

## Questioning the spot light on Hi-tech endodontics

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Received October 12, 2015;  
Accepted November 24, 2015.

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Endodontics as a field of dentistry has made giant leaps in the past two to three decades. Pioneering technological advancements include magnification, innovative material science, designs and techniques for instrumentation and obturation of the root canal systems. Contrary to this ascent in endodontic material, technique, and equipment innovations, a number of treatment outcome data reveal no statistically significant improvement in overall endodontic success in the corresponding period.<sup>1-6</sup> The answers to this debate could be fairly uncomplicated but have been widely overlooked in the race for sophisticated technology and innovation in endodontics.

The foremost factors that have repeatedly been documented to significantly impact the outcome of primary root canal treatment are pre-operative pulpal and periapical status, root anatomy with complex canal systems, achievement of patency to the canal terminus, mid-treatment complications including perforation and instrument separation, root filling with no voids that extends upto 2 mm of the radiographic apex and a leakage free coronal restoration.<sup>4-11</sup> Other than the first two aspects, which are beyond the direct control of the treating clinician, all other factors are directly dependant on the operator's performance.<sup>12</sup>

Objective analysis and diagnosis of pulpal and periapical preoperative status is critical for long term success of adequately treated teeth.<sup>5</sup> The ability of routinely used diagnostic tools to accurately determine the health or disease status of the pulp or periapical tissues is at best questionable.<sup>13</sup> Traditional techniques for pulpal diagnosis primarily assess neural response (electric and thermal pulp tests), instead of the true vitality of the tooth like the pulse oximeter or Laser Doppler Flowmetry, which have been shown to be more objective and accurate in making a clinical diagnosis.<sup>14</sup> Unfortunately, the latter are inaccessible to a large number of dentists, and are neither cost effective nor simplified enough for widespread clinical use.

An accurate clinical diagnosis of the pulpal condition could possibly enable managing initial irreversible pulpitis with vital pulp therapy instead of the radical devitalization approach of root canal treatment.<sup>15</sup> The clinical inefficiencies of traditional pulpal diagnostic methods hinder accurate, scientific decision making ability regarding non-invasive, preservative, preventive, therapeutic or biologic endodontic procedures like pulp capping or pulpotomies with mineral trioxide aggregate (MTA) versus invasive, synthetic, non-biologic based orthograde root canal procedures.<sup>15</sup>

As for intra-treatment factors affecting endodontic outcome, it has been frequently reported that the material of the instrument<sup>16</sup> and their design and taper or motion of instrumentation have had no significant impact.<sup>17,18</sup> Neither has the type of sealer,<sup>19</sup> material,<sup>20</sup> method or equipment<sup>21</sup> used for obturation been of consequence to overall

treatment outcome.<sup>22</sup> However some studies have suggested that warm vertical compaction could have an overall positive impact on clinical outcomes compared to lateral compaction techniques.<sup>23</sup>

The influence of the background, training, skill and efficiency of the operator has been demonstrated to have a larger impact on the treatment outcome of endodontic procedures in independent studies.<sup>11,24,25</sup> This clearly highlights another important but consistently overlooked variable, the individual operator treating the tooth, irrespective of the type, method, instrument, equipment or technology used. Other mid-treatment complications like perforations and instrument separation are largely, if not completely, preventable by well-trained operators.

Advanced endodontics in the form of perforation repair,<sup>26</sup> instrument retrieval,<sup>8</sup> management of open apex cases via regeneration or revascularization,<sup>27</sup> micro-surgical endodontics,<sup>27</sup> have been made possible by the introduction of sophisticated equipments, instruments and materials including the dental operating microscopes,<sup>28</sup> instrument retrieval kits,<sup>8</sup> ultrasonic non-surgical,<sup>29</sup> and micro-surgical instrumentation,<sup>30</sup> guided tissue regeneration,<sup>31</sup> MTA for canal obturation, perforation repair and retrograde filling.<sup>32</sup> However, these treatment modalities form an absolute minority in comparison to the overall numbers of primary endodontic intervention, and are usually performed by well-trained endodontic specialists. Hence, the overall focus should remain on absolute and complete utilization of the currently available technology and equipment.

It could be summarized that factors affecting primary orthograde endodontic success are closely related to adherence to the well-established, traditional and fundamental biologic principles of endodontics rather than gadgets and technology. It is imperative to comprehend that technology is an adjunct that could facilitate treatment, but is totally dependent on the manner of use by the individual operator. Endodontic research should focus in developing highly sensitive and specific devices that would be simple yet cost effective to allow for widespread clinical use while precisely establishing the pulpal and periapical status. Consequently, enhanced treatment outcomes could be achieved with the spotlight primarily on preoperative pulpal and periapical diagnosis and biologic endodontics, while simultaneously enhancing operator efficiency in performing traditional endodontics.

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