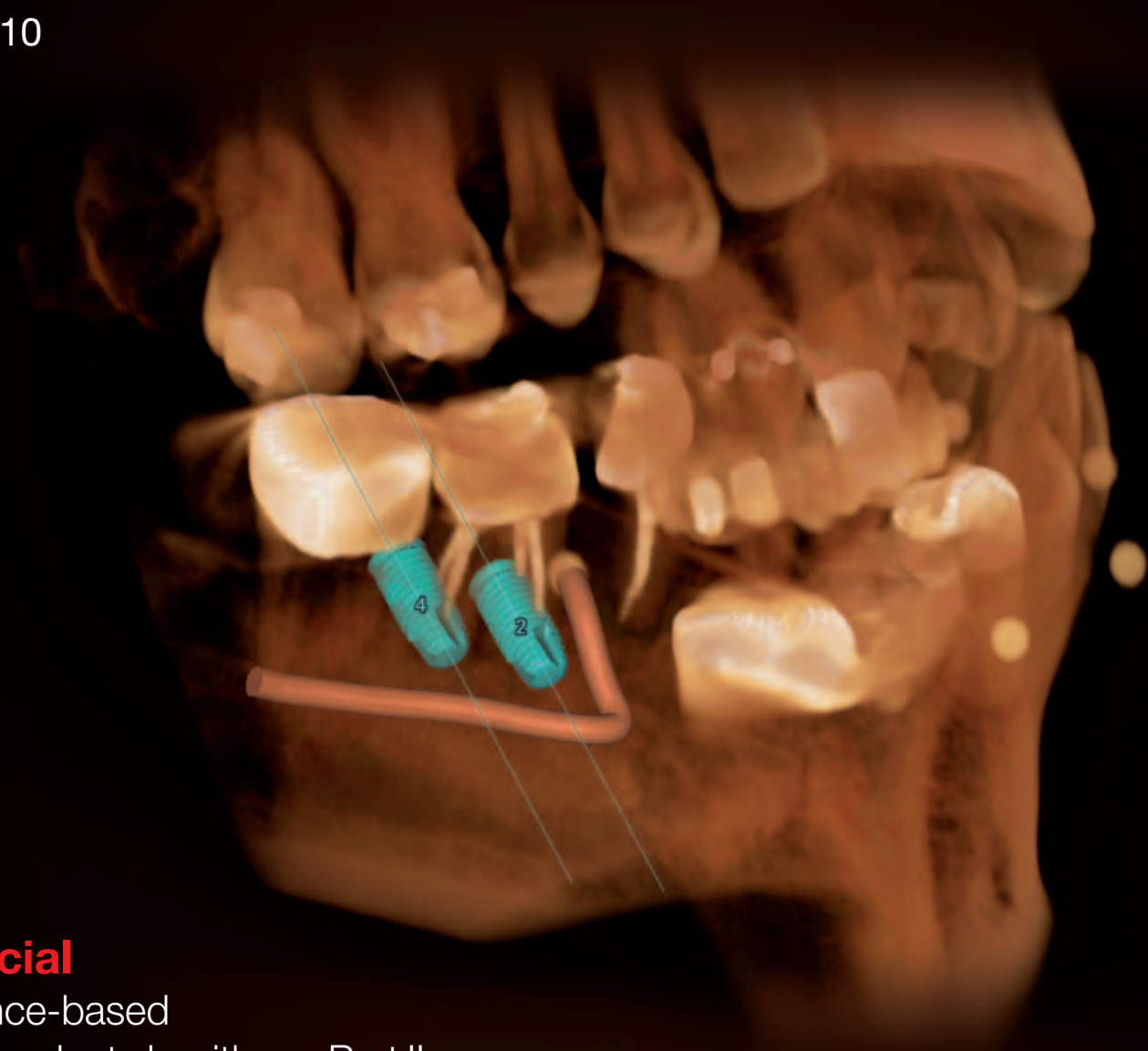


roots

international magazine of endodontology

2²⁰¹⁰



| **special**

Evidence-based
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| **clinical report**

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Dear Reader,



Dr Kenneth Serota
Guest Editor

The cyclic rhythms associated with advances in technology remain the same, regardless of their place in the timeline of human history. Everything from telescopes to teleporters has been received by apathetic acknowledgement or vitriolic condemnation. The message is don't trifle with status quo; and yet time waits for no one.

In a decade or so, there will be a constellation of satellites girdling the Earth that enable wireless communication to speed around the equator and from pole to pole. Holograms, not flat screens, will represent visual media. This construct will drive everything from entertainment to education. Dentistry will benefit from virtual reality learning and virtual on-demand education accessible from our cars, phones, computers and offices, and we will interface with them verbally and intuitively, and they will respond with artificial intelligence.

And yet...

The majority of dental education today comes from an archaic model, moving attendees to presenters, not presenters to attendees. The attendees are not well prepared; they know of the presenters perhaps, but not the presenters themselves, nor have they discoursed with them in person or online, nor for the most part do they know the evidentiary basis of the information they share, nor are they even aware of the style of their delivery, which can be equally as important in what we learn.

The Roots Summit began as means of altering this landscape. Twenty-four hours a day, seven days a week, dentists shared their hopes, dreams and most importantly knowledge and cases, and everyone learned. Once a year, they gathered to put a face to a name and determine their future path. As digital platforms exploded, Roots embraced them as well. Today, we have the Dental Tribune Study Club, Dental XP, glDE and others encouraging the industry and the profession to raise the bar and bring education to everyone, faster, more efficiently and without borders.

I look forward to seeing you all in Barcelona, another star on the horizon of where we are all headed together at last.

Sincerely yours,

Dr Kenneth Serota
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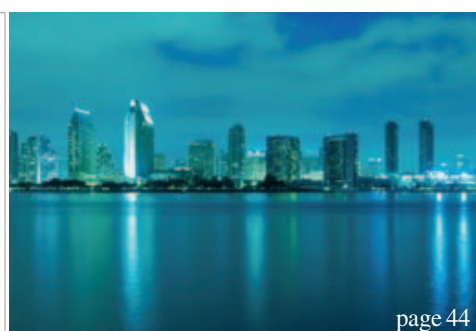
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Cover image: CT-guided endodontic surgery, courtesy of Dr L. Stephen Buchanan.

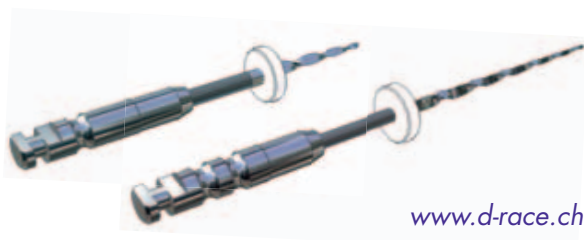


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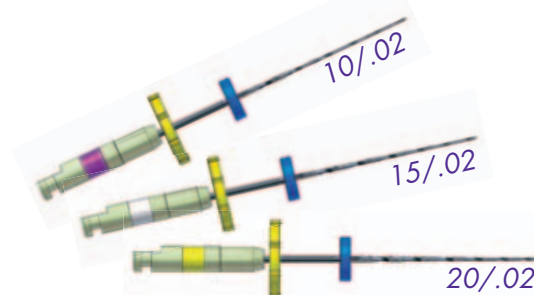
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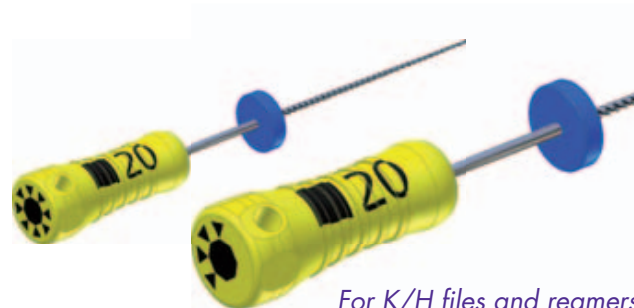
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Back to the egg: An evidence-based endo-implant algorithm (Part II)

Author_ Dr Kenneth Serota, USA

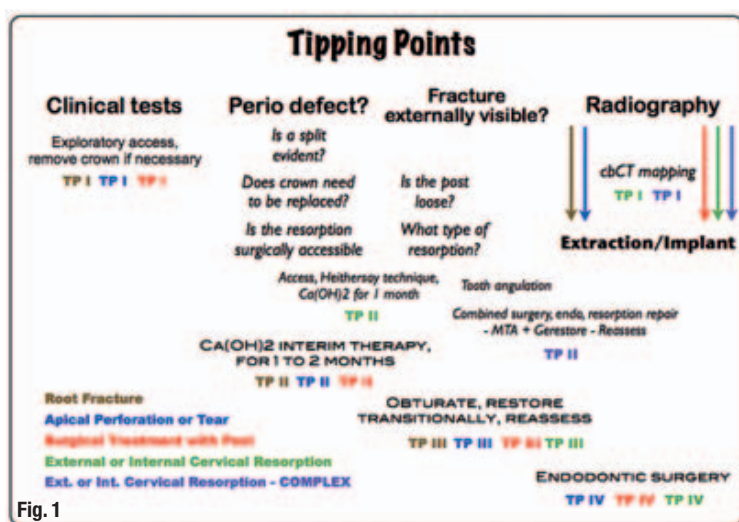


Fig. 1

Fig. 1 The term *tipping point* refers to the moment of critical mass, the threshold, the boiling point. The colour sequence highlights the diagnostic steps to be followed in each tipping-point algorithm for the listed pathological states.

The laws of nature are but the mathematical thoughts of God.

—Euclid of Alexandria

_Four thousand years ago, a number of Babylonian legal decisions were compiled in what came to be known as the *Code of Hammurabi*. The decision with reference to the construction of dwellings and the responsibility for their safety begins: If a builder engineers a house for a man and does not make it firm, and the structure collapses and causes the death of the owner, the builder shall be put to death. We are all builders or engineers of sorts; we calculate the path of our arms and legs with the computer of our brain and we catch baseballs and footballs with greater dependability than the most advanced weapons system intercepts missiles. In our professional lives, however, in contradistinction to the paradigm of evidence-based dentistry, our efforts as builders often rely solely upon personal experience, intuitive cognition and anecdotal accounts of successful strategies.

The challenges posed by implant-driven treatment planning mandate vigilance of the interaction between those involved in research and development, manufacturing and distribution and the leaders of ideologically diverse disciplines. Temporal shifts and trends in the service mix are part of the evolution of the art and science of dentistry; to some degree, the implant-driven vector has captured the hearts and minds of those who seek to nullify preservation of natural tooth structure in the oral ecosystem and defy ortho-biological replacement. The corporate entities from which we derive our tools too often fail to distinguish the point at which science ends and policy begins.

By positioning advocates and acolytes at the vanguard of their marketing campaigns, they effect change; however, their support for education is directed towards dissemination of product, not the fundamentals and rudiments of biological imperatives. Prospective large cohort clinical trials with clearly defined criteria for survival, with and without intervention, quality of life information and economic outcomes are essential to comparing alternative foundational treatments. These studies will require expertise, time and financial support from the various stakeholders, professional and corporate alike.¹

The authority of those who teach is often an obstacle to those who want to learn.

—Marcus Tullius Cicero

Table I As reported by Chugal *et al.*, the most significant vector relevant to post-op healing is the presence and magnitude of pre-op apical periodontitis.¹⁷

Size in mm	Success in %
0	87.6
1–5	65.7
>5	56.2

Table I

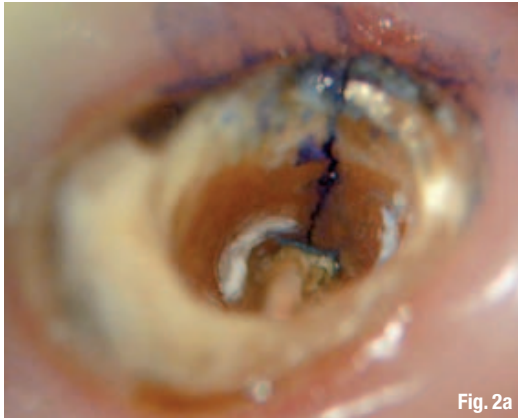


Fig. 2a

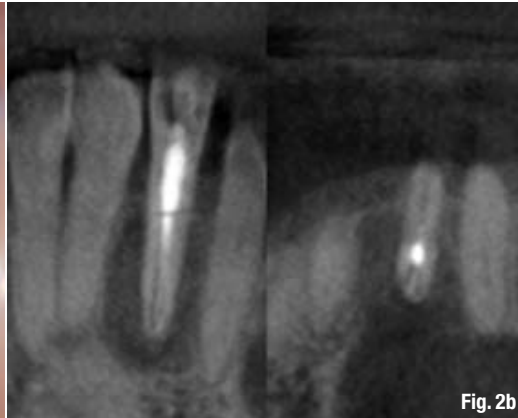


Fig. 2b

Fig. 2a The use of dyes, colouring agents and micro-etching is invaluable in visualising a suspected crack in tooth structure. Cohen *et al.* found that when premolars were used as bridge abutments, a surprising number of these abutments sustained a VRF.⁶¹

Fig. 2b The dental literature reports a statistically higher level of accuracy using CBCT (cone-beam computed tomography) scans for detecting VRF than with the use of peri-apical radiography alone.

The prosthodontic pundits maintain that the spiralling costs of saving endodontically **retreated** teeth, for which extraction may well prove to be the common endpoint, bring into question whether such teeth should be sacrificed early. Ruskin *et al.* concluded that implants have greater success than endodontic therapy, are more predictable, and cost less when one considers the 'inevitable' failure of initial root-canal treatment, retreatment and peri-apical surgery.² Is it responsible therapeutics or irresponsible expediency that justifies the removal and restoration of such teeth from the outset with an implant-supported restoration? Can one ethically argue that extraction is warranted because the financial cost of orthodontic extrusion/soft-tissue surgery, endodontic retreatment and post/core/crown fabrication is greater than extraction with an implant-buttressed restoration, and in all likelihood, more predictable?³

Jokstad *et al.*⁴ identified over 220 implant brands in the dental marketplace. With variability in surface, shape, length, width and form, there are potentially more than 2000 implants for any given treatment situation. A systematic review by Berglundh *et al.*⁵ assessed the reporting of biological and technical complications in prospective implant studies. Their findings indicated that while implant survival and loss were reported in all studies, biological difficulties, such as sensory disturbance, soft-tissue complications, peri-implantitis/mucositis and crestal bone loss, were considered in only 40 to 60% of studies. Technical complications such as component/connection and superstructure failure were addressed in only 60 to 80% of the studies. Are we as a profession standing idly by and watching marketing pressures force treatment decisions to be made empirically, with untested materials and techniques? There is an unsettling similarity between these events and the early days of implant development.⁶

The endodontic pundits argue that major studies published to date suggest there is no difference in long-term prognosis between single-tooth implants and

restored root-canal treated teeth. In fact, regardless of the similarity of treatment outcomes, the preponderance of post-treatment complications favours endodontic therapy. Therefore, the decision to treat a tooth endodontically or to place a single-tooth implant should be based on criteria such as restorability of the tooth, quality and quantity of bone, aesthetic demands, cost-benefit ratio, systemic factors, potential for adverse effects and patient preferences.⁷⁻¹¹ A review of endodontic treatment outcomes by Friedman and Mor¹² used radiographic absence of disease and clinical absence of signs and symptoms as the defining parameters for success. They suggested that the chance of having a tooth extracted after failure from initial endodontic treatment, retreatment and apical surgery collectively would be roughly 1 in 500 cases.

The dialogue comparing endodontic treatment to implant therapy jarringly overlooks the crucial fact that it is often the calibre of the restoration and its prognosis, and not the endodontic prognosis *per se*, that is the determinant of the treatment outcome. The primary biological mandate of any dental procedure is the retention of the orofacial ecosystem in a disease-free state. Surgical and non-surgical endodontic therapies



Fig. 2c

Fig. 2c The multivariate nature of the endo-implant algorithm mandates the use of CBCT to detect and evaluate the degree of peri-apical pathosis. Analysis of the size, extent, nature and position of peri-apical and resorptive lesions in three dimensions is essential for the optimal level of standard of care in diagnosis.

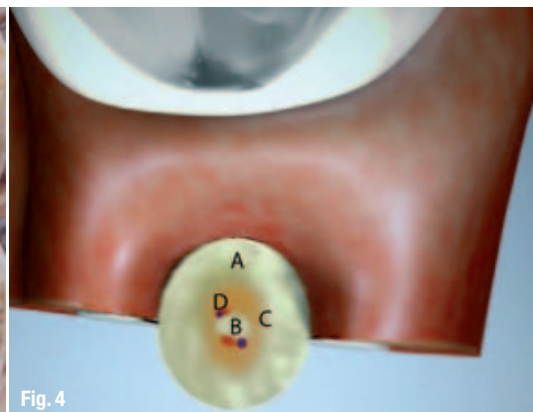


Fig. 3 Two different retreated teeth; two different potential treatment outcomes. The root-canal system of both teeth has been re-engineered in its anatomic entirety; however, the treatment outcome after restoration for both is unlikely to be the same. Regenerative technologies incorporating mesenchymal stem cells derived from dental tissues may one day obviate the concern.

Fig. 4 Less porous, less hydrated and highly mineralised outer dentine (a); pulp canal space (b); more porous, more hydrated and less mineralised inner dentine (c); water in the dentinal tubules and pulp space is held in a confined environment under hydrostatic pressure (d).

have historically been key modalities in the attainment of this foundational goal. Friedman noted that "the patient weighing one 'success' rate against the other may erroneously assume their definitions to be comparable and select the treatment alternative that appears to be offering the better chance of 'success.'"¹³ The conundrum with which researchers and clinicians alike wrestle increasingly includes the non-science of emotion as well.

This publication will address non-surgical and/or surgical resolution of failing primary endodontic treatment outcomes and the historical and ongoing efforts of the dental industry to engineer the biomimetic replacement of natural teeth successfully and replicate the structural predicates that comprise the substitution algorithm of bone, soft tissue and tooth. There are many levels to the accrual of 'best evidence dentistry'. The purpose of this paper is to ensure that all variables in the treatment planning equation of foundational dentistry are understood and given equal weight in the decision-making process for comprehensive care.

Whenever possible, the treatment choice should be an attempt to salvage a tooth using a multidisciplinary team approach, putting aside preconceived notions and biases. Finances should not dictate the advice proffered. Furthermore, it is advisable to forego being clinically 'conservative'. Treatment should not be initiated in the absence of a critical evaluation of the potential for all contributing factors to equate to a positive outcome. When needed, care must be taken to carry out every diagnostic procedure available, even those of a more invasive nature (Fig. 1). Before arriving at a definitive diagnosis and treatment plan, the clinician should obtain consent from the patient to remove any restoration in order to analyse the residual tooth structure and assess the potential to carry out reliably predictable treatment. The patient must understand in detail, the feasibility of and margin for success of each treatment option presented.¹⁴

There are few studies in the endodontic literature analysing the reasons for extraction of endodontically

treated teeth. Root-filled teeth are invariably prone to extraction due to non-restorable carious destruction and fracture of unprotected cusps. Tamse *et al.* found that mandibular first molars were extracted with greater frequency than maxillary first molars; the most significant causal difference was the incidence of vertical root fracture (VRF—1.8% maxillary molar, 9.8% mandibular molar).¹⁵ Teeth **not** crowned after obturation are lost with six times the frequency of those restored with full coverage restorations.¹⁶

Procedural failure, iatrogenic perforation or stripping, idiopathic resorption, trauma and periodontal disease all contribute to a lesser degree. The major biological factor that influences endodontic treatment outcome failure with the possibility of extraction appears to be the extent of microbiological insult to the pulp and peri-apical tissue, as reflected by the peri-apical diagnosis and the magnitude of peri-apical pathosis (Table I and Figs. 2a–c).¹⁷

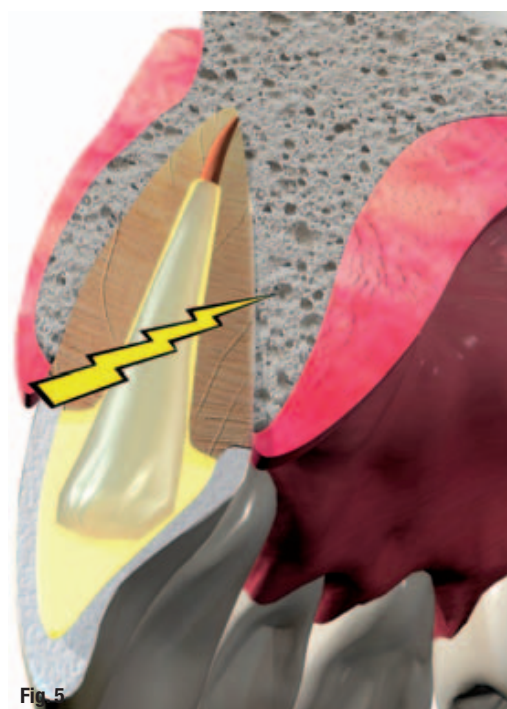


Fig. 5 Primary causes of fracture include excessive structure loss, loss of free unbound water from the root-canal lumen and dentinal tubules, age-induced changes in the dentine and restorations and restorative procedures. Secondary causes of fracture include the effects of endodontic irrigants and medicaments on dentine, the effects of bacterial interaction with dentine substrate and bio-corrosion of metallic post-cores.

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