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## Endodontic Instruments

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**BRIEF HISTORY**

The manufacture of the first instruments for endodontic use dates to 1875. These early instruments, which were made by hand from thin steel wires, performed more or less the function of modern barbed broaches.

In accordance with the lack of sophistication of the time, more importance was given to obturation of the canal space than to cleaning of the root canal system.<sup>2</sup>

With the advent of dental radiology, local anesthesia, and advances in bacteriology at the turn of the last century, a new era opened in endodontic therapy.

In 1932, G. V. Skillen<sup>43</sup> stated that it was necessary to curette the canal walls to remove the pulp debris. He believed that all residual tissue became degenerative and would lead to failure of canal therapy.

Skillen and his contemporaries were occupied in establishing standards for the methods of root canal cleaning, which at the time were not standardized.

Grove<sup>23</sup> designed "standardized instruments and gold cones". His intent was to prepare the radicular canal space according to precise norms of shape, size, and conicity.

Jasper<sup>27</sup> developed silver cones corresponding to the sizes of the files that were in use at that time.

In 1955, Ingle<sup>24</sup> was the first to express finally the need for standardization of canal instruments, which he advocated again in 1958 at the Second International Conference of Endodontics<sup>26</sup> in Philadelphia.

In 1961, Ingle<sup>25</sup> established a basic, standardized shape for endodontic instruments and a standardized endodontic technique using newly-designed obturation instruments and materials. He substituted stainless steel for carbon steel and introduced color-coded instruments that were smaller (06 and 08)

and larger (110-150) than those in use at the time.

In 1965, the American Association of Endodontists adopted the terminology and nomenclature of the proposed standardized system,<sup>1</sup> and in June 1976 the Council on Dental Materials and Devices<sup>12</sup> of the American Dental Association approved the specification # 28, which established the classification norms, requisite physical properties, and procedures for investigation, sampling tests, and preparation for the distribution of root canal files and reamers.<sup>19</sup>

The system of standardization and agreements among the various manufacturers to observe them is therefore a fairly recent development.

**STANDARDIZATION OF ENDODONTIC INSTRUMENTS**

Before the standardization proposed by Ingle and the agreements among the various manufacturers, each company produced its own instruments without adhering to any pre-established criteria. The numbering of instruments from 1 to 6 was purely arbitrary, there was no uniformity governing the progression from one size to the next, and the instruments of one manufacturer rarely matched similar instruments of another maker (Tab. I).

The standardized norms provided a numbering system that indicated to hundredths of a millimeter the diameter of the tip of the instrument at the first rake angle. This diameter is termed " $D_1$ ". The diameter at the end of the cutting edge is termed " $D_{16}$ ". In all instruments, the difference of the diameters  $D_1$  and  $D_{16}$  is always a constant 0.32 mm. This confers a consistent taper to instruments of whatever size (taper .02: the increment in diameter is 0.02 mm x each millimeter of length).

Table I

**Approximate correspondence between conventional and standardized instruments**

Conventional instruments	Standardized instruments
0	10
1	15
2	20
3	25
4	{ 30 35
5	{ 40 45
6	{ 50 55
7	60
8	70
9	80
10	90
11	100

The correspondence of the data presented in this table are approximate, as at the time there was no A.D.A. specification dictating the morphological characteristics of the instruments; thus, files and reamers differed slightly, depending on the manufacturer (from Ingle J.I.: Transactions of the Second International Conference on Endodontics, Philadelphia, University of Pennsylvania, 1958).

The  $D_1/D_{16}$  distance is also constant (16 mm), so that the working portion of the instruments is always the same, despite the variability of the lengths of the available instruments: short (21 mm) for the molars of patients with small mouths, standard (25 mm), and long (31 mm) for the canines and any particularly long roots.

What accounts for the differences in the three lengths is the distance between the most coronal cutting flute and the handle, which represents the shaft, or non-working portion of the instrument.

In this author's opinion, it would be logical that 31 mm instruments have a proportionally longer working portion instead of a longer shaft, since they serve to cleanse a longer root canal or a longer intra canal surface.

The colors have also been standardized. They are repeated every six instruments, with the exception of the first three of the series. In accordance with this standardization, therefore, the increase in  $D_1$  from one instrument to another is 0.02, 0.05, or 0.1 mm. From # 06 to # 10, each instrument increases by 0.02 mm; from # 10 to # 60, by 0.05 mm; and from # 60 to # 140, by 0.1 mm (Fig. 13.1).

The obturating materials were also standardized, so that the manufacturers produce gutta-percha cones and paper points whose size and taper correspond to those of the instruments.

At the 1989 Congress of the American Association of Endodontists, Schilder<sup>38</sup> proposed a new criterion

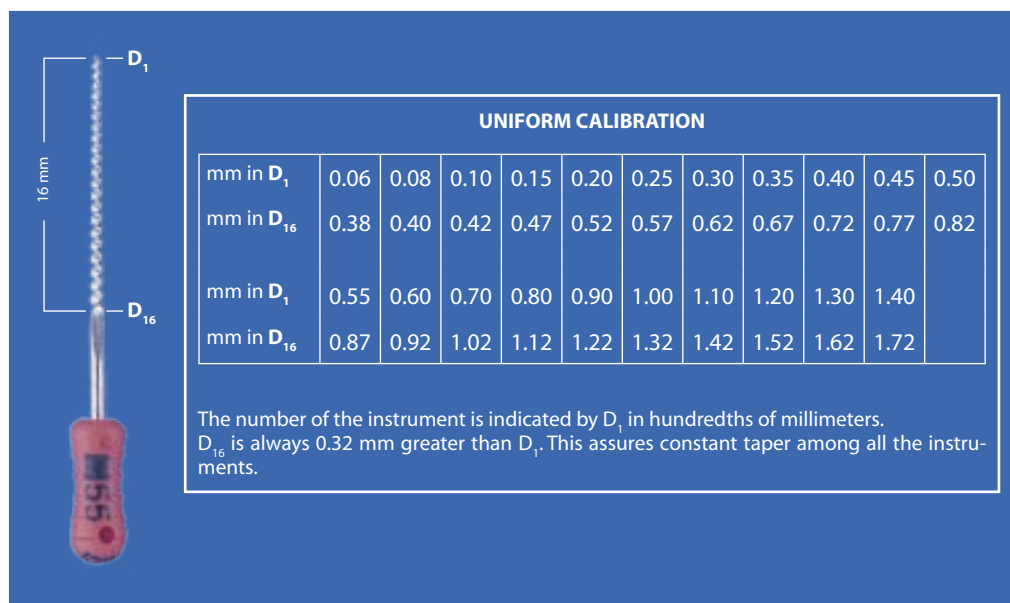


Fig. 13.1. Instrumental diameters according to the standardized norms.