Dental implantology: Evolution or the road to ruin?

By A.ws Alani, UK

Teeth are highly evolved structures that have developed progressively over millions of years in attempts to protect themselves from caries and periodontal diseases. Over the years, many advances have been made that can treat these various diseases predictably. Various strategies have been developed to prevent or slow down these problems given adequate patient compliance and appropriate personal and professional maintenance.

Despite these very significant improvements, there are still instances when patients are advised that one or other tooth has to be extracted. It is the obvious sadness, heartache or despair that patients are caused by this bad news that has driven, caring clinicians to find ways to replace teeth with various devices, including dentures, bridges and implant-retained prostheses.

P.-I. Brånemark, now sadly deceased, famously quipped: “No one should have to die with their teeth in a glass of water beside their bed.” His original inspiration coupled with determination, intuition, passion and an ability to surround himself with a great team of individuals with differing skills made osseointegration much more predictable. Brånemark’s landmark studies changed prosthetic dentistry dramatically, but a careful look at the design of these protocols and the implants themselves reveals that they were hugely different to the patient selection protocols and the types of implants being placed today.

Furthermore, the restorations supported on them were made of the established materials then and obeyed traditional mechanical laws. In terms of biological cleanability, the metal, polished “high water” abutment design allowed for optimal interproximal cleaning, while the implant surface itself was also relatively smooth in comparison with the rougher surfaces we often see today. Market saturation, cost, profit and market share in many technology-driven markets often purport innovation of some sort of change to help gain greater market share or profit. The over-commercialisation of dentistry generally creates a constant turnover of supposedly new and better products, where the common notion of “if it ain’t broke don’t try to fix it” is lost on many directors of marketing or increasingly profit-driven CEOs.

Why and where?

Where this technological change has taken implantology and what the real reasons are for this going on, there are many issues that must be examined. Increasingly, the shadow of peri-implantitis looms like a spectre over the provision of implants.

Unlike caries or periodontal disease, there is very little consensus on how to treat it. More often than not, prosthetic solutions are implemented, looking for the signs of infection to resolve them, instead of addressing the root cause of the problem. This has led to the development of new treatment modalities, which can help restore implant health and prevent further progression.

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search that can provide a predictable cure for what now is a new breed of disease. Peri-implantitis is re-
lessent once established within fine threads of the implant, and the bone resorption and soft tissue problems that follow can result in spectacular problems. Part of the key issue prob-
ably lies in the surface exposed to the susceptible patient’s oral envi-
ronment, as most microbiologists will agree. The bacterial content and make-up of the biofilm is a reflec-
tion of the surface on which it re-
sides. Implant surfaces have become progressively rougher in order to hasten the early osseointegration processes and to try to provide pa-
tients with their restoration quicker in an ever more competitive finan-
cial environment.

However, speed is not always help-
ful. Experience shows that some things are better achieved gradually.

Once exposed to the environment of a susceptible patient, the macro-
topography of the threads provides an ideal ecological niche for bacterial proliferation. Further nano-level features make the implant surface a veritable inflammation super high
way for the pathogenic organ-
isms. Predictably enough, the micro-
organisms found on the rough surface are usually the common pathogenic ones, but also some species are found that have previ-
ously never been discovered in the oral cavity.

**Patient selection issues**

We need to consider the types of patients whom we are now accept-
ing for implant provision. At King’s College hospital, the criteria for state-
sponsored implant provision largely involve patients with hypodontia and those who have suffered trauma. Usually both cohorts are likely to present with well maintained, mish-
ally restored dentition with a scope for oral health improvement prior to considera-
tion for any restoration, let alone an implant. Unfortunately, we are unable to provide this treat-
ment for smokers.

This is in stark contrast to the patients who may be provided with implants in general and specialist practice, such as patients who are likely to have lost teeth as a result of plaque-associated diseases. Indeed, it could be considered a paradox by many interested obser-
vers that some clinicians are providing patients with a history of periodontitis and those with poor oral hygiene are well known to be at a very significantly higher risk of peri-implantitis.

**Ethical, moral and legal issues**

These problems become much more worrying when viewed from an ethical, valid consent and medico-
legal perspectives. This is particularly so when patients are convinced to undergo elective extractions of teeth that often seem reasonably intact or treatable with conventional proven treatment strategies.

It appears that there is a worrying drift towards aggressive treatment with extractions in order to provide a supposed full-mouth rehabilitation with multiple implants. The increas-
ingly dubious practice of sacrificing teeth for the sake of implants appears to many concerned clinicians to be quite irrational. As ethical oral health practitioners, deliberately removing saveable teeth for prophylactic treat-
ment using implants as support ap-
ppears to be consciously flying in the face of increasingly apparent evi-
dence of various complications with implants and many would consider that approach to be foolish. How many “implantologists” doing that to others would genuinely have it done to themselves or done to some close family member?

**Planned obsolescence**

A state-of-the-art implant today is likely to be obsolete tomorrow. Elec-
tively removing teeth is irreversible and replacing teeth with implant-
retained devices means that patients are trapped in the era of the implant-
tology in which these were placed and restored, that means issues of ma-
chinishing, surface blasting, roughness, platform switching, design and at-
tempts at bone augmentation by cow, coral or Californian substances. The list goes on and on and will prob-
ably continue to expand with what many might consider human exper-
imentation without licence.

Now comes the time for implant manufacturers to take stock of their many “market-driven” mistakes, in-
cluding fast initial integration with the roughest possible surfaces. Instead they need now to produce proven (i.e. not speculative) designs to better prevent the well-known problems of infection and breakage.

A wiser, pragmatic approach ap-
ppears to be to concentrate everyone’s efforts on saving teeth and thereby oke out their usefulness for the patient’s lifetime. Recently, Prof. Jan Lindhe, interviewed in the British Dental Journal, summarised the state of play as follows: “There is a reverse of implants in the world and an under-
use of teeth as targets for treatment.”

**Biological versus mechanical problems**

If we are being frank, the pathogenic bacteria-induced diseases are not the only long-term problem that we are now seeing. The reported frequency of mechanical complications has risen over the years, but the reported prob-
lems are probably only the tip of the iceberg, as many complications have not and will not be reported for a variety of understandable reasons.

Over time, the components of im-
plants have shown notable weak-
nesses. Screw loosening, fractured screws, loose abutments and the break-
ning of ceramic can be labourious and ex-
pensive to manage. One aspect, which may be lost on some, is that since they lack a periodontal ligament dental im-
plants cannot and will never be able to aclimatise to changing occlusal and non-axis forces. These are very likely to create stresses within the masticatory system, thereby resulting in breakages. These forces are compounded greatly if patients exhibit parafunction on a daily basis and that is sometimes an unknown risk factor until it is too late. The more implants that are placed, usu-
ally the fewer teeth are present, resulting in a net reduction in physical feed-
back and thereby creating an increased chance of failure of some type.
Managing patients with risk factors

By DTI

GILLINGHAM, UK/GOTHENBURG, Sweden:
Requests for shorter treatment times along with an increasing number of patients with risk factors place greater demands on dentists and technology. Correctly assessing osseointegration and implant stability is key in successful implant treatment. Using traditional methods such as torque and percussion tests are not suitable for monitoring osseointegration, it requires a more advanced diagnostic tool.

Gain insight from these esteemed periodontists on what they do to objectively and noninvasively identify which implants are ready to load and which ones need additional healing time.

Drs Pamela K. McClain and Rachel Schallhorn, both Diplomates of the American Board of Periodontology, have been using Osstell and the ISQ scale (Booth 43d) for a number of years now to measure primary implant stability and osseointegration.

“We are currently using Osstell when we place all implants to establish a baseline measurement of implant stability,” they say. “At the time of placement if the ISQ is too low (depending on the location—anything below 45) we will remove the fixture, possibly graft and then wait another 3–6 months before trying to place another fixture. We try to take the measurement on the buccal/lingual, mesial/distal aspects and record the highest and lowest values.”

McClain and Schallhorn add: “We typically recheck the ISQ value at three months. If the ISQ has improved (or is stable if the number was high to begin with—over 65) we will release the patient for restorative treatment. It gives us and the patient a more objective way to assess the implant stability. If it’s not ready at that time we continue to check every six weeks until the ISQ has improved or indicates stability.”

“Since we began using this device in 2009, our decision making process has become more simple and objective. We will continue to use the Osstell tool. Osstell use is critical for my implant practice. Every year, this device more than pays for itself as there are always several patients who heal slowly or who have implants placed with extremely low insertion torque. This confounds my ability to predict when healing has been adequate to proceed to the restorative phase. Osstell provides me with quantifiable information necessary to make informed decisions. No longer am I the villain who slows up patient care, but it is objective data about the patient’s healing that becomes the determining factor.”

According to Straumann, THE REVU continues to keep us at the forefront of Dentistry in Philadelphia, USA, also explains below why Osstell is important in his practice.

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THE REVU

launched by Straumann

By DTI

CRAWLEY, UK: To facilitate online communication within the implant industry, Straumann has recently launched a new digital hub for dental professionals in the UK and Ireland. With a look of a stylish digital magazine, the THE REVU platform will feature news and clinical cases, among other content covering everything from the dentistry industry and marketing to business and education.

According to Straumann, THE REVU is taking an original approach to blogging and video blogging (vlogging), delivering the perfect combination of branded and non-branded editorial and video content. The platform will launch with interactive questions and answers, scientific reviews and an inside look into one clinician’s journey into implants. It will tell a different story every day by bringing new and informative content to the forefront in a clear and simple manner.

“Our aim is to build an online community that embraces not just our company values, but all dental professionals connected with implant dentistry too,” he commented at the launch.

“The launch of THE REVU is a fantastic opportunity to transform the way we communicate online. Our aim is to build an online community that embraces not just our company values, but all dental professionals connected with implant dentistry too,” he commented at the launch.

“Taking the leap into digital is courageous, but one which we feel continues to keep us at the forefront of both our and our customers’ marketing activities.”

Dental professionals can access the site via their computer, laptop or mobile device at www.therevu.co.uk.

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Peri-implantitis: Is it a crisis?

By Dr Michael R. Norton, UK

In the US over 500,000 implants are placed each year, whilst in the UK that figure was around 140,000 for 2010. The prevalence of peri-implantitis has been reported to be up to 29 percent most notably in patients whose implants are placed within a partial dentition. This yields a potentially vast number of implants, possibly as many as 115,000 in the US and UK alone that might succumb to some form of peri-implant disease on an annual basis.

The bacteria found within peri-implant lesions are similar to those found in deeper periodontal pockets, and cross infection by periodontopathogens as a primary aetiology has been implicated as a possible pathway. However the wide variety of implant designs, surfaces etc. make the treatment of peri-implantitis much less predictable and subject to much greater variability than periodontal disease, where natural teeth present a known anatomy and well defined surface structure.

In 2008 a systematic review of the literature regarding peri-implantitis using PubMed and the Cochrane library revealed little consensus on the treatment of this troublesome condition. One study reported on the efficacy of sub-mucosal debridement using ultrasonic or carbon fibre curettes, while two others compared the effect of an Er:YAG laser against mechanical debridement using fibre curettes. However once peri-implantitis is established, it may become impossible to arrest the condition, leading to wholesale failure of the case (Fig. 1 & 2). Such failures impose a tremendous strain and burden on the clinician (let alone the patient), destroying the confidence of a patient who has endured significant expense and trauma and occasionally results in a breakdown of communication between both parties that all too often results in a legal claim of negligence. Such claims can be hard to defend for patients where no warnings and/or supportive periodontal peri-implant therapy have been undertaken.

The first found similar results between laser and combined therapies, while the second concluded that the laser effect was limited to a six month period. A further study compared combinations of oral hygiene instruction, mechanical debridement and topical minocycline with a similar regime which did not show statistically significant results. However this has been a consistently cited risk factor in many other studies. Indeed a study published in the Swedish Dental Journal in 2010, the percentage of implants with peri-implantitis was significantly increased for smokers compared to non-smokers (p < 0.04).

Other factors that have been implicated include excess cement, poor oral hygiene, and prosthesis design which are of course interrelated with some prostheses making effective oral hygiene untenable, while others present deep margins that make removal of excess cement almost impossible.

The protocol is as follows:
1. Mechanical scaling of implant surface with titanium or carbon fibre curettes.
2. Sub-mucosal irrigation with 5–10 ml chlorhexidine (0.2 %) per site, at the deepest level of the pocket on all sides of the implant.
3. Application of Minocycline Gel 2 % (Dentomycin, Henry Schein Ltd) at the deepest level of the pocket on all sides of the implant.

Warning signals
- Peri-implantitis rarely presents unannounced unless of course the patient fails to be placed on a regular recall programme or fails to attend for regular review. Early signs are often apparent in the form of peri-implant mucositis. This condition is characterised by mucosal oedema, rubor and bleeding on probing (ROP). By definition it is not associated with purulence or bone loss. However once peri-implant mucositis has taken hold it is unfortunate that it is often exacerbated by the design of implants today. The presence of a rough surface, taken to the top of an implant, and the application of microthreads or grooves have been proposed as potential confounding factors for the advance of the lesion due to biofilm formation and bacterial contamination of the surface which leads to bone loss and further surface exposure. With advancing bone loss it often results in colisation of the deeper pockets with well known periodontopathogens and infection ensues. This then is peri-implantitis.

Peri-implantitis is characterised by the presence of vertical crater-like bone defects and spontaneous purulence and bleeding on palpation (Figs. 1 & 2). It is typically associated with deep peri-implant pocketing > 3mm.

This condition is undoubtedly of increasing concern due to some principle factors, such as the almost exclusive use of roughened implant surfaces, the treatment of partially dentate patients with a history of periodontal disease, the placement of implants with inadequate bone volume resulting in facial dehiscences, as well as the use of cement retained prostheses.

Implants with a micro-roughened surface texture have presented excellent long-term data and until recently there has been very little published in the literature demonstrating a susceptibility of these surfaces to this condition. However recent work by Alhousi et al.15, 16 has received widespread attention with concern for the evidence that suggests some modern micro-textured surfaces may be completely resistant to decontamination.

Ultimately, if left unchecked and unattended, it may become impossible to arrest the condition, leading to wholesale failure of the case (Fig. 1 & 2). Such failures impose a tremendous strain and burden on the clinician (let alone the patient), destroying the confidence of a patient who has endured significant expense and trauma and occasionally results in a breakdown of communication between both parties that all too often results in a legal claim of negligence. Such claims can be hard to defend for patients where no warnings and/or supportive periodontal peri-implant therapy have been undertaken.

**Risk factors**
- Poor oral hygiene
- Prosthesis design
- Implant surface texture
- Implant position
- Implant material
- Prosthesis design
- Prosthesis type
- Periodontal condition
- Systemic factors
- Smoking

**Warning signals**
- Mucosal oedema
- Rubor
- Bleeding on probing (ROP)

**Surveillance**
- Regular recall programme
- ROP screening
- Peri-implantitis screening

**Treatment**
- Mechanical debridement
- Sub-mucosal debridement
- Antimicrobial therapy

**Conclusion**
- Peri-implantitis is a serious condition that requires early detection and appropriate treatment.
Open flap debridement, defect decontamination, and repair as well as pocket elimination have all become the mainstay of those treating this condition.

So is there a crisis? The problem is that there is no clear consensus on the prevalence of the disease since this will vary according to the cut off values for the clinical parameters measured and there appears to have been little consensus on these cut off values. As such estimates of incidence of the disease appear to vary from 28 to 56 per cent of subjects and 12 to 43 per cent of implant sites.

Furthermore there is an ongoing controversy about the initiating process of peri-implant disease since it is potentially considered a primary infection of periodontopathic origin by some while others hold that it is a secondary opportunistic infection subsequent to bone loss caused by other etiological factors such as a provoked foreign body reaction or iatrogenic dehiscence of the bone, exogenous irritants such as dental cement, bone loss through occlusal overload etc. If the latter is true then controlling the disease is theoretically made more simple by controlling the conditions for the implant, such as ensuring adequate buccal bone thickness, avoiding or controlling more carefully the use of dental cement, and paying closer attention to the occlusion.

In an effort to gauge the rate of mucositis and peri-implantitis requiring surgical intervention, the author audited his patient pool in the year 2014. Out of a total of 191 patient reviews constituting 795 implants only 15 patients (7.9 per cent) required triple therapy at 20 implants (2.5 per cent) for mucositis while 10 patients (5.2 per cent) required surgical decontamination at 10 implants (1.3 per cent).

As can be seen this is well below the figures proposed in the article by Zitzmann & Berglundh (2005). This may of course reflect a more liberal approach to cut off values for parameters such as pocket depth and bleeding on probing as proposed Klinge in 2012.

Nonetheless after over 20 years running a practice dedicated to implant dentistry the author’s own audited failure rates indicate that less than 1 per cent of implants present as late failures, owing to peri-implantitis or fixture fracture as a result of bone loss. This would corroborate the findings by Jemt et al in which a cohort of patients already diagnosed with peri-implant bone loss showed a slow rate of additional progressive bone loss over a 9-year follow-up with an implant failure rate of 0.1 per cent.

In all likelihood it is the author’s view that peri-implantitis is only a crisis if we allow bad implant dentistry to persist where there is a lack of control of the initiating factors as described above, and that it is more rather than less likely that it is the result of a secondary opportunistic infection rather than a direct susceptibility to primary infection of periodontopathic origin. However there will clearly be some patients with a high genetic susceptibility with other predisposing factors such as the presence of untreated periodontal disease, smoking and diabetes who may succumb as a result of primary infection.

Furthermore there remains a clear need to better define the different types of peri-implant disease and to establish a consensus as to the cut off values for the different parameters used to evaluate the disease so that future figures for incidence and prevalence are comparable.
Making implantology affordable

Controlling costs and increasing access to dental implant treatment

By Dr Tuss Tambra, UK

Implant dentistry is an elective restorative treatment solution with a surgical component and a prosthodontic component. If properly executed, it is one of the most successful and clinically researched treatment modalities in dentistry. Unfortunately, patients who are not disease-free or being treated with dental implants and, as a result, the litigation rate has risen sharply.

A success rate of 98 per cent is almost universally claimed when promoting implant dentistry to patients. So, if implant dentistry is 98 per cent successful, then why are more cases failing and why is litigation increasing? Lack of proper training, poor treatment planning and poor execution (surgical and restorative) are undoubtedly the main culprits. If a clinician has the appropriate surgical and restorative training in dental implantology, does the brand of dental implant used make a clinically significant difference to the success rate? Does paying more for the implant and restorative treatment necessarily mean better results? Why is there an issue?

Price should generally not present access to high-quality, well-researched and effective dental treatment. However, the current pricing structure in implantology means that a huge proportion of patients do not have the disposable income to cover the cost of such treatment. The McCull study demonstrated the numerous benefits (functional, clinical, psychological and general health) for dentate patients. In whom 98 per cent are claimed to succeed in dental implants, patients expect high-quality, safe and affordable treatment. For this to happen, clinicians need to source products at a reasonable price point, passing on these savings directly to the patient, reducing overheads and treatment charges and, therefore, increasing access to treatment. Some of the benefits that clinicians have already felt the impact of the loss of market share and have either bought out competitors, created joint ventures or incorporated competing products into their product lines.

How can this situation be changed to allow more potential patients to access dental implant treatment? First, clinicians could significantly reduce fees charged to patients. This could happen if the component and laboratory costs are reduced, with the dentist passing the savings on to the patient. Another option is that dental implant companies reduce the prices of both implants and restorative components. According to the industry, however, prices across the industry are already competitive and companies need to cover their business costs.

Is there an alternative to the above? Clinicians cannot reduce charges without assistance from the dental implant companies and all dental implant companies are private businesses with shareholders who want to produce products (implants) that benefit society and see some return on their investment in terms of profit generation.

Economic drivers

Market forces must come to bear in dentistry. In the current global economic climate, ignoring the financial implications of the decisions we make is no longer an option. Patients expect high-quality, safe and affordable treatment. For this to happen, clinicians need to source products at a reasonable price point, passing on these savings directly to the patient, reducing overheads and treatment charges and, therefore, increasing access to treatment. Some of the benefits that clinicians have already felt the impact of the loss of market share and have either bought out competitors, created joint ventures or incorporated competing products into their product lines.

Do smaller implant providers offer potential benefits? One is certainly their ability to respond more quickly to increased patient expectations of treatment. The rapid expansion of digital dentistry, CAD/CAM technology and intra-oral scanning is resulting in smaller companies being able to provide implants with a total, open-source guided surgery and restorative solution. With larger companies, the ability to change direction is much more difficult and time-consuming, turning an oil tanker takes more time than a dinghy.

Key points of consideration when reviewing a new implant system

Globally, all medical and dental products undergo strict vetting procedures to ensure patient safety, including product durability testing, animal studies, human trials and testing at universities. They are then required to obtain a CE mark, FDA approval or some other approval to allow the products to be used in clinical dentistry. In short, once a product has a CE/ FDA mark, it meets all the necessary testing and patient safety requirements to be used on humans.

A clone done connection implant can thus be restored with a high-end restorative component provided by another implant company using patent-free connections by open-source milling centres that can provide these components for significantly lower costs. One caveat with open-source milling is to check the quality of the milling provided in order to avoid the complications that arise from poorly fitting restorations.

Systems like the ICX now provide non-precious metal blanks with pre-milled implant connection interfaces and ceramic blanks bonded to adhesive base components. It is a per-made titanium implant connection that is bonded to the all-ceramic block. It is the milling of the implant connection interface that is the most vital part of the process, so if an open-source centre can produce pre-milled connection blanks, then its work is much reduced and the dentist can be rest assured of a high-quality component with an accurate fit. The benefit of adhesive bases in all-ceramic work is the improved strength of the connection and reduced fracture rates compared with all-ceramic abutments.

Is using one of the clone connections listed above an issue? All these connections function with excellent long-term, clinically documented results. The key factor for success is the closeness of fit between the internal/external implant connection and the mating surface of the abutment, also called the micro-gap. This produces a stable, rigid connection with no abutment movement under loading. A stable implant-abutment interface combined with platform switching is the key to bone preservation around the neck of the implant and avoiding screw loosening.

How can one most easily compare multiple connection platforms in a simple and easy to understand way without needing a degree in mechanical engineering? Engineer Holger Zipprich from Goethe University Frankfurt's dental school in Germany has produced real-time videos of
several implant–abutment interface responses to loading that are available on the market. These have been reviewed, a rational decision as to which connections are more stable (rigid) under loading can be reached and this information then applied to selecting an implant system.

Does the system offer a wide range of prosthetic, CAD/CAM and guided surgery solutions for dental implant treatment? Once a dental implant system has gained some degree of market penetration (or traction) and has documented evidence to support its clinical effectiveness, it is worth-while taking an unbiased view of the system. Hopefully, most glitches would have been identified and corrected by the early adopters, thus reducing the risks for the more cautious clinicians.

A personal recommendation is to focus on the restorative aspects first (restoratively driven treatment). Questions to be asked include whether the system has a broad range of components, whether the treatment needs in implant dentistry, CAD/CAM based treatment solutions and a guiding technique are available. It is the sur- gical placement of dental implants. If you are impressed by what you see, then place a few implants and mo- nitor them closely. If the treatment outcomes are successful and you have a positive impression of the system, then there is no reason that you should not add a cost- effective solution to your implant portfolio.

What impact does the macro-geometry (implant shape) and micro-geometry (surface treatment) have in relation to long- term success? The surface treatments applied to var- ious implant systems are designed to improve the degree of osseointegration and bone-implant contact. This is extremely impor- tant for the long term preservation of implants. Smooth or machined surfaces, clinically show reduced levels of osseointe- gration, so the current thinking seems to be that micro-roughened surfaces provide the optimum sur- face for osseointegration.

An affordable implant solution

The low-cost system that will be used here for comparison is the ICX system from the Fraunhofer Institute in Mainz, which also contributed to this article. Here for comparison is the ICX system since it has been viewed, a rational decision as to which connections are more stable (rigid) under loading can be reached and this information then applied to selecting an implant system.

Does the implant system offer a wide range of prosthetic, CAD/CAM and guided surgery solutions for dental implant treatment? Once a dental implant system has gained some degree of market penetration (or traction) and has documented evidence to support its clinical effectiveness, it is worth-while taking an unbiased view of the system. Hopefully, most glitches would have been identified and corrected by the early adopters, thus reducing the risks for the more cautious clinicians.

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The low-cost system that will be used here for comparison is the ICX system from the Fraunhofer Institute in Mainz, which also contributed to this article. Here for comparison is the ICX system since it has been viewed, a rational decision as to which connections are more stable (rigid) under loading can be reached and this information then applied to selecting an implant system.
The glass hybrid revolution

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