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ORIGINAL ARTICLE

# Tooth Numbering System in Saudi Arabia: Survey



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## KEYWORDS

Tooth Numbering System;  
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Academic;  
Saudi Arabia

**Abstract Objective:** There were four aims of the current study: (1) to find the most commonly used Tooth Numbering System (TNS) in Saudi Arabia in both academic and non-academic institutions, (2) to identify the most commonly taught TNS in dental colleges, (3) to understand the reasons why dental practitioners prefer to use a specific TNS, and (4) the consequences of using more than one TNS.

**Materials and method:** Between May 2014 and May 2015, a self-administered questionnaire containing 21 questions was randomly distributed to 121 individuals (20 deans of dental colleges and 101 heads of governmental dental centers).

**Results:** The most commonly used TNS is the Fédération Dentaire Internationale (FDI) TNS for both primary and permanent dentitions in both academic and non-academic institutions, followed by the Palmer TNS and then the Universal TNS.

**Conclusion:** The FDI TNS proved to be the most taught TNS in dental colleges in Saudi Arabia. It is advised that the FDI TNS be implemented as a unified system in Saudi Arabia due to the advantages of this particular TNS and the benefits of using one single TNS.

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## 1. Introduction

All humans pass through two stages of dentitions. The primary dentition consists of 20 teeth, while the permanent dentition consists of 32 teeth. The age-related variations in tooth presence and location necessitate a numbering and encoding method for each tooth. The Tooth Numbering System (TNS) uniquely identifies each tooth by number for charting and communication purposes (Schied and Weiss, 2012). Histori-

cally, different methods of designating and encoding teeth have been used (Frykholm and Lysell, 1962; Türp and Alt, 1995; Peck and Peck, 1993; Lyons, 1947). The first known TNS was proposed by the Viennese dentist, Adolf Zsigmondy in 1861 (Zsigmondy, 1874). Zsigmondy developed a numbering sequence from 1 to 8 for permanent dentition, starting from the central incisor (1) until the third molar (8), and roman numerals I to V (later modified, A to E) for primary dentition. To specify the quadrant location, a grid symbol was placed around the number or character (Türp and Alt, 1995; Peck and Peck, 1993).

In 1870, an American dentist, Corydon Palmer (Ohio, USA), who was unaware of Zsigmondy's prior publication, described a similar numbering method (ADA, 1870; Palmer, 1891). English speaking countries therefore, refer to the numbering system as the Palmer system (Türp and Alt, 1995; Peck

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and Peck, 1993). In addition, variations were proposed. For example, Viktor Haderpup (Denmark, 1887) suggested the use of symbols “+” for maxilla and “-” for mandible teeth. The placement of the symbol indicated left (symbol before the number) or right (symbol after the number) side of the mouth (Türp and Alt, 1995; Peck and Peck, 1993).

The Universal Numbering System, proposed by German dentist Julius Parreidt in 1882 (Peck and Peck, 1993), uses consecutive integers, beginning with the upper right third molar (designated as #1), and counts clockwise around the dentition, finishing with the lower right third molar (designated as #32).

The 2-digit system, originally described by Dr. Jochen Viohl of Berlin in 1966, identifies each tooth with two digits (Peck and Peck, 1993). The first digit indicates the quadrant and the second digit refers to the tooth. At the 5th annual meeting of the Fédération Dentaire Internationale (FDI) in 1970 it was proposed that the 2-digit system be used worldwide (Keiser-Nielsen, 1971). Due to its accuracy, safety, expandability and applicability to modern technology, the FDI believed that the 2-digit system met all the requirements for the ideal TNS. The system is now called the FDI TNS (Keiser-Nielsen, 1971).

The FDI committee described the ideal TNS as a system that is simple to understand and to teach, easy to pronounce in conversation and dictation, readily communicable in print, easy to translate into computer output and is easily adapted to standard charts used in general practice (Peck and Peck, 1993). Prior numbering systems did not adequately meet these requirements. For example, the Zsigmondy/Palmer system is not easily pronounced and does not easily translate into computer input (Peck and Peck, 1993; Keiser-Nielsen, 1971; Elderton, 1989; O'Connor, 1983). The Universal system is difficult to remember and is not easily communicated worldwide (Peck and Peck, 1993; Keiser-Nielsen, 1971; Elderton, 1989; O'Connor, 1983; Thurow, 1986).

A study by Sharma and Wadhwa in 1977, that surveyed 157 fourth-year students at an American dental school, found that 74% of students preferred the FDI TNS, compared to 16% who preferred the Universal TNS (Sharma and Wadhwa, 1977). The deans of 14 dental schools in the UK were asked which TNS they used in teaching and in clinical practice. Thirteen deans responded. For teaching purposes, two reported using all three TNS, three used the FDI and Palmer, one school used the Palmer and Universal, six schools used only the Palmer, and one school used only the FDI TNS. For clinical practice, 12 deans reported using only the Palmer and one reported using the FDI TNS (Blinkhorn et al., 1998). As of 1989, the FDI TNS had been officially adopted by various institutions, including the International Standards Organization (ISO/TC 106), British Standards Institutions, World Health Organization, Interpol, and the International Association for Dental Research (Elderton, 1989). However, according to Peck and Peck in 1996, the Palmer TNS has continued to be the unofficial TNS of choice for many American dentists. These authors encouraged the use of the FDI TNS (Peck and Peck, 1996). The FDI is the TNS recommended by many researchers because of its ease of use in verbal and electronic communications and its worldwide adaptability (Türp and Alt, 1995; Peck and Peck, 1993; Keiser-Nielsen, 1971; Elderton, 1989; O'Connor, 1983; Thurow, 1986; Sharma and Wadhwa, 1977; Peck and Peck,

1996). It is the only system that makes visual sense, cognitive sense, and computer sense (Peck and Peck, 1993).

To our knowledge, there is no standard TNS used at dental colleges and hospitals in Saudi Arabia. The use of a variety of TNS can lead to confusion in teaching in school settings and misunderstandings in consultations and communications in clinical settings. To date no studies have focused on these issues. The purposes of the current study were to (1) explore the geographic distribution of different TNS used in Saudi Arabia in academic and non-academic institutions, (2) identify the most commonly taught TNS in dental colleges, (3) understand the reasons why dental practitioners prefer one TNS over another and (4) explore the effects of a lack of a commonly accepted national TNS.

## 2. Materials and methods

The current study was registered and approved by the College of Dentistry Research Center at King Saud University (KSU) (registration number FR 0046). A paper and pencil survey was distributed to the following groups:

1. All deans of dental colleges in Saudi Arabia (if the dean was not a dentist then the survey was given to the clinical director).
2. The heads of dental departments in the Ministry of Health Hospitals in Saudi Arabia.
3. The heads of dental departments in the Military, National Guard, Armed Forces Hospitals and other governmental dental service providers.
4. The higher authority officers in the Saudi Arabian field of dentistry.

A total of 123 surveys were distributed, 20 surveys to academic institution and the rest (103) to non-academic dental institutions. The survey questions were written by the author and based on prior literature and unstructured interviews with faculty members experienced in writing dental surveys at the College of Dentistry, KSU.

A primary version of the questionnaire was distributed and discussed with two deans of dental colleges and three heads of dental departments in government hospitals. The final questionnaire was completed based on comments and suggestions. The final questionnaire was pilot tested by distribution to 10 dentists to evaluate validity. Some questions were modified accordingly.

There were two final versions of the questionnaire: one for academic institutions and one for non-academic institutions. The non-academic questionnaire was comprised of 19 questions. The academic questionnaire was comprised of 21 questions (19 were the same as the non-academic questionnaire with the addition of two questions). The questions focused on five areas: (1) information about the institution, (2) the specific TNS used at the institution and the reasons for its use, (3) opinions regarding what TNS should be used; and on the academic institution surveys only: (4) the TNS used in teaching and practiced at the dental college and (5) the suggested TNS to be used for academic teaching.

Lists of targeted participants were made based on information from the Ministry of Higher Education for dental colleges in Saudi Arabia (both governmental and private). For

non-academic dental departments, lists were obtained from the Ministry of Health and Health Services Departments of the Ministry of Defense, the Ministry of Interiors and the Ministry of National Guard. The goal was to distribute the survey to as many relevant personnel as possible and to cover all regions of Saudi Arabia. The country was divided into five regions for survey distribution. The middle, east and west regions had greater sample sizes due to the high concentration of dental colleges and hospitals. All private institutions providing dental services were excluded from the study except for private dental colleges.

The questionnaires were delivered in person to the secretaries of the dean or head of each dental department. Weekly reminders to complete the questionnaire were sent to the secretaries. After completion of the survey, they were collected in person. Interns from the KSU College of Dentistry helped in the distribution and collection of the surveys. The author's colleagues also helped in this process.

The collected data were analyzed with the Statistical Package for the Social Sciences (SPSS Inc., Chicago, IL; version 16.0). Descriptive statistics were used to summarize the responses.

### 3. Results

A total of 121 questionnaires were gathered from both academic and non-academic institutions from different regions in Saudi Arabia with a response rate of 100% for academic and 98.1% for non-academic institutions. Table 1 shows the description and distribution of the involved institutions.

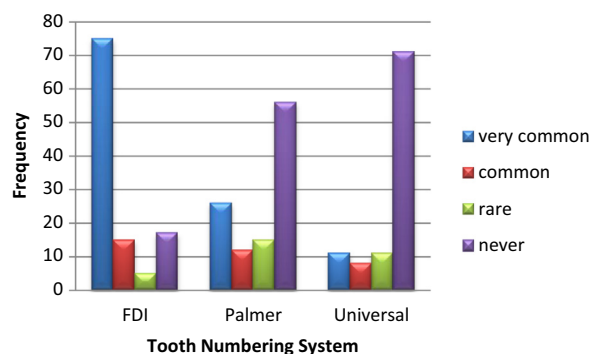
The academic and non-academic DCP who participated in this study responded to the survey questions as follows: the FDI was the most commonly used TNS for both permanent and primary dentition (Figs. 1 and 2), while the Universal TNS was the least commonly used.

Most participants reported a specific reason for choosing one TNS over the others for their institution (Fig. 3). The majority of dental care providers (DCP) (91%) agreed that the use of different TNS within one institution or even within the country leads to issues of misunderstanding.

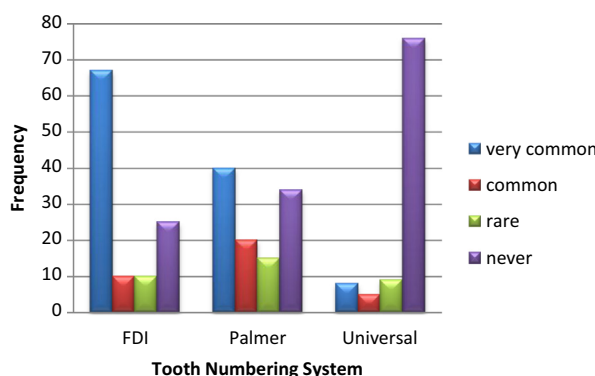
About 51% of respondents did not know whether there was a national governing regulation that specifies which TNS should be used, while 37% acknowledged that there is a specified TNS but that it is not implemented at their institution. Almost all of the DCP (95%) agreed that only one TNS should be used within an institution and 94% agreed that only one TNS should be used throughout the country (Saudi Arabia). The majority of participants (85%) reported a preference for the use of the FDI TNS throughout the country. The DCP believed that the responsibility to accredit and unify the TNS used in the country should be shared by the Ministry of Health and the Educational Institutions. Other institutions were cited as having less responsibility (Fig. 4).

**Table 1** Geographic distribution of the involved dental institutions in different regions of Saudi Arabia.

	Academic institutions	Non-academic institutions
Central	8	41
East	1	15
West	6	23
North	2	11
South	3	11
Total	20	101



**Figure 1** TNS used for permanent dentition.



**Figure 2** TNS used for primary dentition.

It is important to prepare newly graduated dentists by implementing TNS in undergraduate teaching. The majority of DCP (92%) reported that it is important to teach all three common TNS (FDI, Palmer and Universal) to students but that only one system should be used in order to avoid confusion. Ninety percent of the participants agreed that dentists should be aware of and should be capable of using different TNS. Most of the participants (70%) disagreed with the idea that dental colleges should teach and use only one TNS.

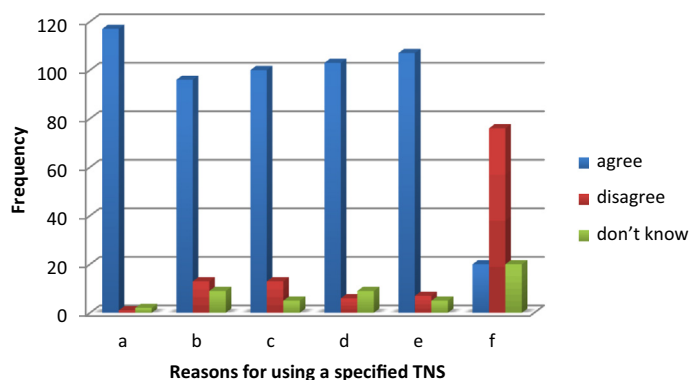
Almost 95% of the DCP agreed that the TNS used should be compatible with computer input, as most of the institutions use electronic medical/dental patient records. The majority of the participants (88%) agreed that changing the national payment system to third party insurance will make a unified TNS a necessity.

While 60% of participants agreed that following the American Dental Association (ADA) recommendation (Universal TNS) was the best choice for unification, 84% supported the idea that following the FDI two-digit system was best.

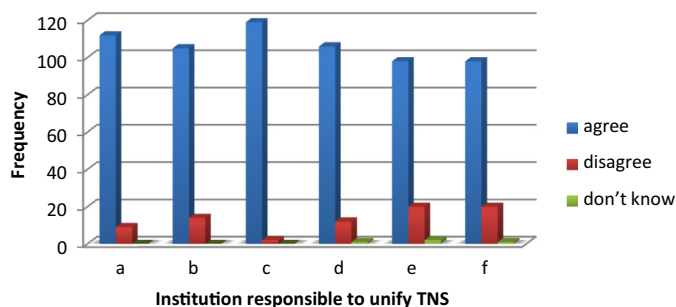
The majority of DCP (65%) knew that the TNS recommended by the World Health Organization (WHO) is the FDI, while few thought it is the Zsigmondy/Palmer (8%) or Universal (10%).

#### 3.1. Academic institutions

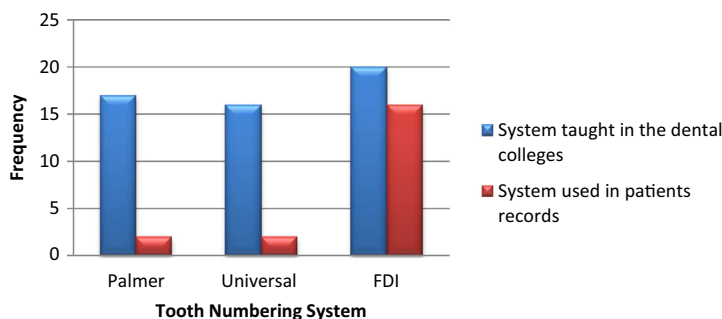
The majority of the deans at dental colleges responded that all three systems are taught to the students, but only one TNS is used for patient records. The FDI TNS (80% of the responses) is most commonly used for patient records (Fig. 5).



**Figure 3** Reasons for using a specified TNS: Ease of use in communication “a”, the commonly used system in the country “b”, easy to translate into computer input “c”, the system applied by your administrative committee “d”, the preference of the dentists working in the institution “e”, or no specific reason “f”. The chart shows the number of HCP who agree or disagree with each point.



**Figure 4** Responsible institution to unify one TNS in the country. Dental Colleges “a”, the institution’s administration “b”, the Ministry of Health “c”, the Saudi Dental Society “d”, the Saudi Council for Health Specialist “e” and the Council of Health Services “f”.



**Figure 5** TNS that are taught in the dental colleges and used for patient documentation in the academic institutions.

**4. Discussion**

A survey-based inquiry into the most commonly used TNS in both academic and non-academic dental institutions in Saudi Arabia was made. Additionally, the rationale behind using a specific TNS was investigated. For academic institutions, specific questions focused on the TNS used in teaching and in patient records.

Questionnaires from academic and non-academic institutions throughout all regions of Saudi Arabia were distributed and collected in order for our results to be representative of

the entire country. Currently, there are approximately 25 dental colleges in Saudi Arabia, 20 of which participated in the survey. Some of the colleges that were not included in the study survey were newly established and had not yet started clinical courses or patient treatment. The greatest number of surveys was gathered from the Central region which included the capital city (largest city in Saudi Arabia). Only private and governmental dental colleges and governmental dental centers were surveyed. Private dental centers were excluded from the study due to their increasing number and the variety of TNS used. The decision to exclude private dental centers

from our analysis was to insure that only professional dentists, who have direct or indirect relationships with decision-making regarding dental services in the country, were included. Private dental colleges were included because of the limited number of governmental dental colleges in the country and because they fall under the umbrella of the Ministry of Higher Education.

In both permanent and primary dentitions, the FDI TNS was cited as the most commonly used TNS in Saudi Arabia (80% for permanent and 68% for primary), followed by the Palmer TNS, and finally, the Universal system. These results are in agreement with other studies performed worldwide, especially those conducted in developing countries. The FDI TNS has been introduced in almost all developing countries and health services research in most industrial countries (Ahlberg, 1987). The FDI TNS has also been adopted by publishers and by a number of dental colleges and health insurance companies (Peck and Peck, 1996). However, as of the mid-late 1990s, the Palmer TNS was still widely used in the UK (Elderton, 1989; Blinkhorn et al., 1998), the USA (Peck and Peck, 1996) and Japan (Türp and Alt, 1995). The USA also reported using the Universal TNS (O'Connor, 1983; Peck and Peck, 1996).

The majority of participants (approximately 95%) in the current study agreed that the use of different TNS leads to problems and misunderstandings, especially for communication between clinicians at different dental clinics. A miscommunication could result in the wrong tooth being extracted (Jerrold and Romeo, 1991; Chiodi et al., 1998; Chang et al., 2004). In fact, 14% of reported malpractice cases involved wrong tooth extraction (Lee et al., 2007). It is therefore generally agreed, that one common TNS should be implemented throughout the country.

The DCP surveyed strongly supported the TNS they currently used, indicating that implementing a change in TNS would be difficult. Prior studies in the UK and USA found that there was great resistance to adopting new TNS (Peck and Peck, 1993; Blinkhorn et al., 1998; Peck and Peck, 1996). Clinicians have cited the following arguments against adopting the FDI TNS: not accepted in general practice, difficult for older staff to learn, satisfaction with current system used, confusion for multiple tooth extractions, lack of pressure to change, and no clinical advantage (Blinkhorn et al., 1998). Peck and Peck (1993) in their study recommended using the Canadians as a model for change in adopting the FDI TNS in their dental communications.

The majority of participants (86%) in the current study supported the use of the FDI TNS. This result is in agreement with a study by Keiser-Nielsen (1971) that found that most of the dentists in the USA preferred to follow the FDI TNS. Furthermore, the WHO and other leading health institutions support the use of the FDI TNS (Elderton, 1989).

Almost 99% of the participants reported that the Ministry of Health and the dental colleges should share the responsibility of unifying and standardizing the TNS in the country. These institutions are the main dental service providers and hold more authority than any other health institution for the implementation of standards and procedural changes. Peck and Peck (1993) had also recommended that academic institutions be responsible for implementing the FDI TNS throughout the USA.

Currently, most health institutions, both academic and non-academic, are moving toward electronic patient files and

records. Participants therefore, found it very important that the TNS be compatible with electronic input. Peck and Peck (1996) named the FDI TNS as a “computer-logical system” and the Universal TNS as a “computer-incompatible system”. The Palmer TNS uses symbols to signify quadrants and these symbols cannot easily be reproduced on a keyboard (O'Connor, 1983). Ferguson (2005), however, proposed a method to resolve this issue such that the Palmer TNS could more easily be used in word processing.

Insurance companies are rapidly increasing in Saudi Arabia. Most of the participants in the current study agreed that the presence of insurance companies in dental service makes it even more important to unify the TNS throughout the country as to avoid confusion and misunderstandings. Insurance companies may prefer one TNS over the others based not on scientific reasoning, but based on advantages provided to the company instead (Pogrel, 2003). A unified TNS is therefore necessary to ensure the well-being of dental patients.

The deans of dental colleges reported that they teach all three TNS to their students, but use only one TNS for patient records. The FDI TNS was reported as the most commonly used TNS in 16 out of 20 dental colleges in Saudi Arabia. These results agree with a study conducted in the USA that found that 74% of the 157 fourth-year dental students surveyed preferred the FDI TNS, while 16% preferred the Universal TNS (Sharma and Wadhwa, 1977). However, our results contradict with those found by Blinkhorn et al. (1998) who studied the dental colleges in the UK. Very few dental colleges in their study taught all three common TNS. Most of the UK schools (12 out of 14) used the Palmer TNS for patient records and only one school reported using the FDI TNS for both teaching and patient records. The majority of the participants in the current study preferred that dentists should be aware and knowledgeable of all three TNS but should use one common TNS for patient records.

We ran into some obstacles while completing this study. We personally delivered the surveys to increase response rate (the response rate was 100% for the deans and 98.1% for the governmental non-academic institutions; only two did not complete and return the survey). However, using this method increased the amount of time and effort needed for data collection. Additionally, the deans of the dental colleges were busy and it was often difficult to get them to complete the survey. Moreover, in two cases, the deans of the schools were not dentists and in such circumstances a clinical director or the vice-dean was asked to complete the survey. Lastly, recent studies on the most commonly used TNS are lacking. Our discussion of our results therefore, revolves around literature from the 1990 s.

## 5. Conclusion

The majority of DCP in Saudi Arabia agree that using more than one TNS leads to misunderstandings and confusion and as such, a unified system should be implemented. The FDI TNS is currently the most commonly used TNS in Saudi Arabia for both primary and permanent dentition in both academic and non-academic settings. The majority of participants agreed that the FDI should be used as the TNS standard.

### Conflict of interest

The author has no conflict of interest to declare.

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