 'first-standing molar tooth...' and 'last-standing molar tooth...' teeth can be identified with clarity.¹⁸

For several years the FDI system has been promoted and recommended by many international healthcare organisations and has been adopted by INTERPOL (the International Police Organisation).¹⁹ A survey sent to the national dental associations of INTERPOL member countries found that of the 45 countries that replied, the FDI notation was the most popular notation system (28 countries) followed by the Palmer system (15 countries).¹⁹ The Universal system was the notation system of choice only in the USA, with both Mexico and Pakistan stating that they used both the Universal and FDI systems. However most of the replies stated that there is no standard system of dental charting in their countries and that there were big variations between

universities, private and governmental dental practices. A recent study from Saudi Arabia found that in that country the FDI system was the most frequently used dental notation system followed by the Palmer system and the Universal system.²⁰ Interestingly, the Alphanumeric system did not feature in either of these papers. This survey indicates that the use of dental notation is changing within the UK and Ireland. Clearly, no single system is dominant in dental hospitals although the Alphanumeric system is now widely used, especially where electronic case notes are used. Previous research, published in 1998, suggested that at the time, the Palmer notation was still the preferred dental notation system in use in the UK.²¹ In this study, dental school Deans in the UK were asked about which notation systems were taught in the undergraduate teaching programme and which system was used for recording clinical details in restorative dentistry. At that time, 13 out of 14 dental schools taught the Palmer notation, six out of 14 schools taught the FDI system and three schools taught the Universal system. Only one school used the FDI notation system for clinical recording, the rest using the Palmer system of notation. This paper also analysed 136 referral letters received by a consultant administering the paediatric dental anaesthetic extraction service in Manchester for the dental notation system used. It reported that 134 referral letters used the Palmer notation, including 15 letters which used FDI notation as well. Only one referral letter used FDI notation alone.

In 2003 a study reviewed the quality of the written communication between seven Scottish hospital consultants and specialist registrars in restorative dentistry with the referring general dental practitioner.²² As part of this study, the dental notation used both by the general dental practitioner in their referral letter, and in the letter of reply from the hospital consultant or specialist registrar, was noted. In the practitioners' letters of referral, the Palmer system was the most frequently used dental notation, although the FDI and Alphanumeric were also used. In the reply letters, the FDI system was most frequently used, with Palmer and Alphanumeric systems used to a lesser extent. It was noted that in many cases different notation systems were used in the reply letter compared to the referral letter.

Since then the Alphanumeric notation appears to have become the most popular dental notation system in use in referral letters. This may be because of journals, such as the

British Dental Journal, adopting its use as the notation of choice in its manuscripts, or may reflect the increasing use of electronic methods of patient referrals.¹⁴

For effective dental care, communication between dental practitioners is essential. That communication should be clear and unambiguous. The use of different forms of tooth notation between different dental practitioners allows the possibility of error in the completion of treatment plans. Miscommunication is a particular concern with respect to wrong tooth extraction which remains a significant problem in dentistry, and understanding its causes and how the risk might be reduced is important.^{18,23–25} To help mitigate this risk, the British Orthodontic Society has advised orthodontists that in written communication regarding teeth to be extracted, two forms of notation should be used to identify the teeth, one of which should be words.²⁶ This is practical advice that recognises that several different notation systems are in use, and acknowledges that practitioners tend to use the notation system in which they have been trained and feel most comfortable in using.

Conclusion

This investigation has shown that various systems of dental notation continue to be used in both dental hospitals and by general dental practitioners making referrals to restorative dentistry. The Palmer notation, FDI and Alphanumeric notation systems are likely to remain in use in the near future and a pragmatic approach is required in that all

dentists should be aware of the potential pitfalls that each system has. The Alphanumeric system has much to recommend it in written communication, and if current trends continue will become the preferred dental notation of choice. The FDI system is perceived to have few advantages over the Alphanumeric system and while it remains in popular use in many countries, its future use in the UK seems likely to decline. The Palmer system allows an intuitive visual representation of the dentition which cannot be replicated in other dental notation systems and it seems likely to continue to be used where this quality is advantageous to clarity. Whichever system is used however, insight into potential safety problems that may arise from miscommunication needs to be understood by all dentists, and the use of longhand description to aid clarity is required where confusion may occur.

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Appendix 1 Questionnaire: Dental Notation

		Yes	No
A	Does your hospital have a written policy regarding use of a dental notation system		
	If Yes, does your hospital have a policy of using only one dental notation system (If Yes, which one:)		
	If more than one dental notation system is used, which of the following systems are used in your hospital in written case notes (examples, in longhand, are for 'Upper left first permanent incisor', 'Upper right deciduous second molar tooth')		
	Longhand		
	Zsigmondy-Palmer notation (eg /_1 and E /)		
	Federation Dentaire Internationale notation – FDI (eg 21 and 55)		
	Universal notation (eg 9 and A)		
	Alphanumeric (letters and numbers) system (eg UL1 and URE)		
	Other (please state)		
B	Does your hospital use electronic case notes anywhere		
	If yes, which of the following dental notation systems are used in your hospital in electronic case notes (examples, in longhand, are for 'Upper left first permanent incisor', 'Upper right second deciduous molar')		
	Longhand		
	Zsigmondy-Palmer notation (eg /_1 and E /)		
	Federation Dentaire Internationale notation – FDI (eg 21 and 55)		
	Universal notation (eg 9 and A)		
	Alphanumeric (letters and numbers) system (eg UL1 and URE)		
	Other (please state)		
	C	What do you perceive to be the advantages and disadvantages of the systems, if any?	
Longhand			
Zsigmondy-Palmer notation			
Federation Dentaire Internationale notation – FDI			
Universal notation			
Alphanumeric (letters and numbers) system			
Other (please state)			
D	What notation do you use for supernumerary teeth?.....		
E	Any other comments		