



Stéphane Simon

Endodontic Shaping with an Adapted Pitch

Abstract: Cleaning and shaping a root canal are two inseparable concepts of endodontics. Shaping facilitates the penetration of disinfecting solutions into the deepest regions of the root canal system, including those that cannot be reached by instruments. The Hero Shaper® is a leading system in the European market, and the concept of the 'adapted Pitch' is of particular interest. Modifying the pitch of this instrument has made it possible to limit the screwing effect of the file in the canal considerably and to improve flexibility. In this paper, the guidelines for use of these instruments are described. Manufacturer's recommendations are presented and modified by the use of Hero Apical® to achieve the fundamental principles of endodontics published by Herbert Schilder more than 30 years ago.

Clinical Relevance: The Hero Shaper® system and the concept of 'adapted Pitch' may enhance the shaping of root canals prior to root filling.

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The purpose of endodontic treatment is to prevent or eliminate infection of the root canal system by removing bacteria and their toxins. It is accepted that complete sterilization of the root canal system is impossible, and one of the aims of filling is to entomb the remaining bacteria/toxins with the filling material.¹ Nevertheless, cleaning and disinfecting the canal system facilitates the eradication of as many micro-organisms and their toxins as possible, so as to place the tooth in a favourable biological context necessary for peri-radicular bone healing.

Instrumentation of the root canal is an important stage of endodontic treatment which shapes the main canal in order to clean it with disinfecting solutions and to fill it three-dimensionally.

Cleaning and shaping are two inseparable concepts. It must be kept in mind that disinfection is achieved by the disinfecting solution and not by instrumentation itself; shaping facilitates the penetration of disinfecting solutions into the deepest parts of the root canal system, even those that cannot be reached by instruments. According to a

study by Peters,² around 45% of the root canal surface is not touched by the mechanical action of instruments.

In modern shaping techniques, manual files are used to explore the canal and Rotary Nickel Titanium files are used for the shaping itself once a glide path is established.

The canal anatomy is complex and having recourse to manual instrumentation is necessary to negotiate any difficulties, to shape straightforward canal shapes or to 'secure the canal' creating a glide path, thereby safeguarding against potential rotary instrument fracture.

Many Nickel Titanium systems are available; these instruments must only be considered as a tool and not as the sole factor responsible for success or failure. In addition to the instrument itself, it is the way it is used by practitioners that will influence the result of the endodontic treatment in the short and longer term.

The Hero Shaper® is a leading system in the European market, and the concept of the 'adapted Pitch' is of particular interest. The Hero Shaper® is a result of development of the HERO 642®, a continuous tapered instrument in which the taper was 2, 4 or 6% and the tip diameter was 0.20, 0.25 or 0.30 mm.³ Modifying the pitch of this instrument has made it possible to limit the screwing effect of the file in the canal considerably and to improve flexibility. This last

factor now makes it possible to shape the apical one-third of the canal with a minimal taper of 4%, which was not possible with the Hero 642®.

It is now agreed that the increase in taper of the very last few apical millimetres is a key factor in optimizing disinfection of the root canal system.⁴

Whichever system is used, the aims of endodontic treatment remain the same and the prepared canal must:

- Have a narrow foramen, with no over-enlargement;
- Have a regular taper from the foramen to the coronal canal entrance;
- Respect the original anatomical form.

The concept of the 'adapted Pitch'

The whole system is composed of nine instruments (Figure 1):

- The Endoflare® (A), used to re-locate the canal entrance;
- Three instruments with 4% taper and with a diameter of 20, 25 or 30/100 (respectively, B, C and D) with a grey rubber stop;
- Three instruments with 6% taper and with a diameter of 20, 25, or 30/100 (respectively, E, F and G) with a black rubber stop;
- Two Hero Apicals® with a diameter of 30/100 and with 6% (H – black stop) or 8% taper (I – red rubber stop).

One of the original features of this system is the use of a special handpiece

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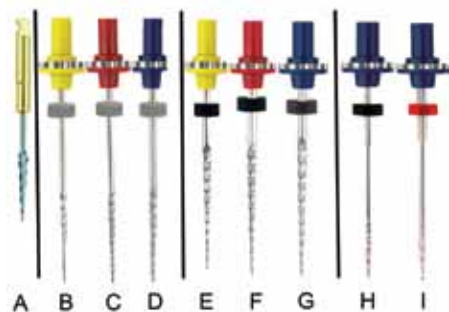


Figure 1. The 9 instruments of the Hero Shaper® system.



Figure 2. The CA Inget.

adapted for endodontic treatment called the CA INGET® (Figure 2). The small size of the head of this instrument frees the surgical field and visibility is optimized. The handles of these instruments are solely for use with this handpiece, but they are also available with conventional handles and can therefore be used with a conventional endodontic handpiece.

The pitch and length of the active parts of the file flutes vary according to the active length of the instruments (Table 1). By adapting these values, it is possible to adjust the ratio of resistance, efficiency and flexibility of the file and to select the ratio best suited to each instrument according to its length and taper.⁵

The 'adapted Pitch' concept is based

on the following premises:

- The more tapered the file, the longer the pitch and the greater the flexibility;
- The smaller the cutting angle, the greater the cutting efficiency;
- Evacuation of debris (ie dentinal chips) is facilitated by the longer pitch because evacuation is direct.

The HERO Shaper® was designed with a triple helix cross-section with three cutting angles and a large inner core. As the taper becomes greater, the central mass of the instrument increases and the instrument becomes less flexible; lengthening the pitch makes it possible to compensate for the flexibility linked to the increase in instrument diameter.

The instrumentation sequence

As with all systems, the manufacturers describe their own recommendations for use. With regard to the Hero Shaper®, Micro Mega proposes three sequences according to canal difficulty, classified as simple, average or difficult. Though this classification is helpful for ergonomic purposes, it is subjective because difficulty is evaluated according to the narrowness of the canal and its apical curvature. The immediate information at the practitioner's disposal may be insufficient to appreciate the true difficulty of the canal.

In the three sequences, it is recommended to shape the apical one-third with an instrument of #30 and 4% taper. Though advocating these values is helpful for shaping purposes, it is also an empirical solution, as nothing can justify systematically preparing a foramen to 0.30 mm. Moreover, an apical taper of 4% is insufficient to ensure optimal disinfection in the last few millimetres.

It is therefore proposed to describe the manufacturer's protocol step-by-step and to complete the preparation with Hero Apical files, to obtain a taper of 6 or even

8% in the last 4 millimetres. Increasing the taper makes it possible to obtain a shape satisfying the aims previously set. The Hero Shaper® can be considered a suitable shaping instrument thanks to its simplicity of use and reproducibility of results.

Straight line access

The last step of the access cavity consists of re-locating the canal entrance and removing the dentine triangles which constrain file use, limiting the instrument's progression into the canal (Figure 3a). Traditionally, this re-location has been done with Gates Gliddens drills, but it can also be done with the EndoFlare® (Figure 3b). The tip of the instrument is placed in the canal entrance and the dentine triangle is removed whilst brushing the appropriate wall (Figure 3c).

The rigidity of this instrument necessitates some precautions in its use, especially not pushing the file down into the canal. Misuse can lead to the formation of a ledge, or even stripping.

The 'simple' canal shaping without any particular anatomical difficulties involves a three-instrument sequence.

The 'average' canal shaping, ie a thin one, but without any exaggerated canal curvature, involves the use of four instruments.

'Difficult' canal shaping, ie a narrow one with a marked apical curvature, involves the use of six instruments.

The use of hand instruments remains necessary, especially for the initial exploration.

The blue sequence for the 'simple' canal (Figure 4)

The canal is explored with 10 and 15/100 hand instruments, using a watch-winding motion (Figure 5). The working length can generally be determined at this stage.

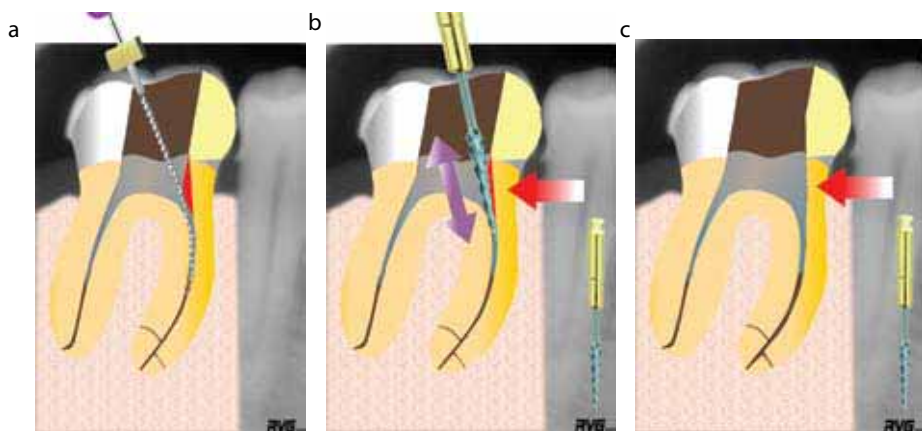
The Hero Shaper 30/06% is used with a vertical pumping motion, up to the equivalent length of 2/3 of the previously determined working length (Figure 6).

The apical part of the canal will be shaped with a Hero Shaper® 30/04%, by pushing/pulling it down progressively to the working length (Figure 7).

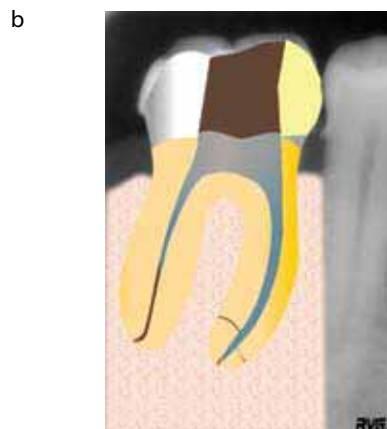
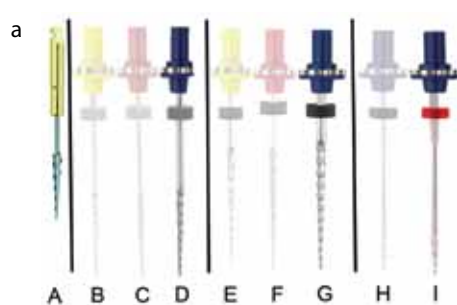
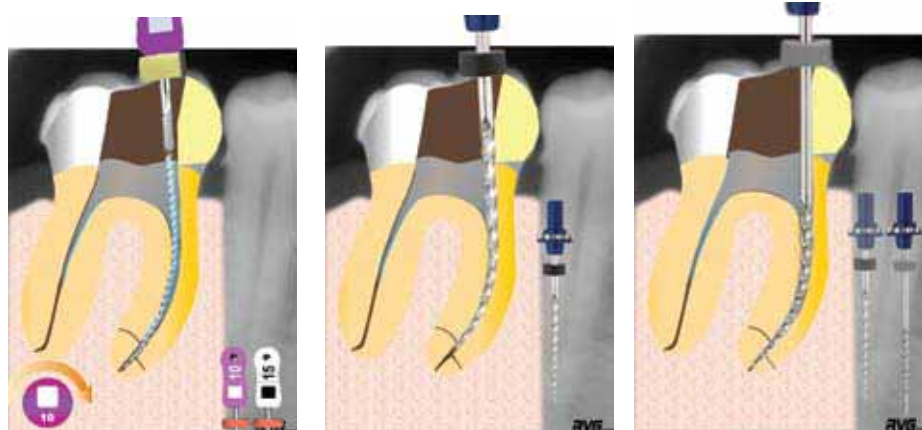
The sequential use of these instruments makes it possible to work in a strictly crown-down way. Each instrument shapes a particular section of the canal and facilitates the use of the next one (Figure

Characteristics of the HERO Shaper®		Pitch length		
Taper	Size	D0	D10	D16
0.04	#20 and #25	0.57	0.83	0.99
0.04	#30	0.70	1.01	1.20
0.06	#20, #25 and #30	0.87	1.26	1.50

Table 1. Pitch length in relation to the diameter and the size of the tip of the instrument. The pitch increases from the tip to the handle.



Figures 3. (a-c) The Endo-Flare® is used to get a straight line access to the canal.



Figures 4. (a, b) Sequence of instruments used for a 'simple canal'.

Figure 5. Determination of the working length with #10 and #15 K File.

Figure 6. The Hero Shaper 30/06% is used up to the equivalent of 2/3 of working length.

Figure 7. The apical part of the canal is shaped with a Hero Shaper® 30/04%.

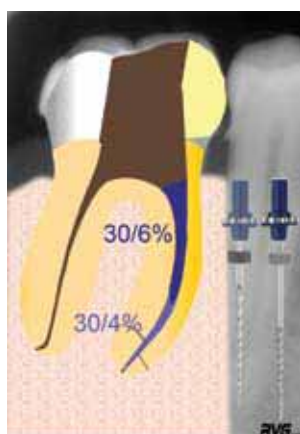


Figure 8. The 'simple' canal is shaped with 2 instruments only.

Once the canal has been shaped, it can be disinfected (Figure 8) before being filled.

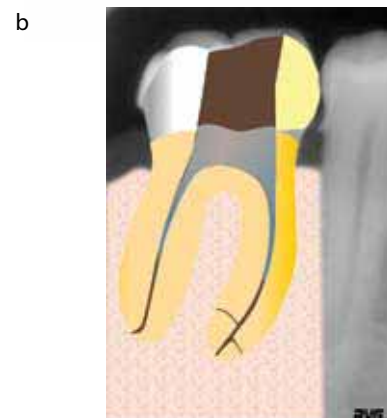
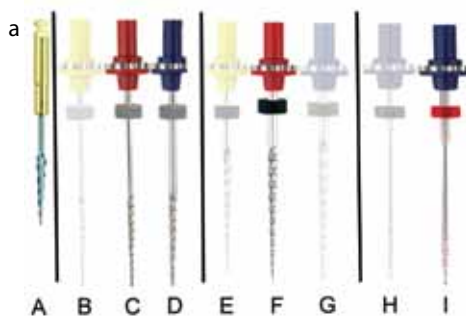
The red sequence for the canal of 'moderate' difficulty (Figure 9)

The canal will be explored with 10 and 15/100 hand instruments, using a watch-winding motion (Figure 10) into the accessible part. Instruments must not be pushed into the canal, and the working length is not necessarily determined at this stage.

The Hero Shaper 25/06% (Figure 11) is used with the same motion as previously up to 2/3 of the estimated working length.

With the coronal restrictive dentine having been removed, the hand instruments will progress further into the canal, and the working length can be determined with a #15 file (Figure 12).

The canal will then be shaped up to the working length with the Hero Shaper



Figures 9. (a, b) Sequence of instruments to be used for shaping a canal with 'moderate' difficulty.

7), thus limiting the constraints and risks of screwing in, which is the main problem encountered with cutting instruments of a constant taper.

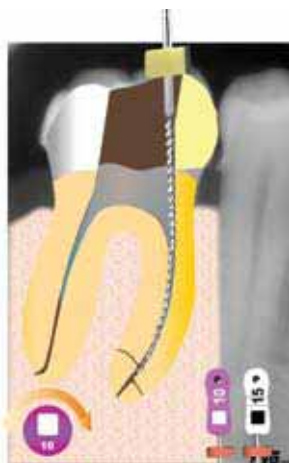


Figure 10. Exploration of the canal with #10 and #15 file.

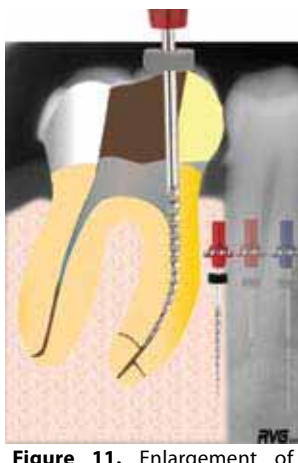


Figure 11. Enlargement of the coronal two-third with the 25/6%.

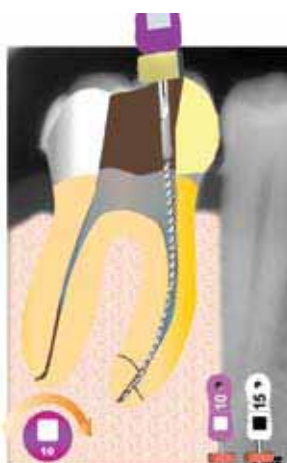
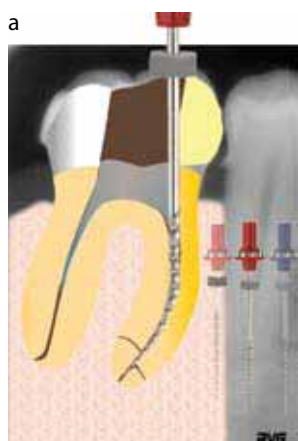
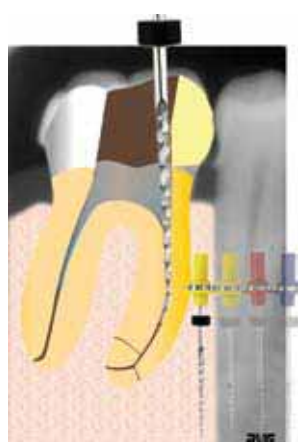
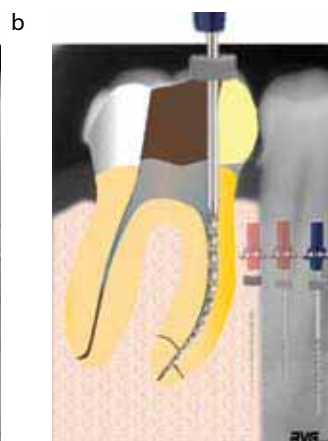


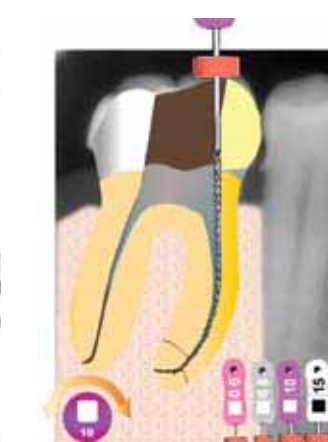
Figure 12. Determination of the true working length.



Figures 13. (a, b) Shaping of the apical one third with 25/4% and 30/4% to the working length.



Figures 16. (a, b) Coronal one third preparation with Hero Shaper 20/6% until the working length could be reached with hand files.



25/04% (Figure 13a), and then with the Hero Shaper 30/40% (Figure 13b).

The canal having thus been

shaped, it can be disinfected with a sodium hypochlorite solution.

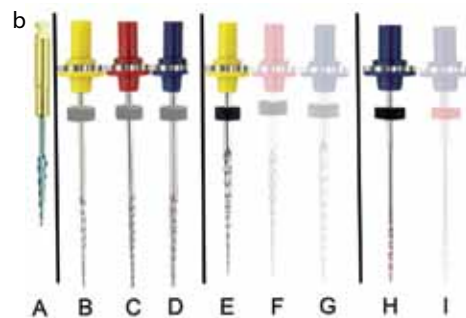
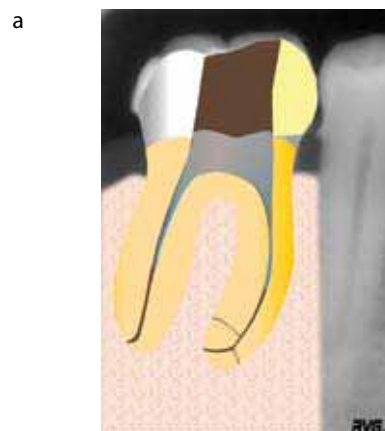
The yellow sequence for the 'difficult' canal (Figure 14a, b)

The canal is explored with #06, #08, #10 and #15 hand instruments using a watch-winding motion, without necessarily seeking to reach the estimated working length (Figure 15).

The Hero Shaper 20/06% (Figure 16a) is used up to the coronal 2/3 of the canal. Exploration with hand instruments is then continued. The same procedure will be repeated until the working length can be determined (Figure 16b). Apical pre-curvature of the instruments may be required and must imitate the canal anatomy, which may be visible in the radiography (bearing in mind that this information remains imperfect as it is two dimensional).

The canal may now be shaped to the

working length, using the Hero Shaper 20/04% (Figure 17a), 25/04% (Figure 17b) and 30/04% (Figure 17c) in succession. Between the use of



Figures 14. (a, b) Sequence of instruments to be used for a 'difficult' canal.

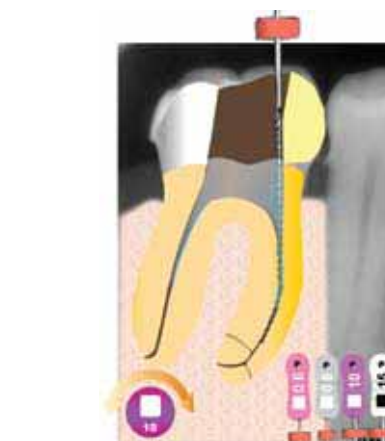
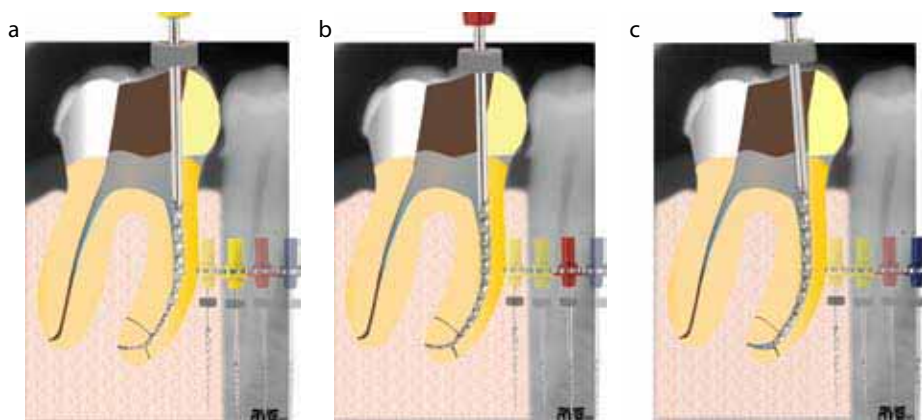


Figure 15. Initial exploration of the canal with #06, #08, #10 and #15 K files.

each instrument, the canal is rinsed thoroughly with sodium hypochlorite solution, and the patency of the canal is checked with a small hand file.

The use of instruments in the crown-down procedure makes it possible to shape each part of the canal successively (Figure 18).

The whole sequence involves apical shaping at 4% taper and 30/100 diameter. It



Figures 17. (a-c) Canal is then shaped to the working length with 20/4%, 25/4% and 30/4%.

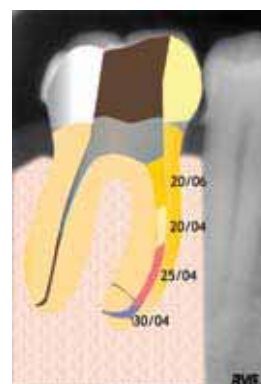
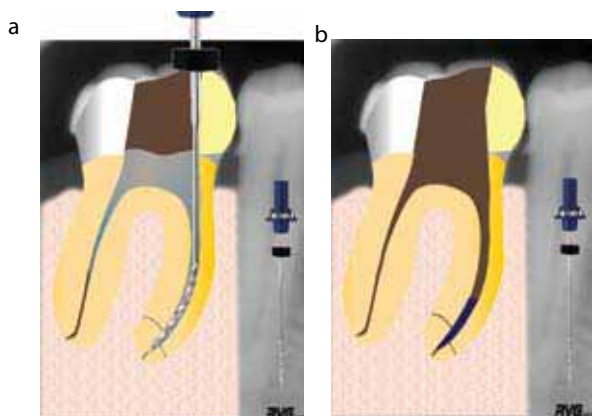


Figure 18. By using the instruments in a crown down manner, each part of the canal is shaped with a specific instrument in sequence.



Figures 19. (a, b) Shaping the apical one third with the Hero Apical allows the taper of the apical third of the canal to be increased to 6 or 8%.

canals (Figure 19a, b). These instruments also exist in a hand version.

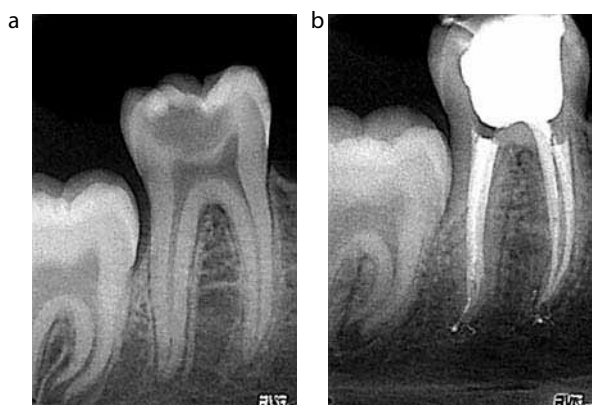
The canal, thus having been shaped, can be disinfected and filled in a conventional way (Figures 20, 21).

Conclusion

It is important to keep in mind that, ultimately, it does not matter greatly which instruments are used as long as the purpose is clearly understood.

An important difference in the use of the Protaper^{®6} and Hero Shaper[®] systems may be observed. The designers of the former aimed for narrowness of the foramen and a continuous taper, whereas for the latter aimed for enlargement of the foramen to 30/100 and a smaller taper.

When reading the endodontic literature, it is difficult to make a clear-cut choice for one approach or the other. It is even more difficult to estimate the difference in the success rate between different shaping and obturation



Figures 20. (a, b) Endodontic treatment on LR6; Root canals were shaped with Hero Shapers following the 'moderately' difficult canal sequence, and apical finishing with Hero Apical.

has been demonstrated clearly in the literature that a 4% taper is not enough to disinfect the canal and fill it using warm gutta-percha techniques. In order to increase the apical taper, it is advisable to complete the shaping by using a Hero Apical 30/08%, even for difficult

protocols as demonstrated by Hoskinson,⁷ who found no significant difference between a 1 mm or ½ mm step back, or thermomechanical vs warm condensation of gutta percha. They did, however, demonstrate the importance of a pre-operative endodontic



Figures 21. (a, b) Endodontic treatment on UR7. Canals were shaped with Hero Shaper system following the 'severe' difficulty sequence; the apical shape was completed with Hero Apical. The root canals were filled using warm gutta percha compaction (Schilder's technique).

lesion and its effect on healing and there was a tendency for delayed healing when the foramen size was greater than size 30.

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Book Review

Open Wide – Memoir of a Dental Dame. By Margaret Seward. London: The Memoir Club, 2009 (£19.95). ISBN 978-1-84104-107-0.

A Very Personal Review by Edwina Kidd

Open Wide, the autobiography of our dental Dame, Margaret Seward, is a fascinating historical record of one of the busiest and most influential people of my practising lifetime. In no way is this review objective, we have been friends for 40 years, we were nearly contemporaries and I am in her fan club! I was always going to find this a good read.

There are 22 action-packed chapters starting with childhood, schooldays at Latymer in North London, the decision to follow her father into dentistry and student life at The London, Whitechapel. After qualification followed house jobs in Oral Surgery, Fellowship examinations and the best decision of her life, to marry Gordon Seward, her surgical Registrar at the time. Subsequently she took a senior hospital dental officer post (mainly oral surgery) at Highlands General Hospital, wrote first publications and took time-out for procreation. The fruit of this labour spawned an interest in teething, leading to a research degree, first lectures and making a film on the subject.

Return to work in the school dental service posed the problems we all faced in picking up the reins again and encouraged a first letter to the BDJ posing the question, 'Why not a woman dentists' retainer scheme?' Thus started a thread that was to pass through the years with surveys of women dentists, establishing retainer and retraining schemes and encouragement of those pioneers who founded the *Women in Dentistry* and achieved some basic rights the young women of today now take for granted.

When she achieved election to the General Dental Council she began to learn the machinations of this august and male-dominated body, which was eventually persuaded to allocate her to a committee, like all other members, and provide a lavatory because they did not like her turning up in the room they considered to be theirs! A council of Europe Fellowship followed and allowed her to see how Holland was training hygienists and operating ancillaries, and so another thread of Margaret's professional life started, her interest in and promotion of, the dental team.

The chance to edit the *British Dental Journal* was grasped as a wonderful opportunity and there followed multiple initiatives, redesigning the journal, BDJ books, study days, and study tours to all corners of the globe. She came to know the BDA through and through and this culminated in a Presidential year and a hugely successful annual conference in Bournemouth.

Chapters on the GDC years, following her election as President, recount an incredibly busy and productive five years including initiatives such as the *Dental Gazette*, revising the undergraduate curriculum (*The First Five Years*), taking responsibility for specialist training and standards as specialization moved into Primary and Community Care, publication of a new ethical guidance (*Maintaining Standards*), and much, much more. These chapters are a detailed study of a plethora of new initiatives and have been written with meticulous reference to source documents to ensure their accuracy. It was now that Dame Margaret became acquainted with Government as she sought to amend the *Dentists' Act*, an immense effort eventually frustrated by a change in government. During these years she also found the time to edit the *International Dental Journal* and participate in numerous FDI meetings, thus bringing her on to the international dental scene.

Retirement from the GDC was followed by jet propulsion into the most powerful dental job, Chief Dental Officer. Despite her astonishment, the promotion is clear and the logic of the decision is patently obvious. Everything up to now had fitted her for this ultimate accolade and two years in this post should have set the scene for the biggest shake up in the delivery of dental care for decades. Put simply, her task was to deliver Tony Blair's promise of access for all to NHS dentistry. She put the building blocks in place ensuring Ministers stressed that new initiatives must be piloted before implementation. Wisely, she does not comment on what happened subsequently: such anguish has no place in an autobiography, but I found it encouraging to realize just how much one competent, hard-working individual could achieve in a relatively short time and thought-provoking how the best laid plans can go so wrong.

So how does one person achieve so much? For me, the answers are in the



autobiography. It is a mixture of luck, ambition, self-belief, a wonderfully talented and supportive partner, loyal and efficient personal assistants, and an ability to network and involve talented people. She chose and conducted the orchestra and then promoted and rejoiced in their success.

Mind you, it was not all plain sailing. There were failures along the way. For instance, she failed her 11+, and zoology A level. She was sacked from the Editorship of the *International Dental Journal* for refusing to publish a paper her referees rejected: a sorry, dirty little tail of academic intrigue. She was rebuffed from several ambitions initially, but followed her school motto which she paraphrased as 'Keep at it and you will succeed'.

This book is more than an accurate history. It is an excellent read, a real page turner. Life's surprises are hinted at, and then presented so suddenly that the reader cannot fail to empathize with the apparent disaster, but we see our heroine pick herself up, dust herself down and get back on track. On another level, there is some excellent advice in these pages. When you want to change something it is easier to do it from within. Meticulous preparation, sharing problems, knowing when and who to ask, a sense of humour, loyal staff, no-of-the-cuff remarks in recorded proceedings, and the ultimate importance and power of government, are just some of the essential ingredients.