
Parameters for Integrating Esthetics with Function

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Sergio Rubinstein, DDS





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Sergio Rubinstein received his dental degree in 1980 from the Universidad Tecnologica de Mexico. From 1980 to 1982 he completed his specialty training in periodontal prosthesis at the University of Illinois at Chicago, where he was an assistant professor until 1992. Dr Rubinstein is the coinventor of a custom abutment to prosthetically correct misaligned implants. He has lectured nationally and internationally, given hands-on courses in adhesive dentistry, and published several articles in adhesive dentistry and implant prosthodontics.

Email: oralrehab1@gmail.com



In 1974, Amsterdam stated that “there may be different ways of treating a disease, but there can be but one correct diagnosis.”¹ This is still true today: Regardless of the scientific and technological advances dentistry has undergone, treatment is still based upon accurate identification of the underlying problem.

A treatment plan is created when a knowledgeable diagnosis of a clinical problem is used to form a practical series of procedures that effectively resolve it. Once the diagnosis is made and the different treatment options have been evaluated, the best option is that which usually provides the best result with the least overall compromise. The rationale for such a decision is to offer the patient a solution that is, if possible, more conservative and long lasting than other available options. The cases presented in this chapter demonstrate examples of how proper treatment planning can provide the patient with a satisfactory solution from biologic, esthetic, and functional perspectives. A conservative approach is always recommended in cases where tooth structure is to be preserved, especially in the young patient, because some treatment modalities could involve irreversible procedures.

Diagnosis and Problem Analysis

The diagnosis dictates creation of a sequence that results in an ideal treatment based on the final expectations of the clinician and patient. Basic aspects of any successful treatment plan depend on (1) an accurate diagnosis, (2) evaluation of the risk involved with the chosen treatment, (3) prognosis of each therapeutic option based on relative risk, (4) consultation with other healthcare professionals as appropriate, and (5) proper execution of each step of the procedure. A correct diagnosis usually leads to a specific treatment option or range of options that are appropriate for the patient. *Prognosis* refers to the probable or expected result of the course of therapy. This is dependent upon the risk involved, however, which requires the clinician to fully comprehend the complexity of any given case so as to define the predictability of the selected treatment. When choices are made that increase risk, it is important that the patient, restorative dentist, and treating specialists understand how the prognosis may be subsequently affected. Consultation with other dental clinicians or specialists is frequently necessary to ensure that the original diagnosis is warranted. Recommended treatment should be directly related to the diagnosis and presented as a series of options.

An incorrect diagnosis usually results in improper treatment that needs to be redone or is altogether unnecessary. In Figs 9-1 and 9-2, three different oral surgeons diagnosed a localized cyst in a patient. Treatment recommendations included extraction and bone grafting, possible osteodistraction, implants, and/or implant-supported crowns.



Fig 9-1 (left) Radiograph of patient scheduled for extraction of mandibular right canine and premolar.



Fig 9-2 (right) Root canal treatment results in retention of the natural teeth and confirms that the original diagnosis and proposed treatment plan were incorrect. (Treatment by Paul Bery, DDS, Evanston, IL.)



Even with contemporary treatment modalities, procedures such as extraction of the canine and premolar, cleaning the surgically curetted area, and placement of a bone graft(s), combined with additional techniques such as osteodistraction, could have led to a permanent defect due to the size of the involved area. Furthermore, the adjacent teeth could face a guarded prognosis even with the most well-executed treatment. Reexamination of the problem led to the correct diagnosis and successful treatment.

It is essential to break down the specific problem in terms of its etiology and location and to visualize the desired result before any procedure is initiated. Detailed knowledge of the problem's origin and the treatment goal helps the clinician determine the appropriate course of treatment and thus should lead to a favorable prognosis. Box 9-1 outlines parameters to be closely evaluated in every patient to create the best possible treatment plan. Although clinical experience can lead to good decision making, the most successful treatment plans are created when a practitioner is able to, as Gladwell notes, “analyze a complex problem and reduce it to its simplest elements by recognizing an identifiable underlying pattern.”²

Treatment Guidelines

It is simpler to establish an appropriate course and sequence of action after the problem has been identified and a diagnosis made. If a question exists regarding treatment sequence, it is important to know



whether reversible options are available, and at what point in the sequence those exist, so as to maintain a predictable outcome. If proper healing time after the selected procedure is allowed and the patient is monitored closely for signs of potential problems, the outcome is more likely to be predictable and successful as well.

When the initial objective changes in the middle of treatment or other problems are encountered, the clinician should set new goals and be prepared to make the necessary adjustments to meet them. The original plan should be discussed with and accepted by the patient before procedures are begun, and any deviation from this plan should be explained before it is undertaken. Skillful execution based on scientific information and knowledge, combined with thorough communication with both the patient and the laboratory throughout the treatment process, leads to the best possible results.

Case Studies

The following four cases demonstrate the treatment-planning concepts outlined above. As each patient's chief complaint is examined to discover the source of the problem, the clinician is challenged to provide a solution that integrates acceptable esthetics and proper function, while keeping in mind the parameters listed in Box 9-1.

Case 1: Replacement of a maxillary crown

A 21-year-old woman presented with a complaint that she was unhappy with the surrounding periodontal tissue and color of the maxillary left central incisor crown, which was completed following an accident less than a year earlier. Medical history was noncontributory. Upon clinical examination, the color of the crown was found to be unsatisfactory. The gingiva was irritated and displayed subgingival recession that was 2 mm deeper than that of the adjacent natural central incisor (Fig 9-3a). Marginal fit of the restoration was slightly overcontoured and bulky. It was unclear whether the gingival recession, which was the main clinical problem, was the result of the incorrect fit of the crown, the original trauma to the tooth, or a combination of both.

After the crown was removed and the prepared tooth could be directly evaluated, it was determined that the restoration was slightly underprepared, with an unacceptable shape and marginal definition (Figs 9-3b and 9-3c). The tooth was re-prepared, and a provisional crown was fabricated. Placement of the provisional crown allowed a new evaluation of the tissue response, which was the most important factor in this case. Tooth contours and color were also assessed to determine the ideal course of action (Figs 9-3d and 9-3e).



Box 9-1 Parameters to consider in treatment planning

- **Tooth**
 - Anatomic/structural/biomechanical factors
 - i. Weakened by caries lesions
 - ii. Endodontic treatment
 - iii. Previous restorative treatment
 - iv. Position
 - Periodontal factors
 - i. Tooth mobility
 - ii. Edentulous area
- **Bone**
 - Quantity
 - Quality/density
 - Width
 - Height
- **Soft tissues**
 - Biotype
 - Location
 - Quantity
- **Systemic and physiologic factors**
 - Occlusion
 - Growth and development
 - Parafunctional activity
 - Temporomandibular joint conditions
- **Intrinsic/extrinsic factors**
 - Pathology
 - Iatrogenic conditions



Fig 9-3a Anterior view of crown completed less than 1 year prior to current presentation.



Fig 9-3b Incisal view showing rough preparation with poor marginal definition.



Fig 9-3c Anterior view with crown removed.



Fig 9-3d Anterior view of patient 1 week postoperatively with acrylic resin provisional restoration.





Fig 9-3e Smile evaluation with provisional restoration in place.



Fig 9-3f Simple short-term orthodontics are used to supraerupt the maxillary left central incisor and maintain esthetics. An Essix retainer (Dentsply Raintree Essix) is worn at night to prevent any undesirable movement of the abutment teeth.



Fig 9-3g Anterior view of definitive Procera crown (Nobel Biocare). (Laboratory work by Toshi Fujiki, RDT, Skokie, IL.)

Simple short-term orthodontics was considered essential to obtain the best possible result, and the patient consented to this treatment plan (Fig 9-3f). The goal was to improve the ratio of crown length to width in the provisional and future crown restorations through supraeruption of the tooth, which would alter gingival levels by bringing down the bone and periodontal tissue.³⁻⁵ The lingual surface and incisal edge of the provisional restoration were reduced to allow the supraeruption to occur without secondary occlusal trauma (Fig 9-3g).





Fig 9-4a Periapical radiograph showing unfinished orthodontic treatment with inadequate room for implant placement.

Case 2: Replacement of a congenitally missing tooth

A 17-year-old girl in the midst of orthodontic treatment arrived for a consultation, requesting permanent replacement of a congenitally missing maxillary right lateral incisor (Fig 9-4a). She did not wish to have a removable prosthesis, but her parents asked for the most conservative treatment available. Medical history was noncontributory.

It is not possible to have two objects in the same place at the same time. If a tooth or teeth are in the incorrect position, orthodontic treatment is a top consideration if the desired results are to be achieved without compromise. Quite often, roots are in an undesirable position, and the practitioner will prepare teeth to accommodate esthetic restorations even though the teeth remain crowded. In a situation with such proximity, if an interdental periodontal problem develops, it could be quite complicated to correct and to obtain long-term healthy and predictable results. When the treatment plan involves implants, as seen in this case, it is even more important to respect the required distance between teeth, teeth and implants,^{6–11} or adjacent roots. Orthodontics can prevent the problems caused by hasty or improper treatment that can lead to compromised long-term peri-implant periodontal health, or a problem as straightforward as the loss of papillae.¹²

Smile evaluation and soft tissue display in an individual play very important roles in the effect that implant depth and soft tissue manipulation have on the overall expected esthetic outcome (Figs 9-4b and 9-4c). If the surgeon is not the restorative dentist, a model-based or computer-based surgical guide is essential to assist in proper implant placement, especially for anterior tooth replacement (Fig 9-4d). The more anterior the restoration, the more critical the patient will be of the final result.¹¹

Communication with the laboratory technician is essential if optimal esthetics is to be achieved. A black-and-white photograph should be provided so that the value of the referenced adjacent teeth can be assessed, which is the first and most important step of the shade selection. Teeth can present with different colors; but even when the shade selection is slightly incorrect, if the correct value is chosen, the restoration will still blend in with the adjacent dentition.¹¹

The next step is to select the required hue and chroma to reproduce the tooth's color, which is generally easier for clinicians to communicate to a technician compared with the concepts of *value* or *depth*. It is critical that the teeth are moist and not dehydrated when a shade is selected.¹³ Although more resin composites and porcelains are under development to give laboratory technicians better options to accurately re-create value and depth, this is an area that will evolve for years to come. In addition to the previously described esthetic concepts, a detailed anatomical assessment of the tooth or teeth textures to be repli-





Figs 9-4b and 9-4c Lateral smile and retracted view of completed orthodontic treatment.

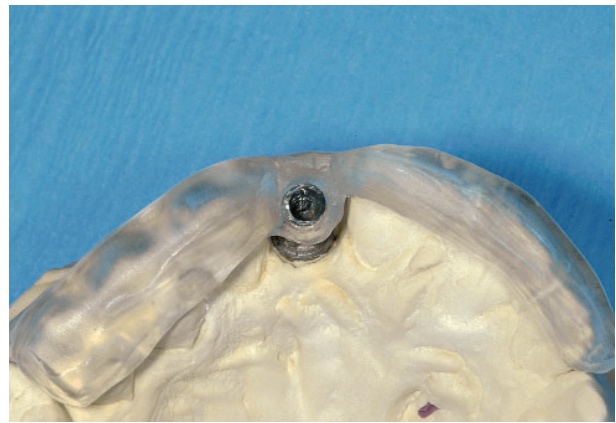


Fig 9-4d Model-based surgical guide in place with metal sleeve to guide surgeon for ideal implant position.



Figs 9-4e and 9-4f Lateral smile and retracted view of the implant-supported crown on the lateral incisor.

cated allows the technician to create the desired illusion by deflecting the light in different directions (Figs 9-4e and 9-4f). Creation of a natural-looking restoration is as significant to the final result as is the soft tissue management during all phases of implant placement.¹⁴



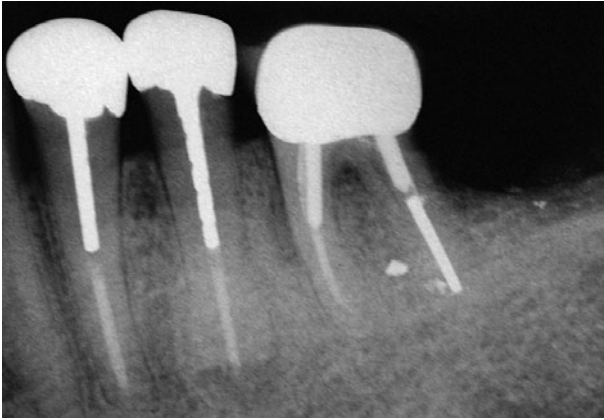


Fig 9-5a Mandibular left first molar with root fracture and hopeless prognosis.



Fig 9-5b Occlusal view of implant with healing abutment.

Case 3: Esthetic solutions for posterior teeth

The patient, a 62-year-old woman, reported pain upon chewing on the mandibular left first molar. Medical history was noncontributory. A radiograph of the tooth in question revealed a vertical fracture (Fig 9-5a). After the tooth was extracted and the area was bone grafted, the patient requested replacement of the missing tooth with a single implant-supported crown instead of a removable prosthesis.

Molars with fractures or localized periodontal problems have historically been treated with root amputations or hemisections, which proved an excellent alternative to extraction of the affected tooth and allowed patients to keep these teeth for several years with very good results.^{15,16} Nevertheless, the inception of the osseointegrated implant¹⁷ and the evolution of its design over the last two decades have allowed for better bone preservation in cases where careful extraction is exercised and a bone graft placed, if necessary, followed by implant placement. Single- or two-stage surgery is effective, as is either delayed or immediate placement.

The implant was placed at the correct buccolingual orientation relative to the available bone, adjacent teeth, and opposing teeth (Fig 9-5b). When the implant is oriented accurately, the abutment crown demonstrates optimal contours and function along the axis of the implant, thus preventing undesirable lateral forces.^{18–21}

A three-dimensional visualization of the clinical case, proper treatment planning, and proper orientation of the implant placement simplifies achievement of the prosthetic goals. Implant placement at an adequate depth is extremely helpful to create space for an abutment with subgingival margins and a proper emergence profile of the crown (Fig 9-5c).



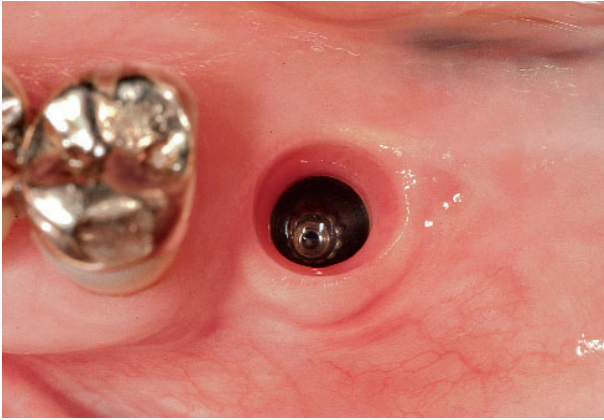


Fig 9-5c Occlusal view of implant without healing abutment. The excellent implant position in relation to the adjacent tooth and the healthy peri-implant soft tissue allow a clean impression to be taken.



Fig 9-5d Buccal view of impression post used in the open tray technique.



Fig 9-5e A custom abutment is tapped through the mesiolingual line angle to allow for a screw-retained crown and permit the creation of a crown with ideal occlusal anatomy.



Fig 9-5f The screw is placed with a mesiolingual orientation.

When impressions of implants are taken, an open or closed tray can be used. The open tray impression technique is preferred for its greater accuracy, especially in cases with multiple implants. Proper placement in a mesiodistal and buccolingual orientation (Fig 9-5d) allows the abutment to have optimal design, regardless of whether the crown is cemented or screw retained (Figs 9-5e to 9-5g).

Although the majority of clinicians prefer to cement the implant-supported crowns (either with temporary or permanent cement), the advantages of using a screw-retained crown are numerous, beginning with the ease of retrieval.¹¹ When the crown is cemented, it is impossible to ascertain whether the cement has been removed in its entirety





Fig 9-5g Sharp edge of the screw is filed down with a no. 4 round carbide bur and brownie rubber point.



Fig 9-5h Definitive crown in place. Note the excellent anatomic contours. (Laboratory work by Toshi Fujiki, RDT, Skokie, IL.)

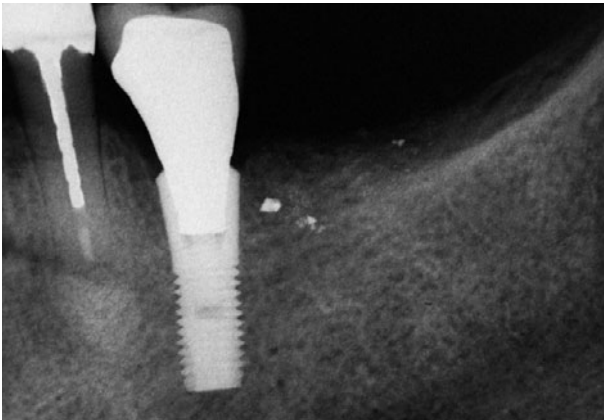


Fig 9-5i Postoperative radiograph showing implant and crown. (Implant placement by Kenneth H. Peskin, DDS, Skokie, IL.)

unless the crown has supragingival margins. As seen in Figs 9-5h and 9-5i, however, excellent gingival tissue response is routinely seen when a screw-retained abutment is used.

Case 4: Replacement of a fixed partial denture with implant

A 46-year-old man with a mandibular left fixed partial denture (FPD) and recurrent caries under the premolar asked for a restorative solution that would allow him to have separate teeth. Medical history was noncontributory. A 20-year-old FPD served as a replacement for the missing first molar. The patient reported pain upon chewing and felt that the FPD was loose around the premolar abutment (Fig 9-6a).





Fig 9-6a Mandibular left FPD with recurrent caries lesion around the premolar.



Fig 9-6b The premolar is treated endodontically and restored with a Peerless Post (SybronEndo).

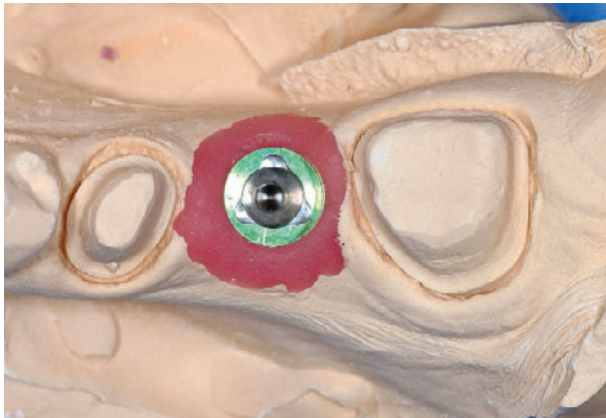


Fig 9-6c Implant properly centered within the available bone and adjacent teeth. One of the tri-lobes has a lingual rather than buccal position.



Fig 9-6d Zirconia abutment inserted at the correct angle. A smooth tooth preparation is critical for accurate impression reproduction.

Radiographs revealed that the premolar was in need of endodontic treatment. After the initial complaint of pain had been addressed and root canal therapy completed, the tooth was rebuilt in a conservative manner (Fig 9-6b). Cast posts have been the norm for restoring endodontically treated teeth for the past century.^{22–26} Prefabricated posts also can be used because they closely resemble the flexural strength of dentin and can strengthen the root, thus reducing the risk of root fracture.^{27–33}

When teeth were extracted in the past, very little emphasis was placed on preservation of the ridge and buccal plate. However, close attention must be paid to (1) preparation of the extraction site, (2) execution of the chosen technique, and (3) soft tissue manipulation if an implant is to help preserve the bone and function properly with the final restoration.





Fig 9-6e Occlusal view of definitive crowns.



Fig 9-6f Buccal view of definitive Procera crowns. (Laboratory work by Toshi Fujiki, RDT, Skokie, IL.)

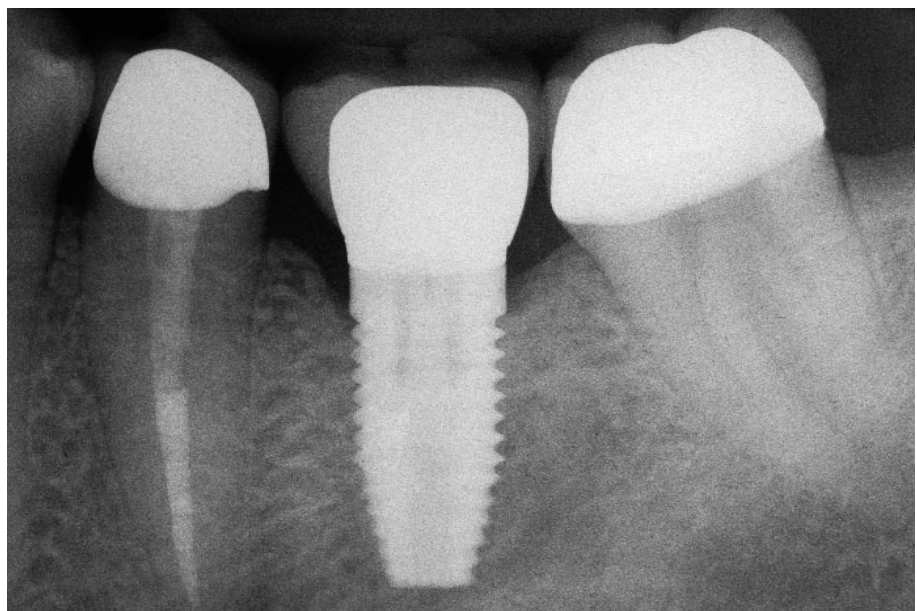


Fig 9-6g Final radiograph showing individual restorations. (Implant placement by Robert Bressman, DDS, Skokie, IL.)



Even when a single implant will be placed and stock or customized components are to be used (Figs 9-6c and 9-6d), the path of insertion of the abutment and definitive restoration is very important. Creation of the proper contours in these components not only enhances esthetics but also contributes to ideal periodontal and peri-implant health (Figs 9-6e and 9-6f).

If natural teeth are included as abutments for the definitive restoration, a well-defined preparation and margin must be established. An electric handpiece is a beneficial tool to achieve this goal because the operator can control torque and speed. The final impression must be accurate and dimensionally stable to duplicate the prepared teeth and the implant position. Modern techniques and materials allow the clinician to create computer-based copings and porcelains that can closely mimic the natural dentition. To deliver the highest possible quality of dental care, communication between the patient and clinician and between the clinician and laboratory technician is as essential as the integration of the clinicians' and laboratory technicians' knowledge and talent. In this case, correct diagnosis, astute planning, and meticulous execution led to the desired results (Fig 9-6g).

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