GUIDELINES ON STANDARDS FOR THE TREATMENT OF PATIENTS USING ENDOSSEOUS IMPLANTS

Produced by a working party from BSSPD and the British Association of Oral and Maxillofacial Surgeons (BAOMS)

BAOMS	J I Cawood (Chairman)	G H Foreman	M 0 Hindle
BSSPD	R A Howell	G D Stafford	R M Watson

This report first appeared as a supplement to the British Dental Journal: 178:(6), March 25 1995 and the text is reprinted by kind permission of the Editor of the BDJ and of the British Association of Oral and Maxillofacial Surgeons. It gives Pilot Guidelines which are in accordance with the custom and practice of the day.

Foreword

1 The need for guidelines on standards in the use of dental implants was recognised by the councils of the British Association of Oral and Maxillofacial Surgeons (BAOMS) and the British Society for the Study of Prosthetic Dentistry (BSSPD).

2 A joint working group was convened in 1992 to draft guidelines which have been approved by the councils of both the BAOMS and the BSSPD.

3 Members of group

BAOMS:

Mr J I Cawood (chairman)
Mr G H Forman
Mr M O Hindle

BSSPD:

Mr R A Howell
Professor G D Stafford
Professor R M Watson

4 This document will relate to the intra-oral application of endosseous implants.

1. Introduction

1.1 The aim of these guidelines is to inform both those offering advice and those providing treatment of the objectives and standards of care expected.

1.2 The guidelines encompass treatment for the edentulous patient and the partially dentate patient, including those requiring single tooth replacement.

1.3 An endosseous implant is a device that may be inserted into a jaw bone and is intended to support, retain and stabilise a fixed or removable prosthesis. Such implants have extended the range and effectiveness of preprosthetic surgery, and should be considered as a valuable adjunct in oral rehabilitation.

1.4 The aim of oral rehabilitation involving implants is the restoration of oral function and facial form, which is rendered deficient as a consequence of loss or absence of teeth and related structures, and may be attained by a combination of surgical and prosthetic means.

1.5 Published data, in refereed journals indicate that this aim may be achieved by placement of selected endosseous implants, which are of scientifically proven efficacy, either alone or in combination with other surgical procedures, depending on the degree of jaw bone loss, mucosal condition, opposing jaw relations and the state of the dental occlusion.

1.6 These guidelines should be updated regularly to take account of continuing research and development.

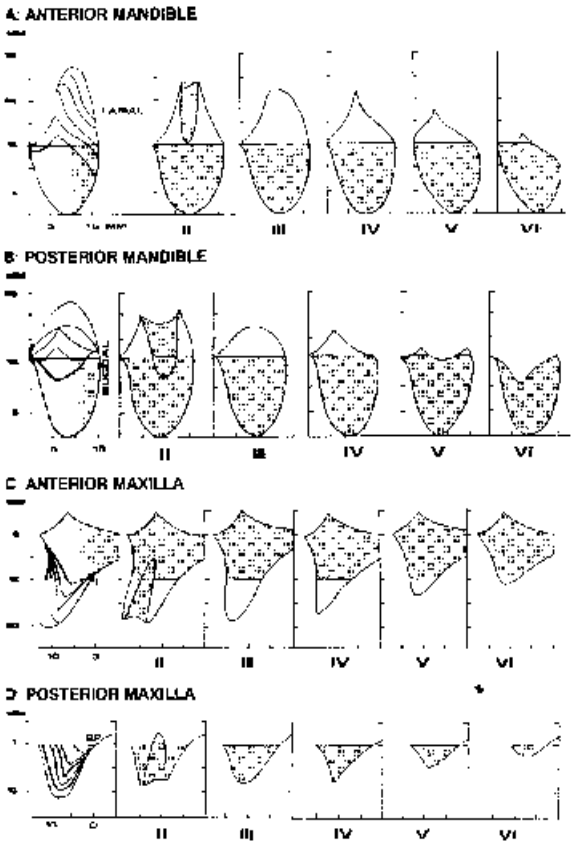

Table 1 Classification of jaw form

A: classification of anterior mandible

(anterior to mental foramina)

B: classification of posterior mandible (posterior to mental foramina)

C: classification of anterior maxilla

D: classification of posterior maxilla

I. Dentate

II. Immediate post extraction

III. Convex ridge form

IV. Knife edge ridge form

V. Flat ridge form

VI. Loss of basal bone that may be extensive but follows no predictable pattern

2. The consequences of tooth loss and jaw classification

2.1 It is recognised that loss of teeth results in progressive loss of jaw bone.

2.2 The edentulous jaw

Loss of bone in the edentulous jaws leads to:

reduction of support for a prosthesis
alteration of the maxillomandibular jaw
encroachment of some muscle attachments in relation to the denture bearing area.

2.3 The effect of these changes, combined with ageing, is circumoral hypotonia and collapse. This results in changes in facial form and appearance.

2.4 The partially dentate jaw

There are similar local changes to those occurring in the edentulous jaw, but in addition there is a potential for unfavourable changes in the remaining dentition.

2.5 A classification of jaw form following tooth loss exists which assists communication and enables rationalisation of treatment. (Table 1 and Reference 1)

3. Criteria for the use of endosseous dental implants

3.1 Successful application of implants depends on:

a favourable anatomical form and environment
biocompatability
favourable long-term biomechanical conditions.

3.2 There must be adequate bone volume (height and width) to place implants safely without interfering with adjacent anatomical structures (such as the neuro-vascular bundle, maxillary sinus, floor of the nose and adjacent teeth)

The implants should not impinge or interfere with the function of the lips, tongue, and floor of the mouth.

3.3 There must be enough bone volume to allow placement of implants of a sufficiently large dimension to withstand functional loading. It should permit optimal axial indination to fulfil the functional and aesthetic requirements.

3.4 The implant giving the maximum surface contact with bone should be placed to achieve optimal load distribution.

3.5 The vertical, transverse and antero-posterior interjaw relationship should be favourable.

3.6 If the foregoing conditions do not prevail, adjunctive surgical procedures, such as osteotomy, bone grafting and vestibuloplasty, should be undertaken.

3.7 There must be adequate access for the surgical procedure. There must also be adequate space for prosthesis construction and for subsequent oral hygiene measures by the patient.

4. Assessment of the patient

4.1 General assessment should include: patient's complaint
medical assessment
psychological
assessment social history
dental history.

4.2 Local assessment should consist of both extra-oral and intra-oral

The extra-oral examination should include assessment of facial asymmetry, facial form tooth display, jaw relations and jaw function The intra-oral examination should include assessment of:

- the oral mucosa and the saliva
- the remaining dentition and periodontium
- the original ridge form, related muscle and soft tissue attachments,
- the amount and quality of attached mucosa
- the inter-occlusal and inter-ridge relations (vertical and horizontal).

4.3 Radiological assessment should indicate:

- retained roots, unerupted teeth or any pathological conditions
- the jaw form and jaw relations
- quality of bone (sclerotic, porotic).

Standard diagnostic views are:

- panoramic tomography
- lateral cephalogram
- intra-oral films.

4.4 Study casts, mounted on an articulator, are an important diagnostic aid.

4.5 A detailed assessment of the jaw bone dimensions of quantity (height and width) and quality can be assessed using:

- radiographs with magnification markers (in conjunction with panoramic tomography and cephalogram)
- tomography
- ridge mapping techniques for assessing bone width multi-planar computerised tomography.

5. Treatment planning

5.1 The restoration is influenced by the type, size, number and orientation of implants that can be planned in relation to anatomical, surgical and prosthetic considerations. If implants are to be placed in one jaw only, the prosthesis should be designed to take account of the remaining and opposing dentition or prosthesis.

5.2 The final treatment plan is based on a combination of:

- patient assessment (see section 4)
- radiological analysis
- analysis of study models
- analysis of diagnostic wax-up/trial prosthesis
- patients' preferences.

5.3 Radiographs indicate:

- adequacy of bone and/or the need for bone augmentation
- related anatomical structures
- jaw relationships
- orientation of potential implant placement relative to the jaw bone, adjacent teeth and the opposing teeth or jaw.

5.4 Study casts should:

- where appropriate be mounted on an articulator, preferably using a face-bow, indicate jaw and occlusal relationships, both vertically and horizontally, and indicate the position and arrangement of any remaining natural teeth
- help decide the possible position and number of implants and the orientation of implants relative to the jaw bone and natural teeth. They may also act as a guide when bone augmentation may be indicated.

5.5 Diagnostic wax-up/trial prosthesis relates tooth position in the restored arch to:

the residual ridge

any remaining natural teeth implant position

the opposing dentition or residual ridge

the necessity for a labial flange for optimal lip/cheek support

orientation of implants to allow a functional and aesthetic prosthesis to be constructed.

6. The maxilla

6.1 With careful patient selection, endosseous dental implants can be used in the Class II and Class III ridge form.

6.2 In selected patients with Class IV, V and VI edentulous maxillae, implants should be combined with augmentation of the maxilla using onlay techniques, inlay gfafting of the sinus and interpositional bone graft techniques. No literature is available, as yet, to attest to a 10-year, long-term validity of these methods. There is a need for controlled prospective clinical research to determine the effectiveness of these combination procedures.

6.3 The choice of a fixed or removable prosthesis that is implant supported, retained or stabilised in the maxilla is influenced by the functional and aesthetic requirements, the patient's ability to maintain the prosthesis, and treatment cost.

7. The mandible

7.1 With careful patient selection, endosseous dental implants can be used in the Class II, III ridge form, both anteriorly and posteriorly.

7.2 It is recognised that surgical interference with the inferior alveolar nerve may lead to neuro-sensory alteration or loss.

7.3 In the Class IV ridge form in the anterior mandible, contouring to remove a narrow ridge crest or an onlay bone grafting procedure may be required to achieve sufficient bone volume to accommodate an endosseous implant.

7.4 In the Class V ridge form in the anterior mandible, an interpositional bone grafting procedure may be required to prevent unfavourable soft tissue encroachment that would interfere with prosthetic function.

7.5 In selected patients with a Class VI ridge form in the anterior mandible, implants may be combined with augmentation bone grafting techniques to provide adequate bone volume for implants.

7.6 Conclusive, long-term data on the use of implants with bone grafting procedures are not yet available.

8. The implant team

8.1 Within the UK, few individuals have sufficient training, experience and expertise in both the surgical and prosthodontic disciplines to provide a comprehensive range of treatment necessary to rehabilitate the patient and deal with complications.

8.2 A team approach is to be recommended. The implant team normally comprises surgeon (responsible for the implant treatment), prosthodontist (responsible for restorative or prosthetic treatment), technician, hygienist and nurse/DSA.

8.3 Cooperation should exist between the prosthodontist and the surgeon during the assessment and treatment planning, be

maintained through the various stages of treatment. and prevail through the follow-up care of the patient. The prosthodontist and surgeon should be aware of the objectives and possible limitations of each treatment.

8.4 In order that a functional prosthesis can be constructed, the implant position and inclination should be decided between prosthodontist, surgeon and technician. Most importantly, lack of cooperation could result in the placement of implants in positions,and with inclinations, which make them unusable.

8.5 The overall responsibility for the design, function and the long-term after-care of the prosthesis rests with the prosthodontist. Monitoring of the implants would normally be carried out by the prosthodontist, but both surgeon and prosthodontist share a continuing responsibility for the success or failure of implant treatment.

9. The patient

9.1 The patient has a duty to cooperate fully with all aspects of the treatment and after-care. Patient selection should be restricted to those patients who show a need and motivation for the implant procedures. Patients should have a realistic expectation of treatment and must be capable of maintaining an appropriate standard of oral health.

9.2 The benefits of treatment must outweigh any risks. The treatment itself should not jeopardise unduly the existing dentition and should take into account the condition of the remaining dentition, its prognosis for survival and likely future treatment. Active periodontal disease and caries must first be controlled.

9.3 The patient must be given a comprehensive explanation of the treatment, be aware of possible complications and feasible alternatives, and valid consent must be obtained.

10. General principles for surgical treatment

10.1 Surgical treatment should be conducted according to established protocol. In particular, the surgical field should be suitably isolated and free from contamination at the time of preparing canals in the bone and the positioning of implant fixtures in the jaws. Sterile implants, packed and prepared by the manufacturer should be used in association with the recommended instrumentation. The careful preparation of bone to avoid overheating is an essential feature of the operation and for this copious irrigation, sharp instruments and low drill revolutions are necessary.

10.2 The positioning of implants should be carried out according to an established treatment plan, avoiding vital structures (such as the inferior dental canal) and the roots of adjacent teeth. A surgical template, identifying the planned implant position and likely position of the artificial tooth crowns of the future prosthesis, is recommended for use in most cases. It is, however, desirable for the surgeon and prosthodontist to have considered the consequences of revising implant positions resulting from unfavourable bone quality or quantity in intended sites.

10.3 Many systems recommend a two-stage procedure in which the endosseous component (fixture) remains isolated for several months within the jaw bone, in order to promote integration with the healing bone. This is the preferred technique

In single-stage procedures it is advised that the implant should not be loaded immediately.

11. General principles for prosthodontic treatment.

11.1 Any temporary prosthesis should be designed to avoid pressure over implant sites.

11.2 A definitive prosthesis may be:

Supported entirely by implants and may be fixed or removable by the patient depending on aesthetic, functional and maintenance considerations

supported by implants and residual ridge. This is removable by the patient (over-denture)
supported by implants and natural teeth (see paragraph 17.7).

11.3 Leverage should be kept to a minimum and the extent of any cantilever should take into account the number, size and distribution of the implants and the rigidity of the superstructure.

11.4 Selection of the appropriate occlusal scheme should be based on sound restorative principles and take into account the type of opposing dentition/prosthesis.

11.5 An implant supported fixed prosthesis, used to restore the dentition of an edentulous jaw, should be retained by implants of appropriate size and number: a minimum of five in the mandible and six in the maxilla.

11.6 An over-denture prosthesis used to restore an edentulous jaw normally requires a minimum of two implants in the mandible and four implants in the maxilla placed appropriately for effective support, retention and stability, together with maximal coverage of the denture bearing area.

11.7 A partial, fixed prosthesis may be constructed on two or more implants. Due to the different behaviour of the attachment of the implant and natural tooth to bone, it is generally considered inappropriate to link implants and natural teeth with a prosthesis unless a device allowing for differential movement is incorporated.

11.8 An implant restoration may be chosen as an alternative to a conventional replacement for an individual tooth. In the anterior maxilla, careful assessment and planning is needed to avoid producing an unsatisfactory appearance.

12. Follow-up maintenance

12.1 Appropriate instruction in oral hygiene measures and care of the implants and prosthesis should be given during treatment, and reinforced at follow-up visits. Effective monitoring of the implants and the associated prosthesis is an essential part of treatment. Following delivery of the prosthesis, the patient should be reviewed regularly to ensure that they are maintaining a satisfactory standard of oral hygiene and that the prosthesis is functioning as intended. In particular, the tightness of fixing should be checked after one month.

12.2 Regular inspection at yearly intervals is recommended after the first year.

12.3 Assessment at review appointments is by:

assessment of plaque and calculus deposits

clinical evaluation of the mucosal cuff around implants including:
visual assessment (gingival index, and, if indicated, bleeding on probing and sulcus depth)

assessment of mobility of each implant by: percussion, application of rotational forces to the implant and electronic mobility tester

radiological examination, preferably using a long cone periapical radiograph to assess the level of marginal bone and to evaluate the implant bone interface.

12.4 Resilient connectors and other components should be replaced as necessary according to the manufacturer's instructions.

12.5 Inspection of the superstructure/prosthesis should be carried out to identify cracks or fractures which may indicate an inexactness of fit between the prosthesis and implants. Marked occlusal wear facets may indicate imbalance in the occlusion or parafunctional habits. Such damage should be corrected by a modification of the prosthesis and/or the occlusion.

13. Criteria for success

13.1 Success must be judged over a long time span, which implies that patient follow-up must be regular, continuing and consistent, including clinical and radiographic examinations.

13.2 To be judged successful the outcome of implant treatment should meet the criteria proposed by Albrektsson et al. These are:

that an individual, unattached implant is immobile when tested clinically

that a radiograph does not demonstrate any evidence of peri-implant radiolucency

that vertical bone loss be less than 0.2 mm annually following the implant's first year of service

that individual implant performance be characterised by an absence of persistent and/or irreversible signs and symptoms, such as pain, infections, neuropathies, paraesthesia, or violation of the mandibular canal.

13.3 High success rates for implants in the anterior edentulous jaw have been recorded with one implant system after a 10 year period. This goal should be recognised, while accepting that the outcome may differ for implants placed in other sites or involving bone grafts and with different implant systems. Caution is recommended in anticipating outcome when advising patients.

In the future, it is likely that the success rate will continue to improve. It is therefore suggested that the criteria for success be reviewed at regular intervals in the light of the results achieved.

References

1 Cawood J I, Howell R A. A classification of the edentulous jaws. *Int J Oral Maxillofac Surg* 1988;1:232-236

2 Terry B C, Zarb G A. Report on 4th International Congress on Preprosthetic Surgery, Palm Springs, USA 1991. *Int J Oral*

3 Albrektsson T, Zarb G, Worthington P, Eriksson A R. The long-term efficacy of currently used dental implants: a review and proposed criteria of success. *Int J Oral*