Individual Aesthetic Implantation: Biological Criteria for Long-Term Success

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This clinical case report presents a single-unit replacement of a central incisor following periodontitis. Criteria concerning tissue management are presented in order to better manage aesthetic issues posed in anterior implantation in the maxilla.

Key words: aesthetic restoration, anterior implantation, attachment tissue, biological criteria, biological space, first intention healing, papillae, peri-implantation, recession

In the upper maxilla, the loss of a central incisor due to periodontitis has two aesthetic consequences: a recession of marginal vestibular tissue and a reduction of papillae volumes. Aesthetic success in replacing the missing incisor becomes an important treatment objective. Pursuing this goal is possible, provided biological criteria are known and well understood.

These biological criteria determine an ideal position of the implant; furthermore, they define the conditions suitable to achieve stable attachment around the implant (Berglundh et al, 1991). The position of the implant is determined by the osseous conditions. Quality of peri-implant attachment mucosa to the implant is determined by several factors. This situation is analogous to that found in natural teeth (Cochran et al, 1997), which explains why this space can be referred to as a true biological space (Gargiulo et al, 1961).

It is crucial that connective tissue integration is obtained during the initial healing stage, thereby establishing a biological barrier favourable to a successful outcome. In the presence of insufficient connective attachment, osseous resorption may occur, leading to the formation of a stable soft tissue attachment (Berglundh and Lindhe, 1996). Remodelling of soft tissue, concurrently re-establishing the physiological dimension of epithelio-connec-

Fig 1 Locally severe chronic periodontitis in a 40-year-old patient; periodontal treatment with GTR was carried out 8 years previously. Now the patient presents class III mobility and facial migration of tooth #11. The patient is no longer willing to accept the 'black hole' between the incisors.

Fig 2 Bone resorption involves more than 3/4 of root length. The periodontal pocket, on the palatal surface, reaches tooth apex. There have been repeated infectious episodes. Conservation of 11 (whatever the treatment) involves the possibility of further destruction of mesial bone tissues located around 12 and 21, and aggravation of the aesthetic problem posed by the papilla.

Fig 4 Temporization achieved with compression-free removable denture.

Fig 3 Extraction surgery preserves the maximum amount of tissue.

Fig 5 Alveolar bone repair occurs naturally. Note the good stability of the septa on 12 and 21.

tive attachment (biological space), may result in unaesthetic tissue recession. Apical displacement occurs mostly during the first 6 months: presence of marginal inflammation due to poor plaque control (Ericsson et al, 1995), lack of mucosa, mobility of soft peri-implant tissue, and high initial probing depth are factors which are all correlated with secondary tissue recession (Bengasi et al, 1996).

While use of single-phase (not embedded) or two-phase implantation (embedded) procedures seems not to have any influence of the quality of mucous barrier (Abrhamsson et al, 1996), repeated disconnection followed by reconnection of the abutment element does seem to be involved in displacement of connective tissue apically with additional marginal bone resorption (Abrahamsson et al, 1997).

Fig 6 The axis chosen for the implant is an ideal axis with palatal emergence of the screw.

Fig 7 In the distal-mesial direction, the ideal position for the implant, relative to the neighbouring teeth, is displayed on the scanner image.

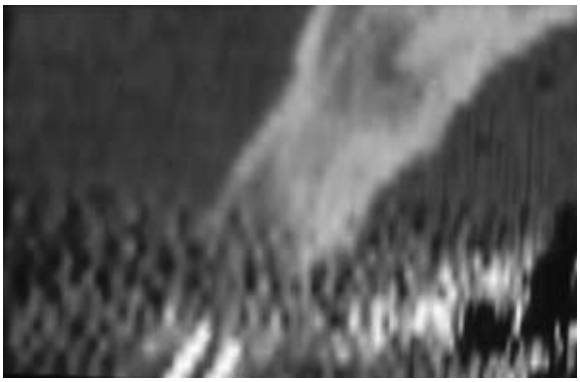

Fig 8 Sagittal image confirms the possibility of placing the implant in the ideal position (broad crestal bone, satisfactory bone density).

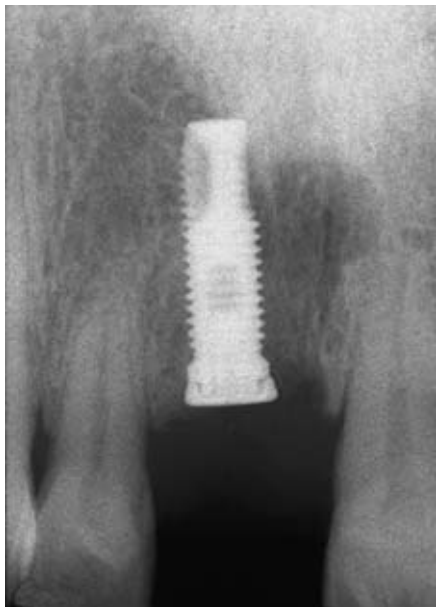

Fig 9 A Brånemark MK2 implant, 4 mm in diameter and 13 mm in length, is placed in site. After implantation and left to bed for 5 months.

Adhesion of soft tissue also varies with used material: peri-implantation mucosa adheres strongly to titanium and ceramic materials. When using gold and resin, attachment is found more apically, osseous resorption occurs, and there is a chance for exposure of the fixture-abutment junction, thereby situating the mucous barrier along the implant only (Abrahamsson et al, 1998).

For both types of implant, whether smooth or ribbed, the vertical dimension of soft tissue is the same and the marginal bone level is identical.

The percentage of bone/implant contact is greatest for the ribbed surface (Abrahamsson et al, 2001), allowing for earlier loading.Concerning the papillae, their regeneration is slow but spontaneous in the case of single missing teeth (Jemt, 1997).

In this situation, several suggestions can be made in order to improve aesthetic outcome:

- avoid immediate implantation: precise positioning of the implant requires optimal bone healing.
- have an excess of soft tissue available of the vestibular/facial surface of the prosthetic element at stage II (the two-stage technique is more favourable in this respect).

Fig 10 After 5 months of healing, the papillae have still not regenerated.

Fig 11 It has been decided to place the final prosthetic element directly onto the implant and to resort to the use of a healing abutment. Surgery performed prior to impression preserves a maximum amount of tissue. An incision on the palatal aspect allows for a small flap to be raised, enough to place the transfer on the implant.

Fig 12 Natural tooth has been conserved. This is used as a guide to reproduce the anatomy of the prosthetic element: cement-enamel junction, radicular morphology. The palatal emergence of the screw allows for using a single-element piece. A Ceradapt abutment was used as the base for this ceramic construction.

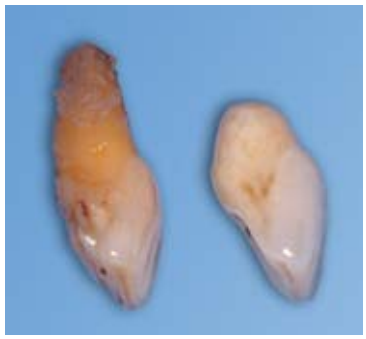

Fig 13 The characteristics of the cement-enamel junction are reproduced.

Fig 14 Slight modifications are carried out as compared with the original tooth. These aim at reducing the unaesthetic 'black hole' without compromising the symmetry of central incisors.

- obtain attachment of soft tissue to implant system as similar as possible to 'first intention' healing conditions.
- choose the most compatible material (titanium or porcelain) and avoid resin in the biological space.
- avoid disturbing the attachment system once established (repeated disconnection of abutment element, accumulation of plaque).

Currently, it seems that an implant with a single scalloped abutment inserted during surgery is the best way of maintaining the natural contours of the supporting tissue (Galluci et al, 2004).
The aim of this article is to illustrate, in a favourable clinical context, the relevance of biological criteria relative to peri-implantation tissues in determining a favourable outcome, with complete and durable integration of the prosthetic restoration.

Fig 15 Pre-impression surgery allows for prosthetic tooth positioning to be made. This leads to facial displacement of crestal tissue, creating a deficit in the papilla and increased facial volume.

Fig 16 Three months after the prosthetic tooth has been placed on the implant, excess mucosa on the facial aspect is still present, though tissue rearrangement is well under way; papilla deficit persists.

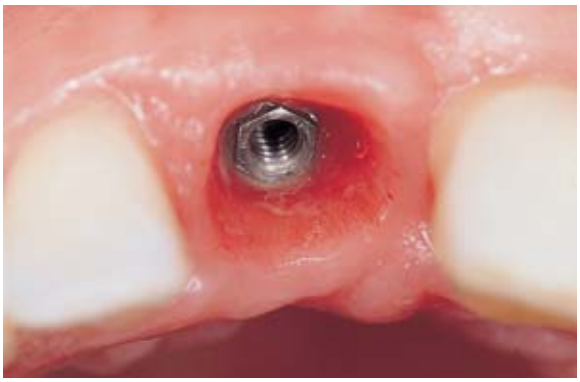

Fig 17 The peri-implantation biological space does not present a constant height. An important advantage of ceramic material (as with titanium), is that it promotes epithelio-connective attachment (unlike gold or resin). Provided plaque control is sufficient, it is to be expected that epithelial attachment will occupy a maximum area (virtual sulcus solution).

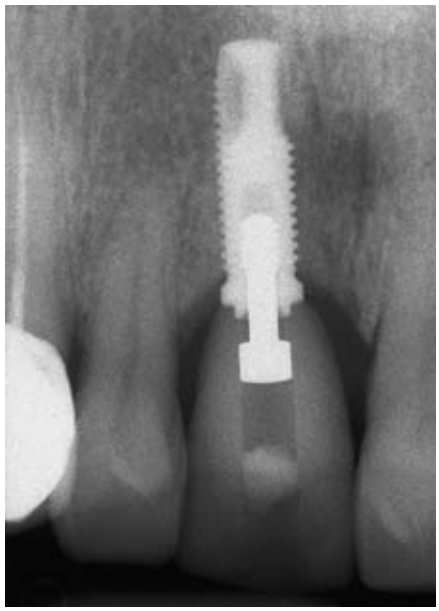

Fig 18 One year after fitting of the prosthetic teeth, good bone behaviour around the implant and incisor septa can be seen.

Fig 19 19 months post-operatively, improvement continues.

Fig 20 Six years later, result is satisfactory and good stabilization of the situation. Very good integration of the prosthetic tooth with considerable papilla regeneration can be observed. A good aesthetic compromise is achieved with a slight increase in volume of prosthetic crown. The negative effect of the 'black hole' has been forgotten.

REFERENCES

Abrahamsson I, Berglundh T, Glantz PO, Lindhe J. The mucosal attachment at different abutments. An experimental study in dogs. J Clin Periodontol 1998;25:721–727.

Abrahamsson I, Berglundh T, Lindhe J. The mucosa barrier following abutment dis/reconnection. An experimental study in dogs. J Clin Periodontol 1997;24:568–572.

Abrahamsson I, Berglundh T, Wennstrôm J, Lindhe J. The peri-implant hard and soft tissues at different implant systems. A comparative study in the dog. Clin Oral Implants Res 1996,7:212–219.

Abrahamsson I, Zitzmann NU, Berglundh T, Wennerberg A, Lindhe J. Bone and soft tissue integration to titanium implants with different surface topography: an experimental study in the dog. Int J Oral Maxillofac Implants 2001; 16:323–332.

Bengasi F, Wennstrôm JL, Lekholm U. Recession of the soft tissue margin at oral implants. A 2-year longitudinal prospective study. Clin Oral Implants Res 1996;7: 303–310.

Berglundh T, Lindhe J, Ericsson I, Marinello CP, Liljenberg B, Thomsen P. The soft tissue barrier at implants and teeth. Clin Oral Implants Res 1991;2:81–90.

Berglundh T, Lindhe J. Dimension of the peri-implant mucosa. Biological width revisited. J Clin Periodontol 1996;23: 971–973.

Cochran DL, Hermann JS, Schenk RK, Higginbottom FL, Buser D. Biologic width around titaniun implants. A histometric analysis of the implanto-gingival junction around unloaded and loaded non submerged implants in the canine mandible. J Periodontol 1997;68:186–198.

Ericsson I, Persson LG, Berglundh T, Marinello CP, Lindhe J, Klinge B. Different types of inflammatory reactions in peri-implant soft tissues. J Clin Periodontol 1995;22: 255–261.

Galluci GO, Belser UC, Bernard JP, Magne P. Modélisation et caractérisation de la JAC pour la conception esthétique optimale d'un implant. Parodont Dent Rest 2004;24: 19–29.

Gargiulo A, Wentz F, Orban B. Dimensions and relations of the dento-gingival junction in humans. J Periodontol 1961;32:261–267.

Jemt T. Regeneration of gingival papillae after single-implant treatment. Int J Periodontics Restorative Dent 1997; 17:326–333.

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