Treatment Planning and Restorative Management


Dr Brenda Baker

By Dr Brenda Baker
Digital and Clinical Consultant at Southern Cross Dental

"Fail to plan, plan to fail."
Hillary Rodham Clinton

The advent of the internet has caused an explosion in the ability to access knowledge. There is so much information available that both clinicians and ever more frequently patients who google are overwhelmed by available resources. Once upon a time, the traditional model of care of dental patients involved use of individual clinical expertise and experience tailored to the specific treatment needs of the patient. The changing times have caused an evolution in the delivery of dental healthcare. The American Dental Association defines evidenced-based dentistry as " an approach to oral healthcare that requires the judicious integration of systematic assessments of clinically relevant scientific evidence, relating to the patient's oral and medical condition and history, with the dentist's clinical expertise and the patient's treatment needs and preferences" (1).

EVIDENCE-BASED TREATMENT PLANNING

Management Overview

Any treatment plan must include short-term, medium-term and long-term goals (2). History taking and clinical examination are two of the most important considerations of the assessment process.

Interdisciplinary, multidisciplinary and comprehensive treatment plans are now commonplace. These cases can be time-consuming and patient motivation is the key (3).

GLOSSARY OF THE TREATMENT MANAGEMENT PROCESS

Stage of Treatment	Treatment Considerations
Crisis Management and Stabilisation	• *Manage acute pain and dental and soft tissue infection Eg. Exodontia –tooth fracture, non-strategic teeth with hopeless prognosis, retained roots
	• Caries and erosion control
	• Assess wear and its management*
Prevention and Disease Control	• Hygiene, initial periodontal treatment and medicament implementation (fluoride, desensitization)
	• Splint therapy
Initial Restorative Treatment	• Basic conservative dental procedures – core placement, relevant interdisciplinary consults
Reassessment and Occlusal Analysis	• Evaluate status of preventive and restorative treatments
	• Facebow with mounted study models on semi-adjustable articulator
	• Diagnostic wax-up of mounted study models
Comprehensive Definitive Restoration	• Define the occlusion required – work to current occlusal scheme (conformative) or reorganise?
	• Evaluate the vertical dimension of occlusion (VDO)
	• Consider interdisciplinary treatment plans to harmonize with reconstruction
Monitoring and Maintenance/ Recall	• Conservative frequent recalls
	• Monitor periodontium, caries activity and marginal integrity of fixed prosthetics including implants

*Separate discourse on wear to follow

Several general principles have been outlined by Garavaglia et al (4) for the planning of treatment:

- Improve the tooth (abutment) prognosis: Retreatment options, treatment reversibility and conservation of tooth structure must be included in the context of tooth prognosis.
- Utilise adhesion. Adhesion can assist with compromised retention and resistance forms and may avoid possible endodontic treatment for prosthodontic needs.
- Adopt a conservative approach.
- Aim to segment prosthetic structures into single units and short fixed bridges. eg. A 3-unit implant-supported fixed prosthesis can be redone if problems occur without jeopardising the entire case (5, 6, 7).
- A tooth-supported bridge especially on non-vital abutments is usually a less desirable option than a single implant to replace a missing tooth (8).
- These factors should be considered for dental rehabilitation specifically involving implant therapy (9):
  - Patient's systemic condition – acute infections, severe anaemia/uncontrolled diabetes/ hypertension/abnormal kidney or liver function, severe haemorrhage or immunocompromised status or use of iv bisphosphonates
  - Prevailing local factors – bone quality and quantity, gingival biotype, periodontal and restorative status of teeth, anatomic limitations
  - The aesthetic success of the implant restorations is based on the correct 3D position of the implant in bone.
  - The anterior maxillary region is often aesthetically challenging and can be made more complex with a thin biotype and high lip line (10). Thin biotype has been reported to be linked with 1.8 mm marginal mucosal recession as opposed to thick biotype with 0.6 mm recession.
  - Fu et al (10) advised a protocol for dealing with thin biotype by use of a concave abutment and crown profile and more palatal and apical placement with a straight-walled platform using platform switching.

Various patient-mediated concerns – finances, treatment time, anticipated morbidity, surgical exposure, hygiene access and maintenance will all impact upon the final treatment plan and various options should be presented.

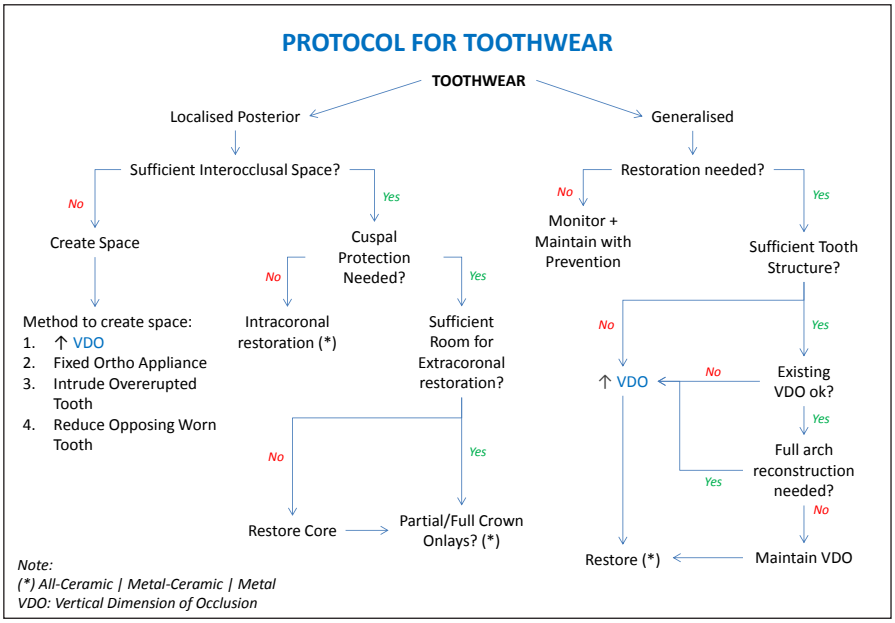

Chart 1

Management of Toothwear

Toothwear describes the surface loss of dental hard tissues from causes other than dental caries, trauma or as a consequence of developmental disorders (11). Normal vertical loss of enamel from physiologic wear is about 20-38 µm/annum (12). "Tooth surface loss" embraces all the aetiological factors regardless of whether the exact cause of wear has been identified.

Subclassification of Toothwear Lesions

Attrition is defined as the "physiologic wear of tooth structure due to tooth-to-tooth contact as in mastication with possible abrasive substance intervention" (13). The early clinical appearance is of a small polished facet on the cusp or ridge or slight flattening of the incisal edge. The lesion's progression results in a reduced cusp height and flattening of occlusal inclined planes with dentine exposure.

Erosion is the loss of tooth surface by a chemical process not involving bacterial action. Typically, they present as bilateral concave defects. Initially, enamel is affected and progression leads to dentin exposure which appears dull.

Abrasion is the physical wear of tooth surface through an abnormal mechanical process independent of occlusion.
A full-mouth reconstruction is a treatment option for generalized toothwear but not always necessary as the dentition may still function and the patient may not have high aesthetic demands (see Chart 1).

Two different occlusal schemes are possible:

- **Reorganized**
  Reorganize:
  - to increase VDO when worn teeth still have adequate crown height
  - with worn teeth that are short and need restorations and
  - where no stable occlusal relationship is evident as the existing dentition is severely damaged or the patient is partially edentulous (Case 1) (14).
- **Conformative**

This mode of treatment is chosen to manage generalized toothwear when the coronal tissues are reasonably worn and if only some teeth need restoration. Placing a relatively small number of intra/extracoronal restorations in a moderately worn dentition with acceptable existing VDO and stable occlusal relationships simplifies treatment (Case 2) (15).

CASE PRESENTATION

The following case studies are examples of the application of contemporary principles for optimal patient care.

Case 1

The patient in their early 50's presented with a worn dentition seeking functional and aesthetic improvement. The dentist followed the following planning sequence:

- Bite registration was taken with wax rims constructed at the laboratory.
- A centric relation record was taken to mount the models in order to provide:
  - Diagnostic wax-up
  - Michigan-style splint to be worn to mimic the planned increase in vertical dimension in the final restorative plan.
  - The splint was fabricated to provide an "ideal occlusion" to include:
    –Even centric stops with at least one centric stop per opposing tooth were incorporated into the splint.
    –Canine guidance enabled disclusion

Fig. 1 These models illustrate the severe wear and lack of posterior support in a severely debilitated dentition.

Fig. 2 The occlusal scheme in the diagnostic wax-up has been restored to create a functional stable dentition.

Fig. 3 Anterior view of increased vertical dimension enabled discussion at the case presentation appointment.

of the posterior teeth during lateral excursive and protrusive mandibular movements.
  - –Even anterior guidance in protrusive movements permitted the posteriors to disclude.
  - –The aim of the splint was to allow muscle activity to return to normal function by disrupting the habitual pathway of closure into centric occlusion.
  - –The vertical dimension increase incorporated into the splint was to be copied in fabrication of both the provisional and final restorations.
- After wearing the splint for 6 months, new models were poured in vacuum-mixed die-stone and mounted on a semi-adjustable articulator in a more accurate centric relation (CR) position (Fig. 1). The diagnostic wax-up was then done at the more accurate CR position (Figs. 2, 3).
- After 6 months of wearing the splint, the dentist was able to utilise pulldowns made from the diagnostic wax-up to rebuild the dentition. Subsequently, laboratory fabricated provisionals were supplied as well as simple flexible dentures which were used as interim provisional restorations to achieve posterior stability.

The provisionalisation phase of reconstruction is crucial to assess

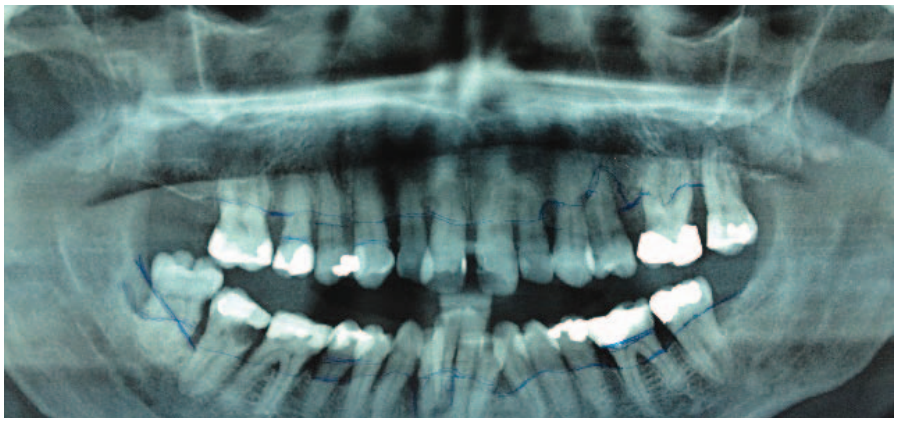

Fig. 4 Preoperative OPG with considerable periodontitis, recurrent caries and apical infection.

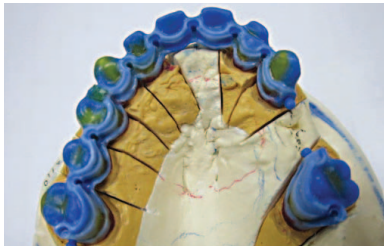

Fig. 5 Wax-up of upper anterior bridges from 14-16 and 13-23.

Fig. 6 Metal try-in to check marginal integrity and verify occlusal registration.

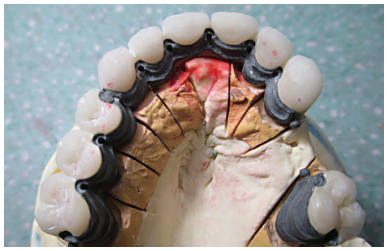

Fig. 7 Occlusal view of milling on palatal surface to subsequently engage the denture and attachments on 13 distal, 16 distal and 26 mesial

Fig. 8 Online dialogue with dentist occurred to verify aesthetics prior to final glazing.

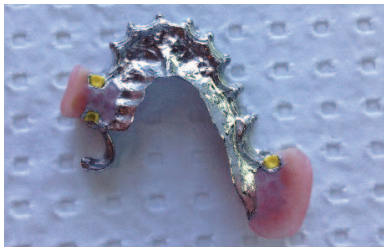

Fig. 9 Tissue fitting surface of casting.

Fig. 10 Final aesthetic and functional outcome.

aesthetic, phonetic and functional requirements. The increased vertical dimension built into the provisional restorations has been well tolerated by this patient.

The dentist presented the following definitive restorative treatment plan which was accepted by the patient:

Upper Jaw: Crowns 13, 11, 21, 22, 26, bridge 22-25, precision attachment distal of 22. Tooth 12 maybe a crown or removed and be part of a bridge. All crowns are to be milled and three-tooth chrome denture provided.

Lower Jaw: Crowns 46, 47, 34 with distal attachment on 34 and composite build-up from 33-43 (Penn stent) and precision-attached chrome denture.

During the course of the definitive temporisation stage, the patient decided not to have upper and lower removable appliances in the permanent restorative plan (as was originally planned by the dentist and agreed to by the patient) and wants to have implants. This highlights how critically important good provisionalisation is for larger cases as the flexibility is present to alter the treatment plan.

This case was presented with the approval of Dr Milton Quigley, NSW.

Case 2

The patient presented with a debilitated dentition without the need for a reorganised occlusal scheme (see OPG Fig. 4).

The prosthodontic rehabilitation was planned to provide upper PFM crowns and then placement of a partial denture with 3 female precision attachments incorporated into the crowns with the milled palatal surface. The semi-precious PFM bridges spanned from 16-14 as a 3-unit bridge and a 6-unit bridge 13-23 with a precision attachment between 13 and 14 and a crown was placed on 26. The upper casting was to replace 24/25/17.

Implants in the maxilla were not an option. The lower anterior teeth were extracted and a provisional bridge was placed.

Figs. 5-9 indicate laboratory and clinical stages prior to finalisation (Fig. 10).

Due to various factors, the upper definitive restorative work was done before definitive restoration of the lower dentition. Once a stable occlusal relationship is achieved in the provisionalisation stage, the dentist and patient are at liberty to stagger treatment. This has obvious benefits with time management, vocational, financial and social obligations.

This case was presented with the approval of Dr Graham Toulmin, NSW.

Case 3

This case was for a patient with high aesthetic demands and combined conventional crown and bridgework with an implant-supported screw-retained bridge. Due to the angulation issues the following considerations became apparent:

For tooth 11, the screw hole would have been placed buccally (see Figs. 11-13) which deemed a normal screw-retained crown unsuitable.

It was suggested to make a cross-screw retained crown for 11 using the Bredent system. An abutment was cast with a semi-precious alloy and then a crown was fabricated with IPS d.sign 53 alloy (Ivoclar Vivadent). It was imperative for no metal to be showing on teeth 11-14. The completed case is reviewed (Figs. 14-16).

This case was presented with the approval of Dr Lincoln Harris, Queensland.

Case 4

The dentist planned a full mouth rehabilitation case which included bridge 15-17, PFM crowns 24, 35 and 46. Implants were to be restored at 14, 36, 37 and 47. The occlusion was opened anteriorly about 3 mm to increase the VDO to gain adequate room posteriorly for reconstruction (Fig. 17).

Fig. 11 This combined case shows the different types of fixed restorative dentistry.

Fig. 12 The angulation of the 11 compelled the laboratory to fabricate a cross-screw restoration.

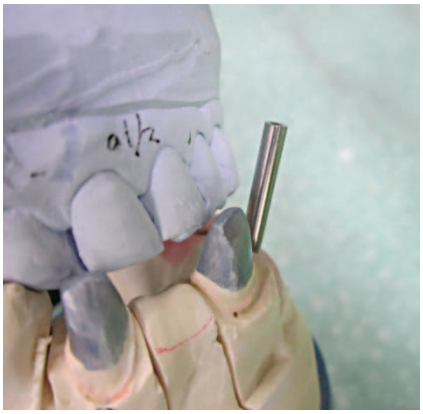

Fig. 13 Occlusal relationship vis-à-vis implant angulation.

Fig. 14 Buccal view of the conventional fixed bridgework.

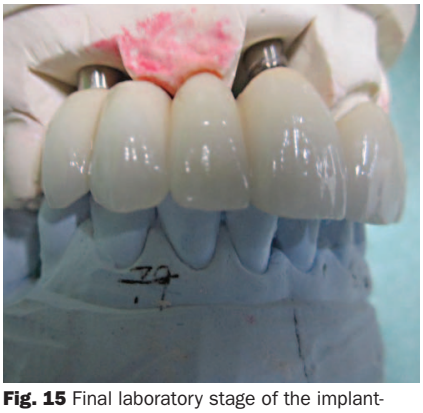

Fig. 15 Final laboratory stage of the implant-supported bridge prior to insertion.

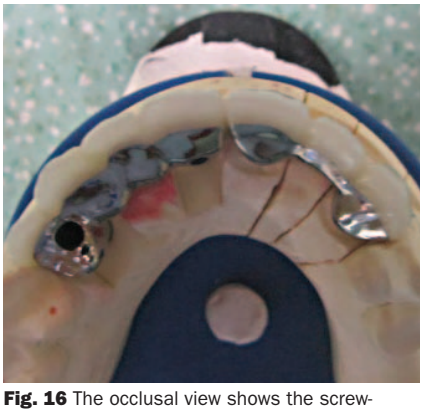

Fig. 16 The occlusal view shows the screw-retained crown on 13 with a lingual cross-screw on 11.

Fig. 17 Preoperative mounted study models.

Fig. 18a Diagnostic wax-up at vertical dimension opened at 3 mm – left side

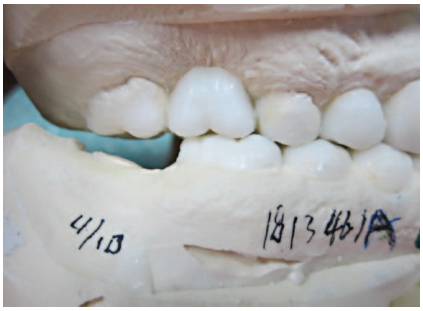

Fig. 18b Diagnostic wax-up at vertical dimension opened at 3 mm – right side.

Fig.19 Definitive posterior restorations mounted on semi-adjustable articulator – occlusal view.

Fig. 20 Definitive posterior restorations mounted on semi-adjustable articulator – left side.

Fig. 21 Definitive posterior restorations mounted on semi-adjustable articulator – right side.

A diagnostic wax-up was fabricated at the increased vertical dimension (Figs. 18a and 18b).

PFM semi-precious alloy was used to fabricate screw-retained crowns with CAD/CAM abutments for 14/36/37/47.

The completed restorations were remounted prior to establishing anterior guidance (Figs. 19, 20, 21).

Upper and lower Penn Stents were fabricated for conservative chairside build-up on the upper and lower anterior and premolar teeth (Fig. 22).

This case was presented with the approval of Dr Andrew Teakle, Queensland.

The spectrum of cases reviewed in this article demonstrate the varied and complex decisions that the clinician must make. A stable long-term temporisation phase may be critical if service providers dictate which treatments are permissible. In addition, a quadrant approach to definitive restoration may be necessary for financial reasons. There are significant differences between dentists being cognizant of important features of treatment planning issues. The patient's views differ as to what they see as acceptable treatment which will be affected by their values, previous experiences and understanding of the treatment plan. Treatment planning in restorative dentistry is not an absolute science but must be evidenced-based and the acceptance of the treatment plan requires the informed consent of the patient.

There is a variation in the treatment provided by different dentists which relates to the individual clinician's education, knowledge, experience and confidence. The availability of close supportive experienced colleagues in the restorative chain facilitates evaluation of different treatment options and streamlines the restorative process. ◆

Southern Cross Dental would like to thank the clinicians who graciously permitted the publication of their cases.

Fig. 22 The anterior teeth have been rebuilt prior to duplication of casts for provision of Penn Stents.

BIBLIOGRAPHY

1. ADA Center for Evidence-Based Dentistry. Available at http:// ebd.ada.org/about.aspx. Accessed December 1, 2012.
2. Newsome P, Smales R. Yip K. Oral Diagnosis and Treatment Planning: part I. Introduction British Dental Journal 2012 Vol 213;1:15-19.
3. Arroyo JG, Bollain IG, Esquiu CP. Multidisciplinary Treatment Plans in the Adult Patient – Step by Step and Rationale. The European Journal of Aesthetic Dentistry. Spring 2012 Vol7;1:18-35.
4. Garavaglia G, Mojon P, Belser U Modern treatment planning approach facing a failure of conventional treatment. Part I: Analysis of treatment options. The European Journal of Aesthetic Dentistry Winter 2012 Vol 7;4:372-381.
5. Tan K, Pjetursson BE, Lang NP, Chan ES. A systematic review of the survival and complication rates of fixed partial dentures (FPDs) after an observation period of at least 5 years III. Conventional FPDs. Clin Oral Implants Res, 2004;15: 654-666.
6. Pjetursson BE, Tan K, Brager U, Egger M, Zwahlen M. A systematic review of the survival and complication rates of fixed partial dentures (FPDs) after an observation period of at least 5 years I. Implant-supported FPDs. Clin Oral Implants Res,2004;15:625-642.
7. Pjetursson BE, Tan K,Brager U, Egger M, Zwahlen M. A systematic review of the survival and complication rates of resin-bonded bridges after an observation period of at least 5 years. Clin Oral Implants Res,2008;19:131-141.
8. Randow K, Glantz PO. On cantilever loading of vital and non-vital teeth. An experimental clinical study. Acta Odontol Scand.1986;44:271-277.
9. Sadowsky SJ, Bedrossian E. Evidenced-Based Criteria for Different Treatment Planning of Implant Restorations for the Partially Edentulous Patient. Journal of Prosthodontics 22(2013):319-329.
10. Fu JH,Lee A, Wang HL: Influence of tissue biotype and implant esthetics. Int J Oral Maxillofac Implants 2011;26:499-508.
11. Hattab F, Yassin O. Etiology and diagnosis of tooth wear: a literature review and presentation of selected cases. Int J Prosthodont 2000;13:101-107.
12. Lambrechts P, Braeme M, Vuylsteke-Wauters M, Vanherie G. Quantitative in vivo wear of human enamel. J Dent Res 1989;68:1752-1754.
13. Eccles J. Tooth surface loss from abrasion, attrition and erosion. Dent Update 1982;9:373-381.
14. Chu FCS, Botelho MG, Newsome PRH, Chow RW, Smales RJ. Restorative Management of the Worn Dentition:3. Localized Posterior Toothwear. Dental Update July/August 2002. 267-271.
15. Chu FCS, ASC Sui, Newsome PRH, Chow TW, Smales RJ. Restorative Management of the Worn Dentition: 4.Generalized Toothwear. Dental Update Sept 2002. 318-324.