An Evidence-Based Endodontic Implant Algorithm: Back to the Egg; Concluding Part
Kenneth S. Serota, DDS, MMSc

A n increased uniform amount of coronal dentin significantly amplifies the fracture resistance of endodontically treated teeth, regardless of the post system used or the choice of material for the full-coverage restoration. A recent article by Coppede et al demonstrated that friction-locking mechanics and the solid design of internal conical abutments provided greater resistance to deformation and fracture under oblique compressive loading when compared to internal hex abutments. These two "seemingly" disparate observations define the inherent continuum between natural tooth engineering and the principles of engineering necessary to orthobiologically replicate the native state.

The use of a ferrule or collet and a bonded or intimately fit post-core to restore function and form to an endodontically treated tooth is analogous to the use of a long, tapered friction fit interface with a retaining screw (Morse taper), to secure an abutment to a fixture. In both cases, the role of contact pressure between mating surfaces to generate frictional resistance provides a locked connection. This has been shown to affect the long-term stability of crestal bone support for the overlying gingival tissues and maintain a healthy protective and aesthetic periodontal attachment apparatus.

Human symmetry
The Roman architect Vitruvius' (Marcus Vitruvius Pollio) description of the perfect human form in geometrical terms was a source of inspiration for Leonardo da Vinci, who successfully illustrated the proportions outlined in Vitruvius' work 'The Architectura.' The result, the Vitruvian man, is one of the most recognised drawings in the world and is accepted as the standard of human physical beauty. Vitruvius theorised that the essential symmetry of the human body, with arms and legs extended, should fit into the perfect geometric forms: the circle and the square. However, Leonardo da Vinci recognised that the circle and the square were only tangent at one place, the base. Observe the insert in Fig. 8. The stabilising platform for the human outlined form begins at that tangent; the intersection is graphically analogous to the structural configuration of platform switching.

In geometry, an oval is a curve resembling an egg or an ellipse. Architects and engineers have used smooth oval curves to support the weight of structures over an open space literally since the second millennium BC. These arches, vaults and domes can be seen in buildings and bridges all over the world; the most perva...

Biomechanics
The goal should be to biomimetically replicate the natural state to the greatest degree (Figures 10a and 10b) in regard to load bearing capacity. Measuring success Stable crestal bone levels are the yardstick by which treatment success and health are measured in the orofacial ecosystem, whether it relates to natural tooth retention or restorative and/or replacement rehabilitation. It is therefore surprising that the treatment outcome standards for

Future modifications to implant biomechanics should focus on designs wherein the osseous trabecular framework retaining the fixture will adapt to the amount and the direction of applied mechanical forces, cope with off-axis loading, compensate for occlusal plane to implant height ratios differences as well as adjusting to mandibular flexion and torsion.

In this new era of implant driven treatment planning, fixtures should be engineered to support single crowns with cantilevers instead of implant/implant or implant/teeth connections for a span of any degree. These engineering design iterations will minimise high-stress torque load at the implant abutment interface and obviate areas with degrees of bone insufficiency.

The seed of a tree has the nature of a branch or twig or bud. It is a part of the tree, but if separated and set in the earth to be better nourished, the embryo or young tree contained in it takes root and grows into a new tree, Isaac Newton.
osseo-integration accept crestal bone remodeling and resorption of up to 1.5 - 2mm during the first year following fixture placement and prosthetic insertion 51.

The concept of “biological width” outlines the minimum soft tissue dimension that is physiologically necessary to protect and separate the osseous crest from a healthy gingival margin surrounding teeth and the peri-implant environment.

A bacteria-proof seal, the lack of micro-movement associated with a friction grip interface and a minimally invasive second-stage surgery (where indicated) without any major trauma to the periosteal tissues, are also important factors in preventing cervical bone loss. The literature suggests that the stability of the implant/abutment interface may have an important early role to play in determining crestal bone levels 52.

Platform switching: By default or by design
‘There is no logical way to the discovery of elemental laws. There is only the way of intuition, which is helped by a feeling for the order lying behind the appearance,’ Albert Einstein.

Platform switching theorises that by using an abutment diameter of a lesser dimension than the periphery of the implant fixture, horizontal relocation of the implant-abutment interface will reduce remodeling and resorption of crestal bone after insertion and loading.

The concept implies that peri-implant hard tissue stability will engender soft tissue and papilla preservation. Maeda et al reported that stress levels in the cervical bone area peripheral to a fixture were reduced when a narrow diameter abutment was connected in comparison to a size commensurate with the fixture diameter 53.

The authors concluded that the biomechanical advantage of shifting stress concentrations away from the cervical area will diminish their impact on the biological dimension of hard and soft tissue extending apically from the FAI (Fig 11a, 11b and 11c). The inherent disadvantage is that it shifts stress to the abutment screw with the potential for loosening or fracture.

Baggi et al detected neutrophilic infiltrate in the connective tissue zone contacting the implant-abutment interface. The facility by which platform switching/shifting reduces bone loss around implants has been investigated by Lazzara et al 54. The authors hypothesised that, if the abutment diameter matches that of the implant, the inflammatory cell infiltrate is formed in the connective tissue contacting the microgap created at the FAI.

If an abutment of narrower diameter is connected to wider neck implant, the FAI is shifted away from the outer edge of the implant, thus distancing inflammatory cell infiltrate away from bone. Hypothetically, less crestal bone loss is expected and an increased implant/abutment disparity allows more stable peri-implant soft tissue integration.

Tarnow’s seminal study on crestal bone height support for the interdental papilla clearly showed the influence of the bony crest on the presence or absence of papillae between implants and adjacent teeth 55. Twenty years later, logic dictates that anticipated early crestal bone loss and diminished, albeit continual, bone loss may have been engineered out of the substitution algorithm for peri-implant tissues 56.

Different crestal bone geometries around implants have been investigated by Lazzara et al 57. The authors concluded that the Ankylos C/X implant based on its platform “biological necessity” of providing a friction grip interface to prevent migration of micro-movement associated with apical crestal bone loss. Hypothetical cell infiltrate away from the cervical area of the implant/abutment interface.

If an abutment of narrower diameter is connected to a wider neck implant, the FAI is shifted away from the outer edge of the implant, thus distancing inflammatory cell infiltrate away from bone. Hypothetically, less crestal bone loss is expected and an increased implant/abutment disparity allows more stable peri-implant soft tissue integration.

Type II bone quality was approximated and complete osseous integration was assumed. It was concluded that the Ankylos C/X implant based on its platform allows more stable peri-implant soft tissue integration.

More Designs by Dentists
www.directadental.com
Distributed in the UK by Trycare, Tel. 01274-88 10 44

be enhanced by osseous generation over the collar of the fixture (Figs 12a and 12b) [59].

The endodontic implant algorithm parallels the question, which came first, the chicken or the egg as an example of circular cause and consequence. It could be reformulated as follows: ‘Which came first, X that can’t come without Y, or Y that can’t come without X?’ An equivalent situation arises in engineering and science known as circular reference, in which a parameter is required to calculate that parameter itself. This is the essence of foundational dentistry.

Nature wisely created a structure that could harmoniously interoperate hard and soft tissue, act as the portal of nutrition and communication for the body and be the gatekeeper on guard and in function through out our lifetime. As such, our role is to ensure that however we reengineer nature, we must adhere to its rules, its logic and its fundamentals.

The best evidence
This is not an easy task, as filtering out the best range of evidence from a wide range of sources, presenting clear, comprehensive analyses and incorporating patient experience is a Herculean task. In many ways, this is analogous to Alice’s Adventures in Wonderland as so much of what we do grows ‘curiouser and curiouser’ as each new innovation demands that we go through the looking glass and determine what Alice found there.

References

The founder of ROOTS – an online educational forum for dentists from around the world who wish to learn cutting edge endodontic therapy, he recently launched IMPLANTS (www.implants.com) and www.kronesline.org in order to provide a clear understanding of the endodontic/implant algorithm in foundational dentistry.

Fig 12a

There’s no use trying,” said Alice. “One can’t believe impossible things.” ‘I dare say you haven’t had much practice,’ said the Queen. When I was your age, I always did it for half an hour a day. Why, sometimes I’ve believed as many as six impossible things before breakfast!” Lewis Carroll.