Explaining Schilder’s Five Mechanical Objectives

Dr Raphael Bellamy addresses each of Schilder’s Mechanical Objectives from a practical, clinical standpoint

Last issue I discussed the concept of cleaning and shaping the root canal system from a historical perspective and compared this with the goals laid down in present-day endodontics. Schilder outlined the modern concept concisely in his article Cleaning and Shaping the Root Canal in 1974 and this is widely regarded as the definitive document on the subject. Within the document he laid down strict mechanical and biological objectives for attaining predictably the goal of successful anatomically generated endodontics. I will discuss the biological objectives in a future issue.

Before explaining the mechanical objectives and their fulfillment, it is assumed that the operator has prepared an adequate access cavity. In other words, there is straight line access to the body of the canal.

The root canal preparation should develop a continuously tapering cone

This shape mimics the shape of the canals before they undergo calcifications and the formation of secondary dentine. The canal should develop a continuously tapering cone from the access cavity to the apical foramen. This conical shape allows effective cleansing of the canal, as well as allowing hydraulic principles to operate by the restricted flow principle. As flow is restricted by the conical form, compaction of warm gutta percha and sealer generates vertical and horizontal vectors of force that take the path of least resistance, obturating and sealing the apical and lateral foramina. This shape enhances the uses of reamers and files by allowing close contact with the root canal surface. Additionally, appropriate funnelling enhances irrigation, debris removal and tactility and reduces the potential for instrument fracture or transportation by freeing up the instrument in the canal.

Decreasing cross-sectional diameters at every point apically and increasing at each point as the access cavity is approached

The second objective is a corollary of the first. This shape creates control at every level of the preparation. It facilitates the removal of organic debris coronally by the action of instruments and irrigating solutions. It allows the placement of condensing instruments deep into the root canal preparation to transmit realistic compaction pressures to the warm gutta percha. This potentiates the likelihood of obturating accessory foramina in the apical one third of the system. The sole exception to this second principle is in the case of internal resorption, where adherence to it would greatly weaken the remaining tooth structure.

...In multiple planes, which introduces the concept of 'flow'
The third objective encourages us to think in the third dimension. As stated in my previous article, this is critical in root canal therapy. The root canals within curved roots are similarly curved, and when these are preserved and cleaned the system exhibits natural ‘flow’. The greatest problem lies in the apical portion of the canal and the greatest care must be taken to maintain the direction of the curves in this region. Properly prepared root canals will...
Remember what I said about thinking in three dimensions? We must continue to feel with hand instruments for the ribbons, flags and banners that are the norm of root canal systems.

Keeping the foramen as small as practical, not the much misquoted small as possible, restricts the gutta percha in compaction and facilitates compaction. Large vertical and horizontal forces are subsequently generated in the correct shape that will find and seal lateral anatomy.

Some of the most difficult cases to obturate are those with enlarged apical openings. Although gutta percha does exhibit excellent rheological properties to facilitate the obturation of the open apex. In cases of pulpal necrosis, sufficient enlargement must take place to ensure the cleanliness of the region, but excessive removal of apical dentine and cementum should be avoided. Clearly in a vital, early pulptic case the same would not apply. Adherence to the principle that the foramen should be as small as practical places no maximum limitation on its size since this is determined by the clinical situation presented. The large foraminal openings in cases of apical resorption may still be as small as practical. Studies...
increase the risk of tearing, it also increases the potential for microleakage.

In summary, the goal is to produce a three dimensional, continuously tapering, multiplaned cone from access cavity to radiographic terminus while preserving foraminal position and size.

It all sounds a bit daunting doesn’t it? Well, no, not really, because on close analysis each of the mechanical objectives is a corollary of the one before. Believe me when I say that these objectives are the road map to predictable endodontics. Remember the burglar analogy I mentioned in my previous article? Well the mechanical and biological objectives are the rules that have to be adhered to if the burglar is to remain undetected. If the rules are violated then we run the risk of awaking the sleeping giant. Next issue I will discuss the little known biological objectives of cleaning and shaping.

References


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