issn 1868-3207

Vol. 12 • Issue 2/2011

implants

international magazine of oral implantology

2 2011

special

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

clinical technique

A simplified method for the removal of cemented implant prosthetics

meetings

DGZI's 41st International Annual Congress celebrated in autumn in Cologne

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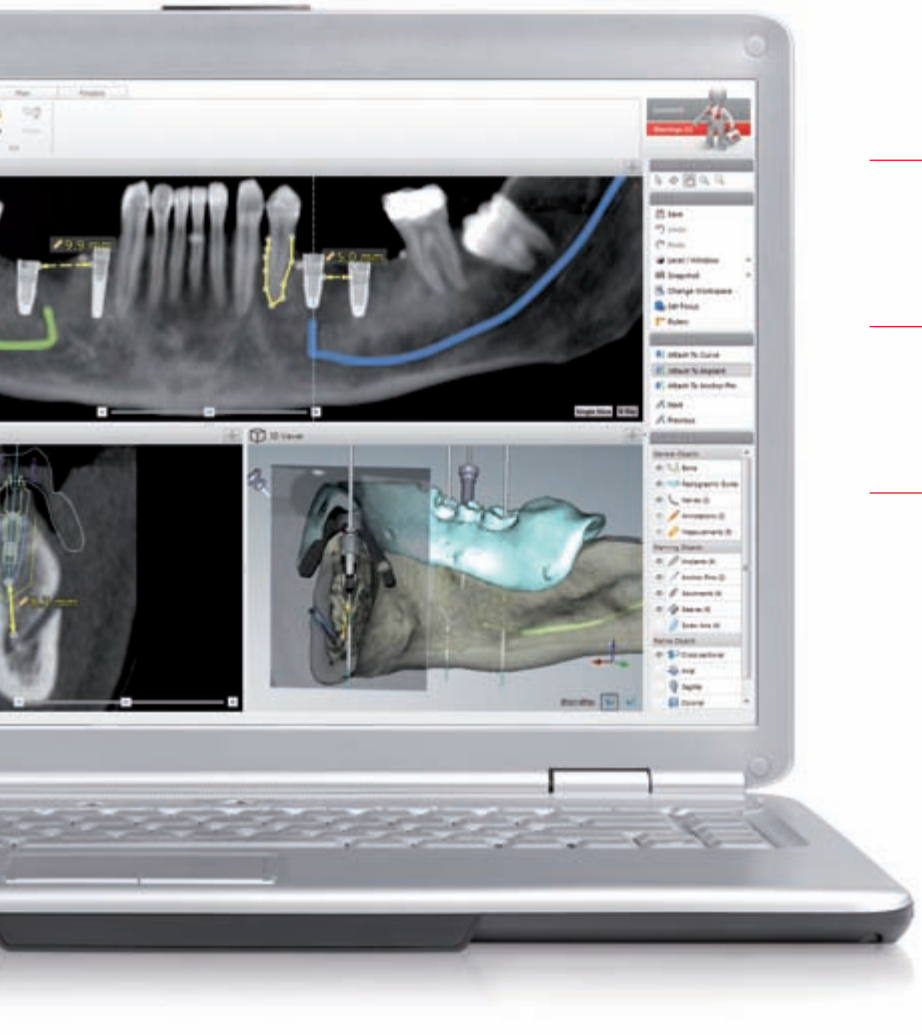

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The key to success

Dr med dent Roland Hille

_The IDS in Cologne, the world's largest dental show, has again closed its doors. With over 2,000 exhibitors from 59 countries it was once more a superlative exhibition. The variety of cultures, different therapeutic approaches, and numerous innovations on display absolutely overwhelmed visitors.

For oral implantology, the digitalization of treatments came to the fore, as this technology will certainly be a very exciting topic in future and will no doubt result in a great deal of information for the field. Due to 3-D diagnostics, computer-aided planning, navigation, and digital impression-taking of CAD/CAM manufactured prosthetics, there seems to be no limit to the increased use of technology in our practices, and in view of our changing job descriptions.

Patients agree with the increased use of technology in their treatment, for it reflects their own day-to-day life experiences. It is our duty as responsible dentists to balance therapies which are scientifically proven to a certain degree of accuracy with any error sources and inadequacies to which we may justifiably expose our patients.

These technical capabilities open up a wide range of dental treatments for dentists and patients as well. It is now up to us to integrate medically sensible and scientifically approved innovations into our everyday work.

Technological development continues to progress, but without an appropriate scientifically-based education (i.e. curriculum, sitting in on classes, and supervision) implantology still cannot be carried out successfully for the benefit of our patients. The key to success is to combine the knowledge base of implantology (including all physiological and biological aspects) with a highly qualified surgical and prosthetic procedure. Digitalization is one means of measuring success. The better the dentist s basic education, the more he will be able to improve the results of his treatment by means of digitalization.

On the occasion of its 41th International Annual Congress, which will take place in Cologne from September 30 until October 1, 2011, DGZI will once again interest you with its congress topic of "Implantology—requirements, possibilities and expectations" and its excellent expert contributions regarding current issues. Allow yourself to be entertained by our podium discussion on the topic "Digital implantology—What should and what must be done?" Here, well-qualified experts will highlight contrasting positions and offer recommendations for your future work, as DGZI remains committed to science as well as success in practice.

I look forward to welcoming you in Cologne and am eager to exchange ideas with you all.

Kindly Yours,

Dr med dent Roland Hille


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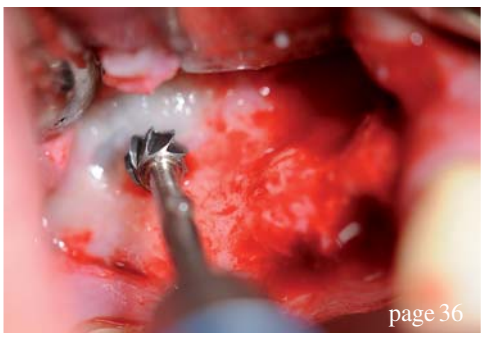
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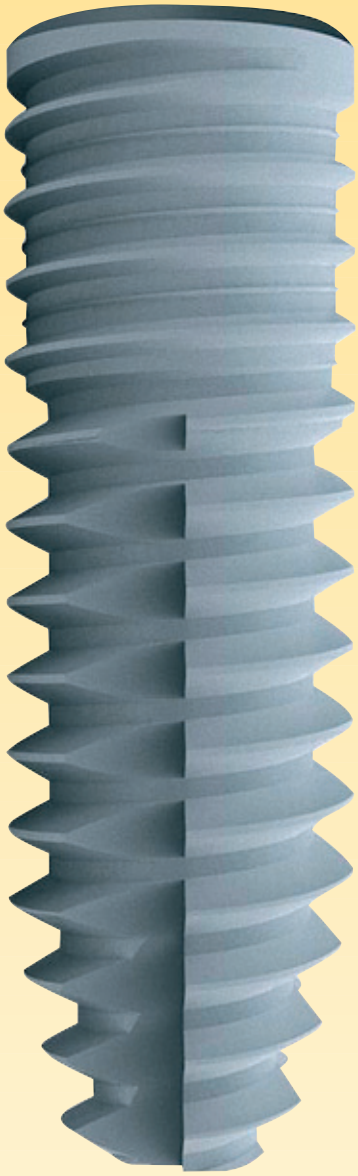

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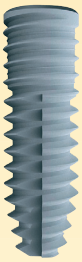

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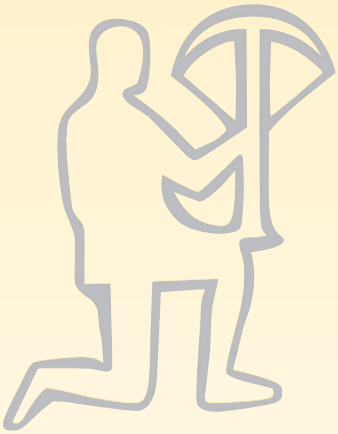

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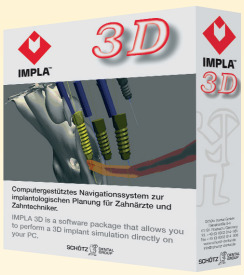

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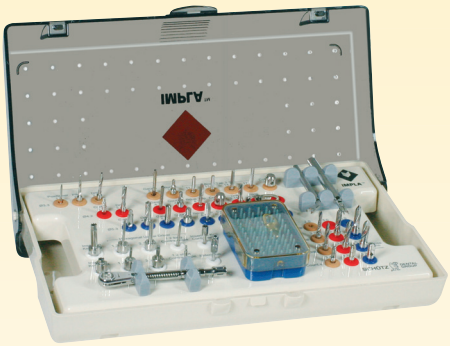

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Back to the egg: An evidence-based endo-implant algorithm (Part II)

Author_ Dr Kenneth Serota, USA

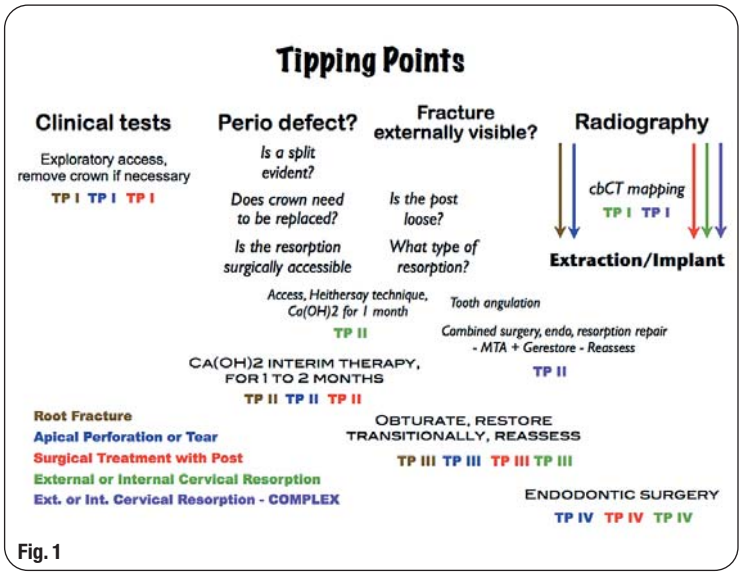

Fig. 1

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 thedeath 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 deify 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

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

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]

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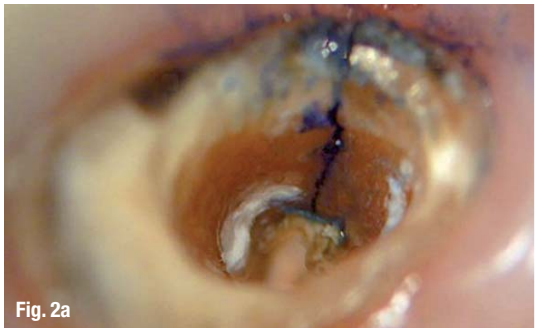
Fig. 2a

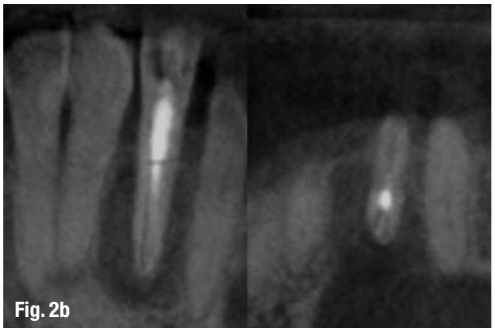
Fig. 2b


Fig. 2c

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.

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.

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 retreat-ment 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 Mor[12] used radiographic absence of disease and cli-nical 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 one 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 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]

Dentine is the most abundant mineralised tissue in the human tooth. In spite of this importance, over half a century of research has failed to provide consistent values of dentine's mechanical properties. In clinical dentistry, knowledge of these properties is pivotal to any number of variables, ranging from innovations in preparation design to the choice of bonding materials and methods. The Young's modulus (the measure of the stiffness of an isotropic elastic material) and the shear modulus (modulus of rigidity) are diminished by viscoelastic behaviour (time-dependent stress relaxation) at strain rates of physiological (functional) relevance. The reported tensile strength data suggests that failure initiates at flaws. These flaws may be intrinsic, perhaps regions of altered mineralisation, or extrinsic, caused by cavity or post-channel preparation, wear, or damage. There have been few studies of fracture toughness or fatigue.[18] Finally, little is known about the biomechanical properties of altered forms of dentine subsequent to decay, the influence of irrigants and chemicals, and the choice of curing techniques used for bonded restorations.[19]

Studies suggest that there are at least two forms of transparent or sclerotic dentine: a form associated with caries and a form associated with age-related changes in the root. The impact upon tooth strength as a function of these altered forms of dentine is not well understood. The long-term predictability of residual coronal tooth structure to function in a manner commensurate with the demands of the orofacial ecosystem may need to be reassessed in light of observations that sclerotic dentine, unlike normal dentine, does not exhibit yielding before failure and that the fatigue lifetime is deleteriously affected at high stress levels.[20] Mechanisms for energy dissipation and crack growth resistance present in young dentine are not present in old dentine. Restorative methods and techniques, particularly regarding ferrule creation for endodontically treated teeth, may need to be amplified to address the fact that fatigue crack growth resistance of dentine decreases with age (Fig. 3).[21]