Dental implantology: Evolution or the road to ruin?

By Aws 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 professional maintenance.

Despite these very significant improvements, there are still instances where 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 reveal 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 pursue innovation of some sort of change to help gain greater market share or profit. The over-commercialization 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 where the real reasons are that this was and is happening need to 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 or agreement. As a result, there is a constant turnover of supposedly new and better products.
search that can provide a predictable cure for what now is a new breed of disease. Peri-implantitis is relentless 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 probably lies in the surface exposed to the susceptible patient’s oral environment, as most microbiologists will agree. The bacterial content and make-up of the biofilm is a reflection of the surface on which it resides. Implant surfaces have become progressively rougher in order to hasten the early osseointegration processes and to try to provide patients with their restoration quicker in an ever more competitive financial environment.

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

Once exposed to the environment of a susceptible patient, the macrotopography of the threads provides an ideal ecological niche for bacterial proliferation. Further nano-level features make the implant surface a veritable inflammation superhighway for the pathogenic organisms. Predictably enough, the microorganisms found on the rough surface are usually the common pathogenic ones, but also some species are found that have previously never been discovered in the oral cavity.

**Patient selection issues**

We need to consider the types of patients whom we are now accepting 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, medically restored dentitions with scope for oral health improvement prior to consideration for any restoration, let alone an implant. Unfortunately, we are unable to provide this treatment 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 disease. Indeed, it could be considered a paradox by many interested observers that some clinicians are providing patients with implant restoration when they have shown that they are highly prone to plaque-associated disease via tooth loss and have not demonstrated any real capacity for changing that. Patients who smoke, those 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.

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 problems 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 implants have shown notable weaknesses. Screw loosening, fractured screws, loose abutments and the wearing out of ceramic lab crowns has been an issue over the years, but the reported problems are probably only the tip of the iceberg. Many complications have not and will not be reported for a variety of understandable reasons.

**Ethical, moral and legal issues**

These problems become much more worrying when viewed from ethical, valid consent and medicolegal 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 increasingly 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 savable teeth for prophylactic treatment using implants as support appears to be consciously flying in the face of increasingly apparent evidence 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. Electively removing teeth is irreversible and replacing teeth with implant-retained devices means that patients are trapped in the era of the implantology in which these were placed and restored, that means issues of machining, surface roughness, thickness, platform switching, design and attempts at bone augmentation by cone, coral or Californian substances. The list goes on and on and will probably continue to expand with what might many consider human experimentation without licence.

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

A wiser, pragmatic approach appears to be to concentrate everyone’s efforts on saving teeth and thereby eke out their usefulness for the patient’s lifetime. Recently, very Prof. Jan Lindhe, interviewed in the British Dental Journal, summarised the state of play as follows: “There is an overuse of implants in the world and an under-utilisation of play as follows: “There is an overuse of implants in the world and an under-utilisation of play as follows: “There is an overuse of implants in the world and an under-utilisation of play as follows: “There is an overuse of implants in the world and an under-utilisation of orthodontic treatment strategies.

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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 recheck 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 value to help guide treatment decisions and as a communication tool with our referring dentists.”

Dr Paul Rosen, Clinical Professor of Periodontology & Oral Implantology Temple University Kornberg School of Dentistry in Philadelphia, USA, also explains below why Osstell is important in his practice.

“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 quantitave 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.”

THE REVU

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 continuous 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 185,000 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 that of mechanical debridement and 2% chlorhexidine as a combined therapy.

The first found similar results between laser and combined therapy, 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 substituted 1% chlorhexidine as the antimicrobial. The former seemed to confer some benefit whereas the latter showed limited or no clinical improvements. Finally, a study comparing two bone regeneration procedures reported clinically significant improvements mediated by both.

Nonetheless a multitude of other studies have also been published reporting on the efficacy of tetracycline, CO2 laser, and photodynamic decontamination amongst others in the treatment of peri-implantitis. Such a plethora of therapies makes it difficult for yet this has been a consistently cited risk factor in many other studies. Indeed in 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 inter-related with some prostheses making effective oral hygiene untenable, while others present deep margins that make removal of excess cement almost impossible.

Risk factors

There have been a number of risk factors cited for peri-implantitis. Recently, in a study published in the Journal of Clinical Periodontology, a clear association was demonstrated through multi-level statistical analysis between risk of peri-implantitis and location, specifically the maxilla whereas over peri-implantitis was shown to be highly correlated to patients with a predisposing history of periodontitis, and being male. Surprisingly in this particular study no correlation was demonstrated with smoking.

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 (BOP). By definition it is not associated with purulence or bone loss. However once peri-implant mucositis has taken hold it is unfortunately 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 colonisation of the deeper pockets with well known periodontopathogens and infection ensues. This then is peri-implantitis.

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 Alhooy et al.15 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 untreated, it may become impossible to arrest the condition, leading to wholesale failure of the case (Fig. 4 A-D). 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 sadly results in a legal claim of negligence. Such claims can be hard to defend for patients where no warnings and/or supportive periodic/peri-implant therapy have been undertaken.

Trends in treatment

Treatment typically requires surgical access to excise any fibrous capsule and for direct access to the implant for surface decontamination. The author’s preference until now has been to use chlorhexidine and tetracycline solution for this purpose while others have reported the use of citric acid and hydrogen peroxide amongst others.13 The use of lasers has also been extensively reported. However in a recent systematic review a meta-analysis could only be done for Er:YAG laser as the literature on all other laser types was weak or heterogeneous.

The author has recently completed the acquisition and treatment of 20 patients in an efficacy study using Er:YAG water laser (Morita, AdvErl Evo) and it is hoped that publication of the results will be forthcoming. Indeed promising data has already been published to date using this same machine. Nonetheless this methodology remains out of the reach of most general practitioners and has yet to be proven predictably effective. As such most attention therefore remains focussed on the conservative management via surgical intervention and topical antimicrobial therapies.
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 it 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 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 0.5 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 dental 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 component necessarily provide better results? Why is price an issue?

Price should generally not prevent 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 McGill study demonstrated the numerous benefits (functional, clinical, psychological and general health) for dentulous patients in whom dental implants were used to stabilize complete dentures. The improvements in chewing efficiency, general health resulting from an improved diet and general well-being (more social interaction owing to a lack of fear of teeth falling out) show the significant impact dental implants make in society as a whole.

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 can 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, allowing overheads and treatment charges and, therefore, increasing access to treatment. Some of the pres-tige implant companies 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 able to provide dental 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. However, if competitive products are on the market, why are there not moremade?

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/MDR mark, it meets all the necessary testing and patient safety requirements to be used on humans.

All CE/MDR-marked systems meet the same standard whether affordable or prestige brands.

The next step is to assess all clinically relevant criteria. Since there are more than 1,300 dental implant systems available, clinicians need to assess all available clinical and scientific data and test the validity of various claims made by dental implant companies. If checking for certification/approval is the first step for a clinician, then the second should be establishing how future proof the new implant is. In the early days of implantology, dozens of companies started trading and most of them closed in a relatively short period. For early adopters of those systems, the risk was not being able to restore or maintain such systems, as parts were no longer available. Therefore, as an agemoral dentist, one should verify the length of time for which the system has been on the market, who the parent company is and what the connection interface is (is it a clone system of a well-known implant that is no longer in patent?). In simple terms, if the company ceases to trade, can I still source components and maintain my patients?

Implant-specific considerations

A significant proportion of connection options (internal hex, external hex, Morse taper and conical connections) are no longer in patent. The clinical research on these has already been done and these connections have been well documented in a multitude of studies. As a result, most affordable implant systems are adopting these non-patented connections rather than developing their own, meaning that prosthetic components are cross-compatible with other similar systems.

A clone 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 ICK now provide non-precious metal blanks with pre-milled implant connection interfaces and ceramic blanks bonded to adhesive bases. It is a pre-milled 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 obtain a pre-milled connection blank, 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 YouTube. These have been viewed, a rational decision as to which connections are more stable (rigid or flexible). Magellan can also be used to monitor the results. The implant will therefore allow the implant trade association interface that is platform switched. The implant was previously used to describe the implant. The implant was previously used to describe the implant. The implant was previously used to describe the implant. The implant was previously used to describe the implant.

An affordable implant solution

The low-cost system that will be used here for comparison is the ICX system from Medentis in Germany. On the market for several years and well known in Europe, it has recently arrived in the UK as part of the company’s global expansion. All of its research has been conducted and validated by several prestigious institutions, adding weight to the product, including the Fraunhofer Institute, which conducted durability testing, as well as universities in Cologne, Aachen and Mainz, which also contributed with clinical research. The Robert Mathys Institute in Bettlach in Switzerland has been involved with both surgical and restorative components for ICX and other brands of implant systems. The Fraunhofer Institute for Microelectronics in Bremen and Mainz, which also contributed with clinical research, has also been involved with both surgical and restorative components for ICX and other brands of implant systems.

How does the implant fare when tested in laboratory against the prestige systems? The Fraunhofer Institute conducted durability (ISO 4680/1) tests (Figs. 3a & b) on several implant systems, including Straumann Bone Level implants. These tests showed that the ICX implant was more fatigue resistant than all of the implants tested (Figs. 3a & b). Thus, the implant has a durable, fatigue-resistant connection interface.

The implant–abutment interface

How stable is the connection when viewed in terms of closeness of fit the micro-gap between the implant and the abutment? The Osteo-Implantologie in 2007, Berlin dentist Dr Stefan Wolf Schermer examined the micro-gap between the abutment and the dental implant connection interface of several systems and showed that ICX implants showed more micro-gap when compared with the final prosthetic screw included. With some systems, the final screw is not completely seated correctly (i.e., peripherally). ICX also has abespoke CBCT guided surgery solution called Megal- lan that is also multi-implant system approved. The system has a broad range of components for the various treatment needs in implant dentistry, CAD/CAM-based treatment solutions and a guiding system for surgical placement of dental implants. If you are impressed by what you see, then place a few implants and monitor 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 various implant systems are designed to improve the degree of osseointegration and bone-implant contact. This is extremely important for the long-term preservation of hard and soft tissues. Smooth or machined surfaces clinically show reduced levels of osseointegration, so the current thinking seems to be that micro-roughened surfaces provide the optimum surface for osseointegration.

When considering an implant solution, the trade-off at the total system costs involved with both surgical and restorative components can reduce the overall cost to the patient. The table shows a price comparison of the ICX dental implant system against multiple implant systems both prestige brands and cost-effective systems based on 2013 costs in the UK. In terms of cost and product content, the ICXimplant seems to provide an effective implant solution for patients.

How does one follow conventional delayed loading protocols, then the surface treatment, as well as the macro-geometry and connection stability, will affect long-term success. Do the longer-prestige dental implant brands provide dental implants with the most ideal thread designs, best primary stability, and highest tolerances of fit of abutments and frameworks, or do the various surface treatments have a clinically significant improvement in long-term success when compared with a so-called budget brand? Again, no real cross-comparison research exists. The surface roughness of the dental implant is also of vital importance, as research has found increased peri-implantitis associated with micro-roughened surfaces. Some of these surfaces clinically show reduced levels of osseointegration, so the current thinking seems to be that micro-roughened surfaces provide the optimum surface for osseointegration. How is research important, as research has found increased peri-implantitis associated with micro-roughened surfaces. Some of these surfaces clinically show reduced levels of osseointegration, so the current thinking seems to be that micro-roughened surfaces provide the optimum surface for osseointegration.
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