Primary stability vs. viable constraint:
A need to redefine

By Michael R. Norton, BDS, FDS, RCS(Ed)

Any regular reader of the Journal of Oral & Maxillofacial Implants or indeed of any other publication on dental implants could not fail to have noticed how much attention has been focused on primary stability. The concept of primary stability is not new, indeed, as early as the 1970s, there were studies emphasizing the need to establish mechanical stability to ensure uninterrupted healing of the bone. This was most evident in the orthopedic literature as it pertains to hip prostheses. By the 1990s, numerous reports were being published on immediate loading of dental implants, and the groundbreaking work by Neil Meredith on the application of resonance frequency analysis (RFA) came to the fore with statements that achievement of implant stability was a prerequisite for long-term positive outcomes.

At the same time, Meredith recognized it was possible for clinically firm implants with poor axial stability to still be prone to failure. Of course, Bränemark recognized this in his early work, proposing as he did a period of submerged healing because of his concern for any destabilization of the bone-to-implant interface during the early healing phase. However, today, we all recognize that such protective protocols are frequently unnecessary, with widespread acceptance of not only transmucosal healing but also immediate or peak insertion torque; they are in essence one and the same and depend largely on the characteristics of the implant, the density of the bone and the differential size of the osteotomy as it pertains to the diameter of the implant.

The gradual shift from primary stability where secondary stability is one where a friction occurs between the implant and the surrounding bone, giving rise to a resisting torque at time of insertion.

This resisting torque is proportional to the effort required to seat the implant and peak insertion torque, they are in essence one and the same and depend largely on the characteristics of the implant, the density of the bone and the differential size of the osteotomy as it pertains to the diameter of the implant.

**STABILITY, Page D2**

### AAID: Digital implant dentistry isn’t the future

By AAID Staff

Digital implant dentistry is not the future. No, far from it. Digital implant dentistry is the here and now for dental implant practitioners.

From digital treatment planning and delivery to patient communication, new technologies are changing the way dentists practice implant dentistry. The American Academy of Implant Dentistry presents a course titled “Implant Dentistry in the Digital World” in Baltimore from April 24-25.

In addition to offering 12 hours of C.E., the AAID is honoring Dr. Leonard Linkow, one of the pioneers of the field of dental implants, with a dinner on Friday, April 24.

The conference, which is co-hosted by the AAID’s Northeast and Southern Districts, will be held at the Marriott Inner Harbor at Camden Yards in Baltimore.

More information and registration is available online at www.aaid.com.

The following programs are among those to be included:

- “CBCT Implant Planning: Digital Solutions from a Laboratory Perspective” (Joe “Ambrose” D’Ambrosia, CDT)
- “Reverse Engineering in Digital Smile Design” (Alain Ménard, DMD)
- “Innovations in Digital Implantology” (Gilbert Tremblay, DMD, FAAID, DABOI/ID)
- “Technology to Enhance Your Practice” (Marty Jablow, DMD)
- “Fixed Implant Prosthetic Considerations” (Shankar Iyer, DDS, MDS, FAAID, DABOI/ID)
- “Planning the Rehabilitation of an Edentulous Arch” (Lou Dipede, DMD)
- “Soft-Tissue Management in Implant Therapy” (John F. Hamrick, DMD, FAAID, DABOI/ID)
- “Protocols to Avoid Complications and Failures with the New Digital Workflow” (Scott Ganz, DMD)

Established in 1951, the AAID is the only dental implant organization that offers credentials recognized by federal and state courts as bona fide. Its membership, which exceeds 5,000, includes general dentists, oral surgeons, periodontists and prostodontists from across the United States and in 40 other countries. For more information, contact AAID at aaid@aaid.com or at (312) 335-1530 or (877) 335-AAID (2245).

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**Image 1:** Stability

**Image 2:** Fig. 2

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mechanical fixation to full osseointegra-
tion in the shortest possible time.

The most fascinating aspect of this de-ate is the lack of correlation between in-
sertion torque and the implant stability
quotient (ISQ) as measured by RFA, which
appears to be counterintuitive. How is it
possible for an implant that is driven in
to 30 Ncm to have the same ISQ as one
that required 100 Ncm of torque? None-
theless, the weight of literature would
seem to suggest this to be the case.

Because ISQ is measuring axial stiff-
ness, it must be clear that frictional ro-
tational resistance is a completely dif-
ferent parameter. After all, I don’t know
what all these people have all experienced
the “spinner” (an implant that exhibits little or no rota-
tional stability) that went on to osseoin-
tegrate, and there are a number of stud-
ies published that report high success
rates for immediately loaded implants
that were inserted with low insertion
torques.23–26

By contrast, implants with an ISQ of
less than 50 rarely go on to integrate suc-
cessfully, and ISQ has been described as
a good predictor of success.19-22 This
dichotomy that has got me thinking and
made me want to write this editorial piece.
Could it be that axial stiffness is far more
pertinent than rotational friction in en-
suring an implant integrates? We already
know from the literature that an implant
can tolerate a degree of micro-motion,
thought to be circa 0.1 mm,18 and this is in
essence what ISQ measures.

Studies have also demonstrated that
insertion torque correlates closely to the
degree of micro-motion.15 However, it is
not the aim to seek complete elimina-
tion of micro-motion, a valuable lesson
learned in orthopedics.17 If it is possible
to place an implant with lower insertion
torque and still achieve axial stiffness with
an ISQ >60, surely this provides us
with a more optimal evaluation of pri-
mary stability.

Our goal must be the rapid onset of
secondary stability, with minimal criti-
cal pressure to the poorly vascularised
cortical bone so unfavorable curative
responses and delayed healing are avo-
ed. At the same time, we need to employ
an objective measure of constraint that
reliably ensures the implant can tolerate
earby momentary loading before intes-
tional micro-motion occurs.27

I have labeled this objective measure
viable constraint (VC), whose central pur-
pose is to obtain a clinically relevant de-
gree of stability while maintaining a low
pressure on the vulnerable corti-
cal tissues through which our implants
are inserted.

Bone is not wood. It is not inanimate. It
would behoove us all to remember this,
and avoid the carpenter’s approach to
implant dentistry.

So I would take this opportunity to
ask that we think in terms of viable con-
straint. It will, of course, take controlled
prospective studies to determine the
optimal conditions for VC, but if I were
a gambling man (which I most certainly
am!), I would guess for a 4.5 mm implant
in bone with a cortex of 1 mm thick-
ness that a maximum torque of 20 Ncm
and an ISQ of 60 represent the optimal
measures we are looking for to ensure

safe immediate loading.

In the past, we used to think length was
important with implants, whereas today
there is increasing focus on short im-
plants. However, I would point out that
a strong correlation has been shown to ex-
ist between ISQ and implant length.16–18
And, as such, for immediate loading,
I also believe a longer implant with a
higher ISQ, inserted at a lower insertion
torque, will yield a more favorable out-
come.

References available upon request from
the publisher.

Note

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About the author

DR. MICHAEL R. NORTON, BDS, BDS, RCS(G), gradu-
ated from the University of Wales, School of Dental
Medicine, in 1988. He runs a world-renowned prac-
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For more than 20 years, Norton has led the way for
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'We need to employ an objective measure of constraint that reliably ensures the implant can tolerate early or immediate loading.'
Simplicity without compromise

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- Versatile implant designs
- Flexible drilling protocol

The foundation of this evolutionary step remains the unique ASTRA TECH Implant System BioManagement Complex.

For more information visit www.jointheev.com
Bone regeneration through tissue engineering offers new prospects for oral procedures

Bone regeneration through tissue engineering offers new prospects for oral procedures.

Regeneration of bone tissue could greatly benefit people with jaw-bone deficiencies due to tooth loss, infection or trauma. While an ideal method of bone tissue engineering is not yet available, research with a collagen-hydroxyapatite-Mesenchymal stem cell composite is showing promise.

Hydroxyapatite is the main component of bone mineral and tooth enamel. A report in the Journal of Oral Implantology details researchers’ efforts to synthesize a collagen-hydroxyapatite composite through mineralization of collagen fibrils with nanometer-sized apatite crystals. The biological properties of the composite were evaluated by culturing with mouse and human mesenchymal stem cells.

Currently, the methods of bone repair and regeneration include the following bone graft types:

- Autografts: grafting bone from the same person
- Allografts: taking bone tissue from another person
- Xenografts: collecting material from a nonhuman species
- Alloplasts: using synthetic materials

Each of these methods has limitations that tissue engineering involving scaffolds and living cells can surpass.

The scaffold is an artificial structure that is combined with living Mesenchymal stem cells to form a tissue engineering construct that can repair or regenerate bone. The scaffold is tested to differentiate into a variety of cell types, which are used to precipitate bone growth.

The current study tested three ratios of collagen to hydroxyapatite: 80:20, 50:50, and 20:80. Both the 80:20 and 50:50 composites supported attachments and proliferation of mouse mesenchymal stem cells and human periodontal ligament stem cells in laboratory tests. The 50:50 ratio had the best mechanical properties suitable for bone grafting applications. The authors report that these findings indicate a strong potential for collagen-hydroxyapatite composite complexes in bone tissue regeneration. The composites are porous and sponge-like, and show good biocompatibility and biomimetic properties.

Alveolar bone deficiency is a limiting factor for dental implant-supported prosthetic therapies. The effective formation of new bone offers a basis for further procedures to successfully repair teeth and jaws.


$1.5 million gift establishes first endowed professorship at UMSOD

The University of Maryland School of Dentistry (UMSOD) has received the largest one-time gift in the school’s 175-year history, a $1.5 million donation from alumni Frederick G. Smith, MS, DDS ’78, and Venice K. Paterakis, DDS ’81, that will establish the institution’s first endowed professorship. This donation will provide resources to fund the work of the school’s distinguished faculty.

“As the world’s first college of dentistry, established in 1840, we celebrate our 175th anniversary this year. This historic gift pays tribute to the school’s illustrious past as a leader in dental and dental hygiene education while ensuring that the UMSOD will remain among the premier dental schools in the world,” said Dean Mark A. Reynolds, DDS ’86, PhD. “I speak for all of us here at the School of Dentistry when I express my heartfelt gratitude to Dr. Smith and Dr. Paterakis for their generosity.”
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Bringing innovation back

Nobel introduces a ‘complete posterior solution’

By Nobel Biocare Staff

Large extraction sockets, limited accessibility, tough-to-remove excess cement and high occlusal forces: These are just some of the challenges a clinician faces when restoring a single tooth in the posterior. And, with molar replacement being among the most common indications, these challenges are encountered repeatedly.

A solution that addresses all these problems in an efficient and predictable way will make life easier for dental professionals and patients. That’s precisely why Nobel Biocare is bringing innovation back to the posterior region with its new complete posterior solution — an original combination of new wide-platform implants and restorative options, all specially designed for molar sites.

An implant like no other

Multiple Nobel Biocare innovations combine to make this solution complete, but the foundation for treatment success is the implant itself. Here Nobel Biocare offers several options, each engineered for the specific demands of the posterior. All are intended to shorten time to teeth for the patient by enabling immediate loading whenever possible.

One option is NobelActive. Many clinicians are already familiar with this award-winning implant. Its distinctive design and the surgical protocol form a unique combination that can enable immediate function in cases where it might otherwise not be achievable.

To condense bone gradually, its tapered body features threads that narrow towards the apex, while the apex itself features no threads. Drilling blades to preserve bone by allowing a smaller osteotomy. These features are all designed for high primary stability, even in soft bone and extraction sockets.

Now, a new variant offers the benefits of the NobelActive family but with dimensions ideal for the molar region. NobelActive wide platform (WP) possesses a wider diameter implant body (5.5 mm) to better fit the large extraction sites in the molar region and a wider implant platform for an optimal emergence profile. NobelActive WP also comes in an option with a shorter body (7 mm) to avoid critical anatomical structures such as nerves.

Stability and flexibility in parallel

Alternatively, clinicians can opt for NobelParallel Conical Connection (CC). Combining a parallel-walled implant body that is well documented with an advanced internal connection, NobelParallel CC offers extraordinary flexibility. It is engineered for use in all bone qualities and for a wide range of indications. The 5.5 mm Wide Platform option is designed for an optimized emergence profile for large molar sites.

Both experienced clinicians and those early in their implant careers will appreciate NobelParallel CC’s straightforward surgical protocol. It offers flexibility and shortens treatment time, benefiting the patient too.

Together, the surgical protocol and implant design form a unique combination that’s intended to allow immediate function in more cases by providing high primary stability. The thread design and tapered apex of NobelParallel CC are designed for underpreparation of the surgical site and bicortical anchorage — techniques that support immediate loading.

High stability during the initial healing phase is then maintained by Nobel Biocare’s unique TiUnite surface. In addition, patented grooves enhance osseointegration for a predictable end result.

Connecting strength and flexibility

Both new implants benefit from Nobel Biocare’s internal conical connection. This advanced connection’s conical seal and hexagonal interlocking mechanism provide high mechanical strength. It offers restorative flexibility too, being compatible with Nobel Biocare’s most innovative restorative solutions, including those designed specifically for the posterior.

These include the new PEEK Healing and PEEK Temporary Abutments, which are anatomically shaped to match the molar contours. As the PEEK Abutments come ready-shaped for an optimized emergence profile, fewer adjustments are needed. This can simplify treatment and reduce costly chair time.

The crown that ‘rules them all’

When it comes to the final restoration, the FCZ (full-contour zirconia) Implant Crown is designed for strength and predictability even under the high occlusal forces of the posterior. There’s no worrying about chipping either, as the full-contour nature of the NobelProcera FCZ Implant Crown removes the need for veneering.

The biocompatibility of the materials used contributes to biological stability in the areas it matters most. Plus, being screw retained, the FCZ Implant Crown is completely cement free, avoiding the risks associated with cement excess entirely. Even the titanium adapter is mechanically retained.

The ability to use an angulated screw channel (ASC) allows the screw access hole on the FCZ Implant Crown to be placed anywhere between 0 and 25 degrees in a 360-degree radius. This means it can be angled towards the front of the mouth for easy access, even in the posterior. It also helps avoid placing the access channel on the cusp of a tooth, where it could affect occlusion. The associated Omnigrip Screwdriver further simplifies work on the restoration. Its effective pick-up function and secure grip on the screw help the clinician to work safely and efficiently.

Natural-looking tooth color is another benefit offered by the FCZ Implant Crown. Whichever of the eight available shades is used, the color is applied throughout the material. This means discoloration isn’t a concern when making adjustments. Backs and staining can also be used to achieve the desired esthetic effect.

Several components, one complete solution

While each product within Nobel Biocare’s complete posterior solution stands out on its own, they stand stronger together. Like all Nobel Biocare innovations, they are tested together as one system, as they exist in the patient’s mouth.

Combining Nobel Biocare components means all elements are designed to work in synergy for the optimal treatment outcome. Restoring single molars represents a clinical challenge for many reasons, but now, by uniting new and proven innovations, Nobel Biocare has the answer.

Find out more at nobelbiocare.com/bringinginnovationback.

References are available upon request from the publisher.
Straumann introduces a flexible collagen membrane that’s easy to handle and place

By Straumann Staff

Straumann is once again expanding its portfolio of regenerative solutions to better meet customer needs. Now, Straumann® Membrane Flex™ joins Straumann® Membrane Plus™, Straumann® XenoGraft, Straumann® AlloGraft, BoneCeramic™ and Emdogain™ to provide a single trusted source for dental implant and regeneration needs, according to the company.

A quick look at Membrane Flex

• Desirable handling characteristics.
• Because it’s not side specific, it’s easy to handle and to place.
• With outstanding flexibility, it easily drapes over defects and naturally conforms to contours.
• Flexibility with placement as it can be easily repositioned for precise placement.
• Can be placed dry or hydrated.
• Even when hydrated, does not adhere to gloves or instruments.
• Takes sutures or tacks with ease, for simple yet secure fixation.
• Proven biomechanical strength enhances fixation assurance.
• In pre-clinical testing, the suture pull out strength was three times higher than a similar product.
• Because of its significantly higher suture pullout strength, can be firmly anchored to surrounding tissue with minimal risk of tearing or detachment.

Supports wound healing

• Biocompatible because it’s meticulously manufactured from highly purified intact porcine collagen and minimally cross-linked for predictable resorption.
• Reduced degree of inflammation and foreign body response as compared to other similar products in pre-clinical testing.
• In pre-clinical testing, the suture pullout strength was three times higher than a similar product.
• Because of its significantly higher suture pullout strength, can be firmly anchored to surrounding tissue with minimal risk of tearing or detachment.

• Protects the graft area from unwanted soft tissue infiltration during the initial phase of healing while still allowing for healthy nutrient transfer.
• Resorbs predictably over three to four months as new host collagen is simultaneously regenerated.
• With a slower initial rate of resorption than other similar products, it provides greater initial stability during the critical early weeks of healing.
• Shown through in vitro and in vivo pre-clinical testing to exceed many of the performance characteristics of other similar products.

Available sizes: 15 x 20 mm, 20 x 30 mm, 30 x 40 mm

This new offering — along with other recent additions to the Straumann portfolio — is one of the latest products the company provides customers with for a total solution that yields patient satisfaction and practice success.

To learn more about the new Straumann Membrane Flex, visit www.straumann.us/bone/

* Data on file with manufacturer

About Straumann

Headquartered in Basel, Switzerland, Straumann (SIX: STMN) is a global leader in implant, restorative and regenerative dentistry. In collaboration with leading clinics, research institutes and universities, Straumann researches, develops and manufactures dental implants, instruments, prosthetics and tissue regeneration products for use in tooth replacement and restoration solutions or to prevent tooth loss.
Improve Your Accuracy

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