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Original Research Article

Is There Any Link In Sizes And Color-Coding Systems Between Hypodermic Needles And Endodontic Files?

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Abstract

Disposable hypodermic needles are essential tools in endodontic therapy. Their basic function is injection of irrigating solutions into the root canal for the purpose of removing debris and microorganisms from the root canal during chemo-mechanical preparation. The objective of this study was to determine the similarities, in gauge/size number, length and color-coding system, between disposable hypodermic needles and endodontic files/reamers. Search engines such as google.com and google scholar were used to collect data on disposable hypodermic needles and files/reamers based on diameter, gauge/size number, length and color-coding system. The obtained data were compared between the two groups of instruments with a view to finding similarities in their sizes, color-coding systems and lengths. The two groups of instruments exhibited variations in lengths, numbering and color-coding systems. However, there were striking similarities between the outer diameters of disposable needles (gauge 28-17) and the diameters of the tips of reamers/files (size 35-40) respectively. It was concluded that disposable hypodermic needles with gauge number 28-17 and files/reamers with number 35-140 are similar in their outer diameters. The understanding of the similarities between these two groups of instruments, within the specified gauge/number ranges, will assist in appropriate selection of needles for root canal irrigation as well as in the technical design of disposable hypodermic needles for carrying plastic materials in orthograde apical third root filling technique.

Keywords: Diameter, Endodontic files, Hypodermic Needle, Root canal, Size.

INTRODUCTION

A disposable hypodermic needle is an important instrument in the armamentarium of endodontic therapy. Its basic function during endodontic treatment is the delivery of irrigating solutions into the root canal which is being treated. A needle is a hollowed stainless steel instrument with a sharp and beveled tip for penetration into a tissue to deliver or withdraw fluids [1-4]. It is usually attached to a hub which may be plastic or metallic material. The hub may also be a metal-reinforced plastic material. It can be attached to a syringe, a cylindrical barrel with a plunger, by means of the hub. One of the major considerations during root canal therapy (RCT) is the method of delivering irrigating solutions into the biomechanically prepared root canal for the purpose of removing debris and microorganisms [5, 6-8].

There are different commercial irrigant delivery systems for improving the cleanliness of root canal during chemo-mechanical preparation [5, 6-8]. However, various studies have shown different results concerning the effectiveness of these devices as compared to a syringe and a needle. The syringe and needle system is the most commonly used method of delivering irrigating solutions into the depths of the root canal [9, 10]. Investigations have shown those factors, such as volume of irrigation, the type, size, and insertion depth of the irrigation needle, which influence success rate of syringe and needle in removing debris and bacteria from root canal during irrigation [11, 12-18]. Studies have also shown that a large-sized needle placed close to the working length during syringe delivery of the irrigant increases the amount of debris extruded into the periapical region compared to a needle that is similar or smaller to the size of the final file used in the preparation of the concerned root canal [19-23]. Therefore, the need to compare the sizes of needles and files has become imperative because the authors' search for studies in this regard did not yield any result. Consequently, the objective of this study was to determine the equivalency of the gauges /sizes of disposable hypodermic needles and endodontic files/reamers for the purpose of selecting a needle of appropriate size during root canal irrigation. The tested null hypothesis is that there are similarities in the outer

diameters and color-coding of hypodermic needles and endodontic files/reamers.

MATERIALS AND METHODS

Search engines, such as google.com and google scholar, were used to gather information on endodontic reamers/files and disposable hypodermic needles concerning their gauge/size numbers, diameters, lengths and color coding systems. During the literature search, phrases such as disposable needle color-coding system, hypodermic needles, root canal irrigation systems, endodontic files and reamers, endodontic armamentarium, reamers and files color-coding system, gauges of disposable hypodermic needles and modification of disposable needles were used. The obtained pieces of information were analyzed as follows:

- The color-coding system of disposable needles was compared with color-coding system of reamers/files;
- The different sizes of reamers/files were analyzed in terms of size numbers, lengths and the diameters of their tips while the different sizes of disposable hypodermic needles were analyzed in terms of their gauge numbers, lengths and their outer diameters;
- The different sizes of disposable needles were also compared with the different sizes of reamers/files in terms of size/gauge number, length and metric diameter; and
- The link between the gauges and outer diameters of the disposable hypodermic needles and the sizes and diameters of the tips of files was also carried out.

RESULTS

The results of this study were presented in tabular form as shown in tables 1, 2, and 3; and they were summarized as follows:

- The gauge numbers of disposable needles vary between 32 and 14 (Table-1);
- The commonly used lengths of disposable hypodermic needles are 25mm, 32mm and 38mm while available lengths are 13mm, 16mm, 19mm, 25mm, 32mm and 38mm (Table-2);
- The gauge number of a needle represents the size of the wire used; and it is a pointer to the outer diameter of the needle which is measured in hundredths of a millimeter (Tables 1 & 2);
- The greater the gauge number, the smaller the diameter; and the smaller the gauge number, the greater the diameter. In other words, the gauge number is inversely proportional to the diameter of the needle (Tables 1 & 2);
- The inner diameter of the needle is dependent upon the outer diameter and the thickness of the wall. The bigger the outer diameter, the bigger the inner diameter (lumen or bore). The inner diameter is the difference between the outer diameter and the thickness of the wall. There is no consistency in the thickness because thickness is categorized as standard, thin and extra-thin;
- The size number of each file/reamer represents the diameter of the tip of the file/reamer. The diameter of the tip of each file increases as the size number of the file increases;
- The color-coding system of disposable needles is different from the color-coding system of files/reamers (Table-2).
- The color-coding system of endodontic files is different from the color-coding system of disposable needles as previously mentioned. This is shown in Table-2;
- A comparison of the gauges and external diameters of the disposable needles with the sizes and diameters of the tips of endodontic files produced some perfect similarities with respect to the diameters of the tips of files and outer diameters of the disposable needles (Table-2). For example a disposable needle of gauge 21 has an outer diameter of 0.80mm while a file of size 80 has a diameter of 0.80mm at its tip;
- Disposable hypodermic needles are identified by their gauge numbers and colors while files/reamers are also identified by their size numbers and colors (Table-2);
- Disposable needles are made of tubular wires while reamers/files are made of solid wires;
- Disposable hypodermic needles are cylindrical in shape and consist of three different parts namely: hub, shaft and beveled tip (cutting or piercing tip) (Figure-1) while reamers/files are tapered or conically shaped and consist of three parts namely: handle, shaft and tip (Figure-4). The distance from the tip of a reamer/file to 16mm up the shaft is known as the cutting blade; and
- The length of a disposable hypodermic needle refers to the sum of the lengths of hub and shaft while the length of a reamer or file refers to the length of the shaft, excluding the handle.

Table-1: Showing the metric dimensions of disposable hypodermic needles

Gauge	Outer diameter (mm)	Inner diameter (mm)
14	2.10	1.60
15	1.80	1.47
16	1.60	1.29
17	1.40	1.16
18	1.20	0.92

19	1.10	0.76
20	0.90	0.64
21	0.80	0.55
22	0.70	0.45
23	0.60	0.37
24	0.55	0.34
25	0.50	0.29
26	0.45	0.29
27	0.40	0.24
28	0.35	0.19
29	0.33	0.19
30	0.30	0.16
31	0.25	0.12
32	0.23	0.10

Table-2: Comparison between disposable hypodermic needles and files/reamers based on gauge/size number, diameter, length and color-coding

Disposable Needles				Files/Reamers				
Gauge	*O D/(** I O) ***(mm)	Color	Available length ***(mm)	Size	Tip Diameter ***(mm)	Color	Available Length ***(mm)	
32	0.23 (0.10)	Deep Green	13, 16, 25	15	0.15	White	21, 25, 28, 30	
31	0.25 (0.12)	White	13, 16, 25	20	0.20	Yellow	21, 25, 28, 30	
30	0.30 (0.16)	Yellow	13, 16, 25	25	0.25	Red	21, 25, 28, 30	
29	0.33 (0.19)	Red	13, 16, 25	30	0.30	Blue	21, 25, 28, 30	
28	0.35 (0.19)	Blue Green	13, 16, 25	35	0.35	Green	21, 25, 28, 30	
27	0.40 (0.24)	Grey	13, 16, 25	40	0.40	Black	21, 25, 28, 30	
26	0.45 (0.29)	Brown	13, 16, 25	45	0.45	White	21, 25, 28, 30	
25	0.50 (0.29)	Orange	13, 16, 25	50	0.50	Yellow	21, 25, 28, 30	
24	0.55 (0.34)	Purple	25, 32, 38	55	0.55	Red	21, 25, 28, 30	
23	0.60 (0.37)	Dark-blue	25, 32, 38	60	0.60	Blue	21, 25, 28, 30	
22	0.70 (0.45)	Black	25, 32, 38	70	0.70	Green	21, 25, 28, 30	
21	0.80 (0.55)	Deep Green	25, 32, 38	80	0.80	Black	21, 25, 28, 30,	
20	0.90 (0.64)	Yellow	32, 38	90	0.90	White	21, 25, 28, 30,	
19	1.00/1.10 (0.76)	Cream	32, 38	110	1.10	Red	21, 25, 28, 30,	
18	1.20/1.30 (0.92)	Pink	32, 38	120	1.20	Blue	21, 25, 28, 30,	
17	1.40/1.50 (1.16)	White	38	140	1.40	Black	21, 25, 28, 30,	

*O D = Outer Diameter, (** I O) = Inner, *** (mm) = millimeter

Table-3: Showing the specifications of the proposed blunt-tipped "disposable endodontic needles"

Proposed gauge of endodontic needle	Inner Diameter (mm)	Outer Diameter (mm)	Length of Needle (mm)
35	0.19	0.35	25, 30, 33, 38
40	0.24	0.40	25, 30, 33, 38
45	0.29	0.45	25, 30, 33, 38
50	0.32	0.50	25, 30, 33, 38
55	0.34	0.55	25, 30, 33, 38
60	0.37	0.60	25, 30, 33, 38
70	0.45	0.70	25, 30, 33, 38
80	0.58	0.80	25, 30, 33, 38
90	0.67	0.90	25, 30, 33, 38
100/110	0.83	1.00/1.10	25, 30, 33, 38
120/130	0.92	1.20/1.30	25, 30, 33, 38
140/150	1.16	1.40/1.50	25, 30, 33, 38

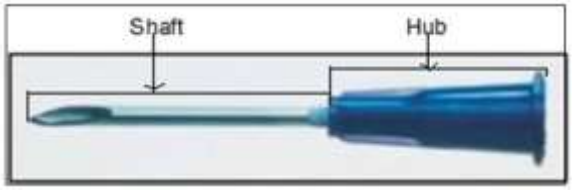

Fig-1: Shows a sharp-tipped disposable hypodermic needle

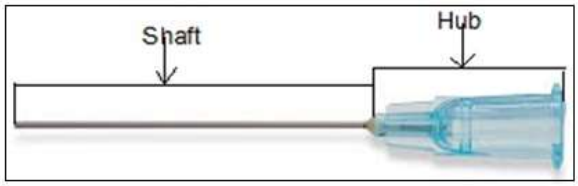

Fig-2: Shows a blunt-tipped disposable hypodermic needle

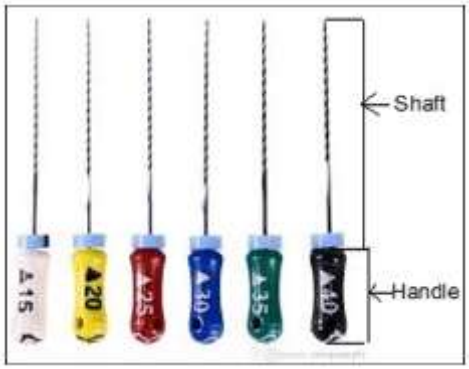

Fig-3: Shows endodontic reamers

Fig-4: Shows endodontic files

DISCUSSION

Creativity is about seeing a new thing in an old thing. This involves a thorough analysis of the old thing, for its proper understanding, so as to modify it to produce a new thing. Disposable hypodermic needles and endodontic files/reamers differ in their usage and fabrication. However, their operational method involves insertion into a tissue to deliver or remove a given material.

This study showed that the numbering system of disposable needles was quite different from the numbering system of files (Table-2) [24-30]. The gauge number of a disposable needle was inversely proportional to its outside diameter while reamers/files showed direct proportionality between the sizes and the diameters of the tips of files/reamers (Table-2) [24-30]. The difference in the numbering system between disposable needles and files/reamers might be related to the method of manufacture, usage and nature of material used in the manufacturing of the two different groups of instruments [10].

In spite of the observed difference in numbering system between disposable hypodermic needles and files/reamers, striking similarities, were noticed in the metric designation of the diameters of disposable needles and reamers/files such that a disposable needle of gauge 26 with a designated metric unit of 0.45mm was the same as a file of size 45 with a metric unit of 0.45mm. These striking similarities were found between disposable hypodermic needles and files/reamers within the gauge range of 28-17 and within the size range of 35-140 respectively (Table-2) [24-30]. The technical significance of these observed similarities was that disposable needles, within this identified gauge range, could be manufactured as "disposable endodontic needles" for delivering irrigating solution into a prepared root canal; and these proposed "disposable endodontic needles" should constitute a part of endodontic armamentarium. However, the color-coding system of the conventional disposable needles is completely different from the color-coding system of files/reamers as observed in this study [31]. Consequently, the proposed "disposable endodontic needles" should match the color-coding system of files/reamers for easy selection.

This study also showed that disposable needles were available in length of 13mm, 16mm, 19mm, 25mm, 32mm and 38mm while reamers and files were available in length of 21mm, 25mm, 28mm and 30mm (Table-2) [24-30]. It is worthy of note that the length of a disposable needle is the sum of the lengths of the hub and the shaft including the tip (Figures 1 and 2). However, the lengths of reamers or files refer mainly to the shafts of the concerned files/reamers but excluding their handles (Figures 3 and 4). Therefore, if the length of the handle of a file/reamer is added to its shaft, the total length will approximate that of a needle in the upper range of 25mm, 32mm and 38mm lengths. Consequently, lengths of 25mm, 32mm and 38mm should be considered for the proposed "blunt-tipped disposable endodontic needles" because the available lengths of files or reamers lie within the range of available lengths of commonly used disposable needles.

For the purpose of optimization of their intended use, it is proposed that "disposable endodontic needles" be designed and fabricated based on the following specifications:

- The tips of the needles should be blunt;
- The external diameters of the needles should be similar to the diameters of the tips of standard reamers/files in the range of 35–140 sizes (Table-3);
- The internal diameter should be the same as the corresponding disposable hypodermic needle (Table-2);
- The wall of the needle should be thin to allow for adequate capacity of the lumen (bore) of the needle;
- The hub of the needle should be made of plastic; and

- The available lengths of the needles should be 25mm, 30mm, 32mm and 38 including the hub. The use of these "disposable endodontic needles" involves appropriate selection of a needle based on the size of the file/reamer used at any given time in the biomechanical preparation of the canal; and the predetermined working length is measured and marked with a rubber stopper on the selected "disposable endodontic needle". With the rubber stopper in place, the depth of the needle in the root canal can be varied and controlled.

Clinical Significance

This study provides important information on the similarities between the external diameters of conventional disposable hypodermic needles and the diameters of the tips of files/reamers within a specific gauge/size range. Thus, the selection of appropriate disposable needle size for delivering irrigating solutions into a prepared root canal, based on the size of file, is made easy. It should also be noted that the proposed "disposable endodontic needles" are innovative additions to endodontic armamentarium; and they will provide an alternative method of carrying irrigating solutions into a prepared root canal.

CONCLUSION AND RECOMMENDATION

The equivalency of the diameters/sizes of conventional disposable needles and endodontic files/reamers in gauge/size ranges of 28-17 and 35-140 respectively was established in this study. However, the color-coding systems of the two groups of instruments are different. The understanding of the equivalency of the sizes of these two different groups of instruments will enable easy selection of appropriate irrigating needle. Therefore, it is recommended that "disposable endodontic needles" which are equivalent, in external diameters, to the diameters of the tips of files/reamers in the size range of 35-140 should be manufactured based on the aforementioned specifications as a part of endodontic armamentarium for easy selection of appropriate needle for delivering irrigating solutions into prepared root canal. The color-coding of the "proposed disposable endodontic needles" should also be based on the color-coding system of files/reamers.

Declaration of Conflict of Interest

The author declares no conflict of interest in any instruments mentioned in this study; and that this study was self-sponsored.

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