Implants

The key to successful implant dentistry is planning and predictability

There can be few techniques that have had such a fundamental impact upon restorative dentistry and prosthodontics than osseointegrated implants. It is no great surprise that implants are impacting on the dento-legal front as well.

Notably, in terms of problems arising from the provision of implants, but also due to the fact that implants are increasingly being proposed as alternatives to bridgework or dentures as remedial treatment in negligence claims arising from the loss of one or more teeth. This can often drive up the amount of damages claimed by patients, although there is room for doubt that many of the patients receiving these damages ever proceed with the implants that have been proposed for them.

An analysis of the factors that result in negligence claims against dentists relating to implant dentistry (Fig. A) reveals that most of the problems arise from shortfalls in the preliminary stages (ie, patient selection, case assessment, investigations, diagnosis, treatment planning and consent) rather than the treatment itself.

Indeed, many of the problems that result from the procedures themselves can also be traced back to deficiencies in the case assessment and treatment planning stages. Let us now examine some of these issues in more detail.

Preliminary Considerations

Training

A number of Dental Boards and Dental Councils around the world have expressed their concern that dentists sometimes get involved in implant procedures without having sufficient knowledge, understanding, training and experience to undertake these procedures safely and to an acceptable standard. Furthermore, this same allegation sometimes features in negligence claims as an alleged breach of a dentist’s duty of care. Of particular concern is the short training course that is promoted, organised and conducted by those companies and individuals who have a direct commercial interest in expanding the number of dentists who are carrying out these procedures.

Approaching the Treatment

Patient selection

Not every patient who might seem, at first sight, likely to benefit from implants is going to be a suitable candidate for their provision. A number of risk factors (medical, social and psychological) have been identified in the literature, which have the potential to undermine the prognosis for implant dentistry; all of these need to be carefully considered. The provision of implant-supported restorations may be a last-ditch effort to avert the prospect of becoming edentulous and needing to wear complete dentures. On these occasions it is relevant to look back at the factors that led to the patient being in this situation. These might relate to oral hygiene and patient cooperation, to the patient’s medical history and to a range of other host factors and tissue response generally.

Fig. 1

Fig. A

Fig. B

Problem areas with implants

When do things go wrong?

- Case assessment/investigations/consent
- Unsatisfactory aesthetics/function
- Implant failure (biological causes or system design)
- Collateral damage
- Other

- Surgical phase
- Joint responsibility
- Restorative phase
- Other issues

Fig. 1

Fig. A

Fig. B

27% 22%
28% 14% 9% 34% 36% 27%
3%
The selection of an appropriate implant system, with a suitable weight of published research evidence to support its use, is essential. Beware of the “copycat” implant system that adopts some of the principles of various other systems, while having no independent research evidence of its own. The credibility of such a system is easily challenged, and this can raise questions of consent unless it has been made entirely clear to the patient, prior to treatment, that the proposed implant system is relatively unproven and/or experimental.

Investigations
This is a critically important stage in the preliminary assessment of any case that involves implants. A detailed assessment of the hard and soft tissue would normally be accompanied by study models, photographs, radiographs and, if appropriate, cephalometric views, CT scans and 3-D reconstructions. It is essential to confirm that any implant fixture can be placed without damage to adjacent structures, and with sufficient bone available. Bone mapping allows a three-dimensional assessment of proposed implant sites to be made, although the quality of the bone in the proposed site may not be fully determined until the time of operation.

Where bone harvesting (or bone grafting) is necessary for a ridge augmentation, or for bone grafting) is necessary for the proposed implant sites to be made, although the quality of the bone in the proposed site may not be fully determined until the time of operation.

Consent
It is important to explain to the patient the likely nature of the procedure, any potential risks and complications, and the benefits the proposed treatment is intended to provide. Consent to treatment is essential, and the patient must be given the opportunity to consider any alternative options. To support this process, the clinician should discuss with the patient the likely appearance and function of the completed restoration, whether this is fixed or removable. The patient must be in a position to appreciate the final result at first hand, it is often too late to make any commitments to changes. Any treatment must be given to the patient in a manner that is appropriate to their age, culture and educational background.

Record keeping
The dental record provides a detailed account of the treatment provided, the conditions at the time of treatment, and the progress of the patient. It should be kept up to date, clear and accurate. It should be stored in a secure and confidential manner. The dental record is an essential part of the patient’s medical history and should be kept for at least 7 years after the date of the last treatment. It is important to keep a record of any patient who has a history of allergies, as this information may be useful in the future.

Summary
There has been a steady increase in the provision of implants. It appears that they are being placed in more clinical situations, by more clinicians than ever before. Not all of these clinicians can demonstrate that they have received adequate formal training and supervision, and have sufficient technical knowledge and experience, to carry out these procedures safely and successfully. This factor causes great concern for the future. Furthermore, our patients are living longer and the fast-evolving science and technology of implant dentistry is perhaps leading some clinicians into this field who might otherwise have been prepared to refer their patients on to more experienced colleagues. While this increased clinical ambition is understandable, it is important for dentists to be aware that this is a potentially high-risk field for the inexperienced. In the longer term, the greatest threats to patients may well come not from negligence claims, but from the activities of regulatory bodies around the world. These organizations are becoming increasingly intolerant of dentists, and also of dentists who show an apparent disregard for their responsibilities to patients and the public. As a result, we are now seeing an increasing number of complaints against practitioners undertaking procedures for which they are not sufficiently skilled and trained.

Contact Info

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Bone is formed by osteoblasts derived from uncommitted mesenchymal stem cells. After implant surgery the biomaterial surface is populated by these progenitor cells and eventually bone is formed directly along the surface. Astra Tech embarked on a research program to define a method of modifying the TiOblast™ surface to support even more rapid bone formation by the implant surfaceadherent cell. The discovery that ionic fluoride modification of the TiOblast™ surface improved the bone-to-implant interface resulted in an intensive research program and development of an improved dental implant surface, namely the OsseoSpeed™ surface.

Clinical challenges to osseointegration

Today, there are indications for dental implants that challenge osseointegration’s success, including type IV bone, implant placement in extraction sockets, and immediate loading of dental implants. Further improvement in the rate and the amount of bone formation at implants may overcome these clinical challenges. OsseoSpeed™ has the potential to provide these improvements.

Studies confirm greater osteoblast differentiation

One way to examine the role of an implant surface in bone formation is to measure stem cell differentiation to osteoblasts in the cell culture laboratory, as Professor Cooper did at the University of North Carolina. When human mesenchymal stem cells were cultured on TiOblast™ surfaces modified with ionic fluoride, the rate and extent of osteoblast differentiation was greater than on the same surface without fluoride modification. An excellent indicator of osteoblast differentiation is the increased level of Bone Sialoprotein (BSP). Measurement of BSP after 14 days revealed that three times more BSP was made by cells grown on fluoride-modified surfaces than on unmodified ones. This important initial finding was reproduced in three different independent experimental models. The tests were carried out completely ‘blind’ on the samples sent from Astra Tech in Sweden. “I wanted to know what they were sending me, but I was told that the whole procedure had to be kept completely blind,” says Professor Cooper. “They were not going to tell me anything until we had finished.”
Positive effects on adherent stem cells

Additional details of the OsseoSpeed™ surface’s effect on the adherent stem cell have recently emerged. For example, human mesenchymal stem cells produced 2.5 times more of the key regulator for osteogenesis (chaf1) when they were grown for only one day on OsseoSpeed™ compared with TiOblast™. More information from genome wide microarray analysis of the adherent cells’ behavior indicates that specific signal transduction pathways important to cell proliferation and differentiation are upregulated within the OsseoSpeed™ adherent cell. Microarray analysis comparing cells cultured on the TiOblast™ and fluoride-modified surfaces showed the presence of a number of key ‘enabler’ genes that play an important role in osteogenesis.

Professor Cooper says he is excited about the new opportunities that OsseoSpeed™ can provide for clinicians. The clear conclusion from his work is that the implant surface can be an active component of clinical success. A relatively small, but effective fluoride modification of the TiOblast™ surface is associated with greater osteoblast differentiation of adherent mesenchymal stem cells as well as increased bone-implant contact in vivo. The advantages of more rapid and greater bone formation around dental implants may be clinically realized.

Summary

To examine the role of an implant surface in bone formation, Professor Cooper measured stem cell differentiation to osteoblasts in the cell culture laboratory. When human mesenchymal stem cells were cultured on TiOblast™ surfaces modified with ionic fluoride, the rate and extent of osteoblast differentiation was greater than on the same surface without fluoride modification. In fact, measurement of Bone Sialoprotein (BSP) after 14 days revealed that three times more BSP was made by cells grown on fluoride-modified surfaces than on unmodified ones. In addition, micro array analysis comparing cells cultured on the TiOblast™ and fluoride-modified surfaces showed the presence of a number of key ‘enabler’ genes that play an important role in osteogenesis.

‘Human stem cell and molecular research shows there is a bioactive process at work when the OsseoSpeed™ surface is in contact with human bone tissue,’ says Professor Lyndon Cooper, at the Department of Prosthodontics, University of North Carolina, USA.

In vivo tests confirm in vitro findings

Having established in vitro that the fluoride-modified TiOblast™ surfaces accelerated the process of osteogenesis, Professor Cooper then conducted in vivo tests to investigate if this would also be reflected in a greater bone-implant contact area. The surfaces used in the stem cell research were supplied in implant form and fixed in rat tibiae. The results were consistent with the in vitro findings: after three weeks, it was found that the OsseoSpeed™ surfaces that had stimulated the highest levels of BSP also produced a greater bone-implant area of contact (55.45% vs 34.21%) at the early 3-week point in time. The parallel cell culture studies suggest this effect is due to surface modification-dependent increases in adherent cell osteogenesis.

Exciting clinical opportunities

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Results from in vivo studies are consistent with the in vitro findings.

Interviewed:

Professor Lyndon F. Cooper, DDS, PhD, Department of Prosthodontics, University of North Carolina, School of Dentistry, North Carolina, USA
The truth is out there—looking for the evidence behind bone regeneration

By Anthony Bendkowski oral surgeon and president of the Association of Dental Implantology (UK)

I t is widely recognised that one of the key factors contributing to the long term success of dental implants is the quantity and quality of supporting bone. When undertaking implant surgery we are frequently faced with defects in the bone that are a consequence of previous underlying periodontal disease, infection or the trauma associated with the preceding extractions.

Even a minor bony defect can be a significant barrier where the correct placement of implants is concerned. Without appropriate bone support there is often less than optimal soft tissue profile and consequential compromise in the aesthetic outcome. As clinicians, we are fortunate that bone has a unique potential for regeneration without compromise in the aesthetic outcome. As clinicians, we are fortunate. Without appropriate bone support there is often less than optimal soft tissue profile and consequent compromise in the aesthetic outcome.

The vascular and mechanical considerations are important, as is the need for contact with underlying sound living tissue together with passive tension free primary soft tissue closure. The fibrin clot serves as the initial calcifiable matrix containing a concentration of calcium and phosphate ions onto which precursor cells can migrate. This clot needs protection from mechanical stress as any distortion or disruption can profoundly impair the regeneration process.

A further major hindrance to new bone growth is the rapid formation and ingrowth of soft tissue in competition with the slower forming bone regrowth. Fibroblasts have a faster rate of migration than osteoblasts and their proliferation may totally prevent osteogenesis. It is therefore desirable that the soft tissues are excluded from the graft site. This can either be achieved by the use of a barrier membrane, either laid or pinned in place over the underlying particular graft, rather like a tarpaulin covering a mound of sand or by incorporating an additional hard-setting resorbable chemical phase into the graft material which acts as a barrier to soft tissue downgrowth.

The general term Guided Bone Regeneration (GBR) has been applied to procedures that attempt to regenerate bone, either prior to or at the same time as the placement of dental implants. GBR is accomplished using bone graft materials such as autogenous bone, xenografts, human donor grafts, as well as various synthetic or ceramic materials, usually also in association with a bio-compatible membrane.

As already mentioned, the use of a membrane ensures that competitive cells do not invade the area where we want new bone to regenerate. The mechanical barrier provided by the membrane offers a means of excluding mucosal tissue and epithelial cells that would interfere with bone healing from the clot. This permits the slower bone-producing osteoblasts to facilitate clot organization and produce unimpeded osteous healing.

GBR membrane materials must maintain the integrity of their barrier function long enough to allow osteoblasts to migrate into the wound. Both resorbable and non-resorbable membranes have been used as a GBR barrier. However, non-resorbable membranes such as e-PTFE, although effective, must be surgically removed after the healing period. A resorbable membrane that can transmit tissue fluid, but excludes undesired cells from the clot, has the advantage of not requiring surgical removal. Examples of resorbable membranes include bovine and porcine collagen, PLLA-PGA polymers and calcium phosphate.

The science, application and clinical effectiveness of the various bone graft materials, whether autograft, allograft, xenograft or alloplast, is currently one of the most controversial in implantology and periodontology. Auto- grafts may still be considered by many surgeons to be the graft of choice for specific indications, but there is no current consensus regarding the most appropriate materials for each clinical situation.

There is still much work to be done in this field and we still await the production of good quality randomised controlled trials. Recent years have seen more development of synthetic based bone augmentation materials and a decrease in the prescription of human derived bone substitutes.

The ideal graft material should preferably be gradually resorbed and fully replaced by vital bone that is subsequently remodelled into a natural bone structure that is capable of supporting implants re- stored into the occlusion. If the implanted material does not fully resorb, as is the case with some hydroxyapatites, the incorporation is restricted to bone apposition to the material surface, but no substitution occurs during the remodeling phase. This may be desirable for cases where simple ridge preservation or augmentation is required, eg to help stabilise conventional removable prostheses or improve soft tissue outcomes around conventional pontics, but is not so desirable in implantology.

As clinicians, we have a professional duty to discuss treatment options with our patients and only undertake those procedures which have a reasonable likelihood of a favourable outcome. This is particularly true of elective surgery such as dental implantology and associated bone augmentation procedures.

The gold standard for evidence supporting clinical practice is the randomised controlled trial. While unfortun- ately in dental implantology, as in many other branches of clinical practice, we are faced with a relative lack of high quality trials of this type. Around the world, researchers are working to establish the gold standard, but much of the important evidence is still to emerge.

Before prescribing materials and treatments for bone augmentation, clinicians need to arrive at their own conclusions from the available information regarding the suitability of these materials and their limitations.

In recent years I have come to the conclusion that it is no small challenge to assimilate this information in an impartial way and free from commercial influence. Discussion with colleagues and reading of the literature only really extends to anecdotal information and small groups of case studies or presentations. For some time I have nurtured a desire to put together a specialised meeting dedicated to reviewing the choice of materials available as bone substitutes.

One of my first initiatives, there- fore, on recently taking over the presidency of the Association of Dental Implantology was to organ- ise the forthcoming meeting—Fo- cus on Bone Substitutes—to be held at the Manchester Conference Centre on Monday 28th April 2008.

This full day symposium will examine both the biological basis, as well as the evidence supporting the clinical use of the currently available bone augmentation materials. During the day, seven renowned experts will present the evidence for both xenografts and synthetic materials. Specialist guest speakers will discuss the suitability of these materials in both alveolar ridge reconstruction and sinus augmentation.

Following this meeting, clini- cians should be in a better posi- tion to critically evaluate the evi- dence supporting the bone substitutes currently available for bone re- generation in day to day clinical practice. The truth is certainly out there to be discovered.
Dentistry has become so exciting and challenging since predictability has been recognized for long-term dental implant and restoration success. As the number of patients selecting dental implants as a treatment option continues to grow, the dental team must accept the challenges of maintaining these sometimes complex restorations.

Proper monitoring and maintenance is essential to ensure the longevity of the dental implant and its associated restoration through a combination of appropriate professional care and effective patient oral hygiene. The value of using conventional periodontal parameters to determine peri-implant health is not clearly evident in the literature. Therefore, it is paramount that the dental implant team understands the similarities and distinctions between the dental implant and the natural tooth. Subsequently, by examining the similarities and differences between a natural tooth and a dental implant, basic guidelines can be provided for maintaining the long-term health of the dental implant.

Direct anchorage of alveolar bone to a dental implant body provides a foundation to support a prosthesis and transmits occlusal forces to the alveolar bone. This is the definition of osseointegration. With the increased acceptance of dental implants as a viable treatment option for the restoration of a partially edentulous or edentulous mouth, the dental team is faced with maintaining and educating those patients.

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Recently, the focus of implant dentistry has changed from obtaining osseointegration, which is highly predictable, to the long-term maintenance health of the peri-implant hard and soft tissues. This can be achieved through appropriate professional care, patient cooperation, and effective home care. Patients must accept the responsibility for being co-therapists in maintenance therapy, as the dental team essentially must screen the potential implant patient. Diagnosis and treatment planning based on a risk-benefit analysis should be performed subsequent to a thorough medical, dental, head-and-neck, psychological, temporomandibular disorder and radiographic examination.

There is convincing evidence that bacterial plaque not only

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implants long axis. (Fig. 4) When a periodontal probe is inserted into the sulcus around an implant the probe tip advances passing between the fibers of the gingival cuff till the crestal bone prevents it from further advancement.

The peri-implant mucosal seal may be less effective barrier to bacterial plaque than the periodontal around a natural tooth, tissue attachment18. There is less vasculature in the gingival tissue surrounding dental implants compared to natural teeth. This reduced vascularity concomitant with parallel-oriented collagen fibers adjacent to the body of any dental implant make dental implants more vulnerable to bacterial insult17. Periodontic-adjuncts, peri-implant periodontal probing should be performed only when signs of infection are present, ie., exudate, swelling, bleeding on probing,探查到附着龈软组织, and/or radiographic evidence of peri-implant alveolar bone loss. Lastly, routine periodontal probing or peri-implant bone loss should not be performed, because this procedure could damage the weak epithelial attachment around dental implants, possibly creating a pathway for the ingress of periodontal pathogens16. Commerically available plastic probes should be used when investigating the crevicular depth around dental implants. The probing depth around dental implants may be related closely to the thickness and type of tissue surrounding the implant. A healthy peri-implant sulcus has been reported to range from 1.5 to 3.5 mm, which is greater than those depths reported for natural teeth19. In essence, the best indicator for evaluating an unhealthy site would be probing data gathered longitudinally20.

For all of these reasons, personal oral hygiene must start at the time of dental implant placement. Thus, personal oral hygiene must be maintained, especially if the patient has no keratinized tissue surrounding dental implants. The probing of the peri-implant sulcus has been reported to be the focus of all oral hygiene instructions. The presence or absence of keratinized tissue in this critical area has not been unequivocally documented to state that gingival inflammation, probing, invasive, and recession are more vulnerable to the ingress of pathogenic bacteria with or without the presence of plaque around dental implants. Therefore, healthy implants should appear nonmobile, even in the presence of peri-implant bone loss, if an adequate amount of sup- plementing alveolar bone still exists20.

When monitoring the health of the peri-implant soft tissues, the clinician should be cognizant of changes in soft tissue color, contour, and consistency. The presence of a fistulous tract could indicate the presence of a pathologic process or implant fracture.

Bleeding

There is controversy in the literature on the accuracy and significance of bleeding upon probing around dental implants. Therefore, the clinician should be cognizant of changes in soft tissue color, contour, and consistency. The presence of a fistulous tract could indicate the presence of a pathologic process or implant fracture.

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or cause a galvanic reaction at the implant-abutment interface.

Ideally, hand periodontal scalers for cleaning dental implants can be plastic, Teflon, gold-plated, or made of wood (Figs. 3 and 4). When using gold-plated curettes, the manufacturer recommends not sharpening these hygiene instruments, as the gold surface could be chipped exposing the hard metal underneath this coating. Stainless steel scaling instruments may abrade the implant surface, stripping off any surface treatment such as hydroxyapatite (HA) as the instruments hardness is greater than the titanium alloy the implant is fabricated from (Fig. 7).

Other cleaning armamentarium contraindicated for use with dental implants are air powder abrasive units, flour or pumice for polishing, and sonic and ultrasonic scaling units. Ultrasonic, piezo or sonic scaler tips may mar the implants surface leading to microroughness and plaque accumulation. The stainless steel tip may also lead to gouging of the implants polished collar. (Fig. 8) However, some clinicians advocate using a sonic instrument with a plastic sleeve over the tip for scaling dental implants. Air powder polishing units may also damage the implant surface and should be avoided during hygiene appointments. (Fig. 9) Even the use of baking soda powder in these units may strip off any surface coating on the implant. Additionally, the air pressure may detach the soft tissue connection with the coronal of the implant leading to emphysema.

Titanium or titanium alloy surfaces of dental implants can be polished using a rubber cup along with a nonabrasive polishing paste or a gauze strip with tin oxide. Not only is the hygiene armamentarium important, but so are the home care techniques used to maintain endosseous dental implants. Patients should be taught the modified bass technique of brushing using a medium-sized head, soft-bristled toothbrush. The use of intradental brushes should be used by implant patients after being shown their proper use. The plastic-coated wire brush is the only type to be used with dental implants to clean and not scratch the implant surface (Fig. 10).

Recently, automated mechanical toothbrushes have been advocated as a daily mode of tooth cleansing. These devices may be a rotary, circular, or sonic type. With these home care instruments, the key to their effectiveness is proper instruction on their use and then diligent daily use by the implant patient.

As with natural dentition, adjunctive cleaning aids such as flossing are still valuable. As with dentate patients, an implant patient’s home care requirements should be individually tailored according to each patient’s needs. Individual needs are based on the location and angulation of the dental implants, the position and length of transmucosal abutments, the type of prosthesis, and the dexterity of each patient.

The other popularized type of cleansing device is the use of oral irrigators with or without the addition of antimicrobial solutions. Also, oral rinses with antimicrobial properties such as Listerine or chlorhexidine have been widely advocated throughout the literature.

Summary

During the infancy years of dental implantology, the emphasis for long-term success of osseointegrated implants was the surgical phase of dental implantology. In the years that followed, the emphasis for success had switched from a purely surgical influence to focusing more on the proper fixture placement which would be dictated by the prosthetic and aesthetic needs of each particular case.

In more recent years, the dental professional has recognized professional implant maintenance and diligent patient home care as two critical factors for the long-term success of dental implants. The microbiota and clinical presentation of peri-implantitis is the same as periodontitis around a natural tooth.

A complete list of references is available from the publisher.

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Servicing South East England
Peri-implant soft tissue recessions

By Dr. André P. Saadoun, D.D.S., M.S.

Introduction
A beautiful aesthetic result is difficult to obtain with implants in the anterior areas. Both the alignment of the gingival margin and the presence of papillae are essential elements in resolving aesthetic implant problems to achieve an harmonious smile. These two soft tissue entities, however, are closely related to the patient’s biotype and to the quality/quantity of underlying structural alveolar bone.

The peri-implant gingiva, particularly if it is narrow, with a thin scalloped biotype, inevitably retracts six months after the abutment connection and restoration, owing to the reformation of the biologic space (Small and Turnow, 2000).

The process of soft and hard tissue healing must be understood and incorporated into a carefully coordinated sequence of therapy. It is also important to identify complications and clinical mistakes and their implications on the final aesthetic outcome (Saadoun et al, 1999).

How, then, should soft tissue recession (bone and gingiva) around an implant be prevented or treated?

Prevention of peri-implant recession
Marginal bone loss of 1 mm in the first year following the abutment connection, followed by loss of 0.2 mm per year, were among the criteria defined for implant success (Albrektsson et al 1986). Saving a few millimeters of bone around an implant does not increase the longevity of the implant, and should be done only for aesthetic reasons. To prevent or to decrease peri-implant bone resorption and consequent gingival recession following implant restorations in the anterior zone, several strategies have been proposed, which are explained in detail in the following points.

1) Implant design and diameter
The design of the collar of the implant should stabilize the crestal bone by bringing the roughened surface right up to the platform, and the threads/microgrooves as close as possible to the platform, with no divergence of the collar walls.

The thread position of the implant determines the effective level of remodeling after loading, and this is perhaps even more important than the position of the implant abutment microgap. (Rompen et al, 2005).

Placement of the implant platform 1.5 mm above the bone, helps to minimize bone loss as the biological space around the implants is established on the collar (Lezly Miller, 2003).

2) Implant placement and extraction timing
To make the best choice between different alternatives of implant placement, a precise pre-surgical diagnosis is necessary in order to evaluate the gingivo-osseous parameters, to determine the optimal moment to extract the tooth and place the implant, and to decide whether implant placement and loading should be immediate, early or delayed (Saadoun and Landsberg, 1997).

Orthodontic treatment is the best solution for patients who wish to limit the surgery required for the placement of implants to a single session, and to enhance the hard and soft tissue profile prior to extraction and implant placement (Salama et al, 1993).

5) Flap design
On healed site the limited flap design minimizes interproximal bone and papillae loss. Many flap design have been described for healed sites, some raising the total interproximal papillae with surgical incision around adjacent teeth, others using midcrest/palatal crest incision with sulcular envelope flap and, finally, tissue punch flap recommended in large amount of keratinized gingiva.

Flapless approach using tissue punch procedure has many advantages: less trauma to the bone and disturbances to the soft tissue stability, reduction of pain and oedema, and less post surgical information.

Immediate implant placement after extraction is usually a flapless surgical procedure, the extraction being done using a periosteum to minimize traumatic damage to the hard and soft tissues.

4) Tridimensional implant placement
Satisfactory morphology of the papilla and of the gingival margin after anterior implant restoration depends ultimately on two factors: implant placement (Esposito et al 1995), (Saadoun et al, 1998, Jonas and Testori, 2003) and implant restoration. The tridimensional criteria for implant placement in the aesthetic zone are:

- Mesio-Distal: 1.5-2.5 mm between implant and adjacent tooth
- Bucco-Lingual: 2.5-3.5 mm from the cervical height of the adjacent teeth
- Buccal cortical bone

6) Abutment and restoration
Optimal aesthetics will be promoted if the final abutment is installed at the time of implant placement, and left in place undisturbed, throughout the final restoration phase, avoiding disturbance of bone and soft tissue architecture.

Therefore, if immediately post extraction implant placement is indicated, the osseotomy must be performed against the palatal wall to prevent any damage to the remaining (and usually thin) buccal cortical bone (Testori, 2003).

5) Connective osseous grafts
An autogenous bone and xenograft with a membrane is used to gain buccal thickness knowing that bone resorption/gingival recession always occurs after extraction/implant placement.

Gingival biotype plays an important role in determining tissue levels achieved around implants. A thin biotype is generally more susceptible to peri-implant recession, induced by the resorption of a thin labial cortical plate. The use of osseous and connective grafts converts a thin gingival biotype into a thick gingiva (Mathew, 1999), which can enhance gingival marginal stability and simplify tissue management during the restorative treatment phase.

Fig. 1: Deformed ridge following traumatic extraction (right view)
Fig. 3: Deformed ridge following traumatic extraction (central view)
Fig. 5: Deformed ridge following traumatic extraction (left view)
Fig. 4: Implant insertion after flap elevation
Fig. 2: Bio-Oss graft combined with PRF particulate
Fig. 6: Implant and graft covered with PRF membrane
Fig. 7: Coronoally advanced flap (frontal view)
Fig. 8: Coronoally advanced flap (lateral view)
Disconnection and reconnection of the abutment disrupts the biological zone, inducing the junctional epithelium to migrate apically beyond the implant-abutment junction until it can adhere again. This often results in marginal bone loss, particularly in cases of thin gingival biotype.

It is important to minimize the bacterial contamination in and around the implant-abutment junction. The seal provided by an abutment of locking-tapered design has been demonstrated to be optimal in this respect, in vitro (Dibart et al, 2005).

Implant abutments of gold or glazed ceramic should be avoided. Only titanium or zirconium abutments are recommended because hemidesmosomes have been shown to attach to them (Touati and Guez, 2002).

In order to retain soft and hard tissue around the implant-abutment connection, the transmuscosal aspect of the implant abutment should not be oversized and divergent, but rather narrow and concave in order to induce thickening and immobilization of the peri-implant tissues, thus increasing the interface between the implant and the soft tissue, and creating an “O-ring connective tissue”. This will ensure the long-term stability of the biological width (Rompen et al, 2007).

Beneath the restoration, the concave abutment should provide maximum space to the soft tissue and clearly avoid a flared geometry. Its submerged profile should be negative to avoid compression of and to allow maximum thickness and stability of the soft tissue, as well as more room for the biologic width (Touati 2004). On the buccal aspect, the emergence profile of both the provisional and the final restorations should be flat or concave (under-contoured), to minimize pressure-induced apical migration of the gingival margin.

Design of final crowns to comply with the following "norms" will go a long way toward optimising papillary form (Salama et al., 1999; Elian et al., 2002).

- Distance from interdental bony crest to contact point between natural crown and implant-borne crown: 4.5 mm.
- Distance from inter-implant bony crest to contact point between two implant-borne crowns: 5.5 mm.
- Distance between bony crest and connection point between an implant-borne crown and a pontic: 5.5 mm.

7) Occlusal trauma
It has been proven that an excessive occlusal load during
function can cause the loss of peri-implant bone (Misch et al., 2003). The control of horizontal, trans-axial forces on an implant during the first months of function is a determining factor in reducing stress in the crestal zone, in enabling bone adaptation, and in minimizing crestal zone, in enabling bone function is a determining factor in reducing stress in the crestal zone, in enabling bone adaptation, and in minimizing crestal bone loss (Legall et al., 2002).

Conclusion

The essential prerequisites for an optimally aesthetic implant restoration should always remain a careful, precise, comprehensive, biologically- and prosthetically-based diagnosis, as well as the choice of the most appropriate implant materials, most conservative, and least traumatic treatment techniques, aimed at conserving, and where necessary augmenting gingival and bone to achieve a successful outcome.

References


About the author

Dr. Saadoun has received his De- gree in Dental Surgery from the Faculty of Paris and completed his Post-Graduate Certificate in Periodontology at the University of Pittsburgh and Post-Graduate Certificate in Implantology at the University of California in Los Angeles. He was an Associate Professor in the Department of Periodontics at the University of Southern California.

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