



An Interdisciplinary Approach to Treatment Planning in Implant Dentistry

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ABSTRACT

The practice of implant dentistry requires an interdisciplinary approach that integrates the knowledge, skills, and experience of all the disciplines of dentistry into a comprehensive treatment plan. The team must examine the anticipated restorative site to determine the suitability of the existing hard and soft tissues for implant placement. Deficiencies in hard and soft tissue, which prevent ideal implant placement, must be recognized and addressed to ensure a more predictable esthetic outcome. This article outlines a comprehensive interdisciplinary treatment philosophy designed for developing the foundation of optimal esthetics in implant dentistry. Cases are presented to illustrate the utility of interdisciplinary treatment in which specialists are recruited to enhance and improve a patient's dental function and esthetics.

Esthetics is an inseparable part of today's dental treatment. However, the consistency of the results, reliability of treatment modalities, and long-term prognosis require scientific approaches to therapeutic procedures.¹ In recent years, implant dentistry has been increasingly influenced by esthetic considerations.² The primary reason for this is the



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patient's demand for naturally appearing restorations.

With the elevated expectations of patients and increased experience and knowledge of clinicians, there is no doubt an interdisciplinary approach that integrates the knowledge, skills, and experience of all the disciplines of dentistry into a comprehensive treatment plan can yield better results.

Diagnosis and treatment planning must have a proven scientific basis for long-term success. Diagnosis is a prerequisite to successful interdisciplinary therapy.

The goal of modern implant dentistry is no longer represented solely by successful osseointegration. In order to claim success, the definitive restorations must be surrounded by a soft and hard tissue environment in harmony with the existing dentition.³ Talented ceramists can fabricate restorations that mimic the adjacent teeth. However, if reconstruction of the surrounding tissue is not realized, the result will not be esthetically pleasing. It remains the responsibility of the implant team to consider all the variables that can influence the final outcome prior to embarking upon treatment.⁴

Well-executed, implant-supported restorations can offer exceptional satisfaction to both the patient and dentist. It can transform an unhealthy, unat-



Figure 1. Maxillary occlusal view.



Figure 2. Mandibular occlusal view.

tractive dentition to one that is esthetically pleasing to the patient. In addition, implant-supported restorations can improve comfort and function. The longevity of implants is well documented, and in many situations where posterior support is lacking, implant-supported restorations are the only method of predictably providing this support for occlusion in the long term.⁵

To obtain optimal results, attention must be paid to a myriad of details. The process starts with the patient interview and assessment. Meticulous treatment planning and precision in active treatment will lead to a more predictable result.

The objectives are to improve oral health, establish proper occlusal function, and to create the most ideal esthetic result possible. Diagnoses are made based on data collected, problem lists

and the patient's chief complaint. It is only through an organized and systematic approach that appropriate diagnoses can be made. Additionally, based on these diagnoses, functional and esthetic problems can be addressed predictably.

The delivery of a successful esthetic-oriented treatment plan requires the coordination of many practitioners who need to have similar treatment philosophies. It is imperative the team leader appropriately selects a team of practitioners. The selection process can either have a positive or a negative impact on the overall treatment. Each provider on the team must have an optimal level of skill in his or her area of expertise to be a positive factor.⁶

The complex nature of interdisciplinary therapy necessitates a highly organized method of communication between the team members so that all



Figure 3. Radiographic full-mouth series.

aspects of treatment can be equally voiced. It is through this communication an interdisciplinary treatment plan can be formulated prior to generation of a joint treatment letter. This letter should include a discussion of the treatment provided by each team member, the time frame of the proposed treatment, the inherent risks involved, treatment alternatives, informed consent, and the financial responsibilities of the patient. It can be said that the quality of treatment is dependent upon the quality of the communication. It is critical the team leader maintains communication between the specialists both during treatment and once it has been completed. It is only through this approach that optimal care can be delivered and regular planned follow-up care can be implemented. The team leader in this respect should be the restorative dentist since he or she is responsible for the definitive appearance of the prostheses to be seated on the implant.

Following a preoperative evaluation, it is the restorative dentist who must define the ideal morphology of each element to ensure the prostheses blends seamlessly into the existing oral environment.⁷ Therapy must begin with a detailed clinical and radiographic evaluation. Mounted diagnostic casts are critical in all phases of prosthodontics and permits discussion of proposed treatment between team members. Diagnostic casts allow analysis of the occlusion, assessment of edentulous ridge relationships, and evaluation of the position of natural abutments to calculate space requirements. Interarch space can be determined and the opposing dentition can be observed for any encroachment on the anticipated prosthetic space. The casts can be duplicated and used to fabricate a diagnostic wax up that can assist with implant site selection and angulation requirements during the

surgical phase of treatment. Most often, the diagnostic wax up is the blueprint from which a surgical guide is fabricated. This guide serves as a reference for the entire team. Every effort should be made to attain prosthetic contours that have proper intrinsic proportions, as well as proportions consistent with the adjacent teeth.

To achieve optimal esthetics, each phase of treatment must be well executed from the initial evaluation and the preparation of the implant recipient site, to the provisional phases prior to implant placement, through provisionalization following implant integration, and the fabrication of the definitive prostheses.

The following cases illustrate all of these considerations that have led to predictable esthetic treatment results.

Case No. 1

A 67-year-old woman was seeking replacement of her current removable partial denture with fixed restorations. Her specific complaint was the instability of the denture as well as the Class III tooth relationship of her mandibular anterior teeth (**Figures 1, 2**).

On clinical and radiographic examination, a diagnosis of lack of posterior support was made (**Figure 3**). There was also insufficient bone in the posterior

maxillary and mandibular areas for direct placement of implant-supported restorations.

The objectives of treatment included providing the patient with implant-supported restorations in both the maxilla and mandible, as well as orthodontically retracting the mandibular anterior teeth to provide for a more Class I horizontal and vertical tooth relationship.

When significant numbers of teeth are missing, the orthodontist is at a disadvantage because of lack of anchorage to effect the desired tooth movement. The literature has shown that dental implants can be used as anchors for both orthodontic and orthopedic movement.⁸⁻¹⁰ By utilizing an interdisciplinary approach, implants can be used to provide anchorage, and then restored as implant-supported restorations.

With these objectives in mind, a treatment plan was formulated that required communication between the surgeon, orthodontist, and prosthodontist.

The first stage was to complete a bilateral maxillary sinus lift with bone augmentation, as well as onlay grafting of the mandibular posterior sextants.

Implants are usually placed prior to the start of orthodontic treatment, which can be difficult since the post-orthodontic position of the teeth needs



Figure 4. Preorthodontic-mounted diagnostic casts.



Figure 5. Orthodontic set up, mandibular anterior teeth retracted. Note amount of horizontal overlap.



to be determined beforehand. An orthodontic set up was completed on the cast to determine the final position of the teeth (Figures 4, 5). Using this set up, a surgical template was fabricated to communicate the positioning of the implants to the surgeon (Figures 6, 7). The maxillary and mandibular implants were placed (Figures 8, 9).¹¹ The implant

in position of tooth No. 21 could not be ideally positioned due to the distal root inclination of tooth No. 22.

Once osseointegration had been established, provisional restorations fabricated from polymethylmethacrylate were placed on the implants (Figure 10). These restorations simplified the attachment of the orthodontic appli-

ance, restored occlusal function, improved esthetics, provided posterior vertical support, and served as blueprints for the definitive implant-borne restorations.¹²

Orthodontic brackets were attached directly to the provisional restorations using polymethylmethacrylate resin and orthodontic treatment was begun immediately. Using nickel titanium wires, a sustained orthodontic load was applied to effect lingual movement of teeth Nos. 22 to 26 (Figure 11). On completion of the orthodontic treatment, a second set of provisional restorations was fabricated since the vertical and horizontal relationships of the anterior teeth were now a more Class I relationship (Figures 12, 13). The existing provisional restorations facilitate the fabrication of the definitive prostheses in that they are the blueprint for the final design. These restorations were used to communicate esthetic and functional information to both the patient and laboratory technician for a predictable outcome (Figures 14-16).

Communication between the allied specialists is essential to achieve optimal results. Without adequate communication, the treatment provided will fall short of the desired results, regardless of the initial planning. A systematic planned and executed treatment protocol will meet the desired goals and inevitably will result in a satisfied patient.

Case No. 2

A 28-year-old woman presented with congenitally missing lateral incisors. These edentulous spaces had been restored previously with resin-bonded fixed partial dentures, which had not provided a successful outcome. The patient also felt the maxillary central incisors were narrow and requested a more dominant appearance (Figure 17).



Figure 6. Mandibular surgical guide.



Figure 7. Maxillary surgical guide.



Figure 8. Mandibular implant placement. Note nonideal placement of implant in region of tooth No. 20 as a result of the distal inclination of the root of No. 22.



Figure 9. Maxillary implant placement.



Figure 10. First set of provisional restorations on implants. Orthodontic brackets bonded to mandibular anterior teeth and implant provisionals in the posterior mandible.



Figure 11. Retraction of mandibular anterior teeth, using implant provisionals as anchorage.

Clinical and radiographic examinations indicated a number of issues that could be corrected to improve the overall esthetics. These included relative tooth dimensions, prosthetic replacement of the lateral incisors, color and smile symmetry.¹³ To confirm the analysis matched the perceptions of the patient, a diagnostic wax pattern was

formed and an acrylic resin template of the wax pattern fabricated. This template served to communicate the desired result to the patient. Approval from the patient was sought and obtained. The treatment plan was formulated and put into action.

Radiographic examination revealed inadequate interradicular space for

placement of the implants without damaging the adjacent teeth. Computer-aided tomography revealed inadequate buccolingual osseous dimensions for insertion of implants (Figures 18, 19).

A treatment plan was formulated, which included communication between the orthodontist, surgeon and prosthodontist. The first phase of treatment included orthodontic therapy to provide sufficient interradicular place for placement of implants. The space for the prosthetic restorations was communicated to the orthodontists by means of a diagnostic wax up. The patient was informed that following orthodontic therapy, the incisal edges of teeth Nos. 8 and 9 would be irregular, and as a result, would require restoration (Figure 20).

Following orthodontic therapy, an



Figure 12. Second set of provisional restorations following orthodontic movement of mandibular anterior teeth.



Figure 13. Maxillary occlusal of provisional restorations.



Figure 14. Definitive metal ceramic prostheses.



Figure 15. Maxillary occlusal of definitive restorations.



Figure 16. Mandibular occlusal of definitive restorations.



Figure 17. Preoperative condition. Patient presents with congenitally missing lateral incisors.



Figure 18. Periapical radiographs displaying inadequate interradicular space for implant placement.

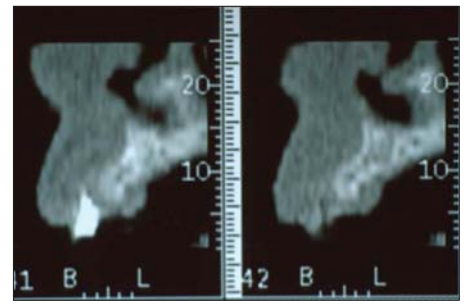


Figure 19. CT scan showing inadequate osseous volume faciolingually for implant placement.



autogenous bone graft was performed to restore the osseous volume in the regions of teeth Nos. 7 and 10. Bone was harvested from the mandibular symphysis, providing a cortical graft. Advantages of this type of transplant are a short healing period, maintenance of osseous density, intraoral access, proximity to the recipient site, low morbidity, and no cutaneous scarring (Figure 21).¹⁴



Figure 20. Orthodontic movement to create interradicular space for implant placement.

To attain the optimal morphology of the prosthetic restorations, accurate 3-D positioning of the implant fixtures is critical. A diagnostic wax up was completed and used to fabricate a surgical template, which served to communicate the implant position to the surgeon. The mesiodistal positioning of the implant required at least 1.5 mm of clearance from the adjacent teeth. This clearance was necessary to develop and maintain the integrity of the papilla.¹⁵ Faciolingually, the implants were placed for screw-retained restorations with the screw access holes emerging from the cingulum of the definitive restorations. Apicocoronally, the fixtures were placed 2 mm apical to the adjacent cemento-enamel junction. This allowed for the adequate transition from the cross section of the implant

to the natural contours of the replacement tooth. An implant level impression was obtained immediately after implant insertion (Figure 22). This impression was used to fabricate provisional restorations, which were delivered after uncovering the implant (at Stage II) to develop appropriate soft tissue contours (Figure 23).¹⁶

After preparation of Nos. 8 and 9 for porcelain-bonded restorations, the implant provisional restorations were used as impression copings and incorporated into the impression (Figure 24).¹⁷ A soft tissue cast was poured against the provisional restoration to provide a good replication of the soft tissue. Provisional restorations were provided for the patient and definitive restorations were fabricated (Figures 25, 26).

The definitive restorations satisfied the functional and esthetic goal of



Figure 21. Autogenous bone transplant in region of No. 10.



Figure 22. Fixture level impression with surgical template and resin.



Figure 23. Provisional restorations on Nos. 7 and 10 two weeks following uncovering.



Figure 24. Provisional restorations on Nos. 7 and 10 used as impression copings.



Figure 25. Implants and veneer preparations provisionalized.



Figure 26. Definitive metal ceramic implant supported restorations on Nos. 7 and 10. Bonded porcelain restorations on Nos. 8 and 9.

treatment. This was a result of coordinated efforts between the surgeon, orthodontist, prosthodontist, and laboratory technician. Restoration of tooth position and optimal bone volume were essential to ensure that only minor adjustments were required at the time of implant placement. Careful observation of the chronology of treatment stages and constant communication between the allied specialists ensured an optimal esthetic and functional outcome.

Summary

This article illustrated the advantages of an interdisciplinary approach to the management of patients who

require complex treatment utilizing implants. Treatment planning must begin through a visualization of the end result. By paying attention to details, systematically analyzing each factor that affects the esthetic result, and recognizing inadequacies in osseous and gingival contour, the restorative dentist can take advantage of the benefits of orthodontic and periodontal treatment to enhance the esthetic and functional outcomes. Without an interdisciplinary approach, the final outcome can be compromised. With a team approach to the management of patients who require implants, fewer compromises will occur and more ideal restorations can be developed with predictable results.

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- References** / 1. Nowzari H, Aesthetic periodontal therapy: introduction. *Periodontol 2000* (27): 7, 2001.
2. Rufenacht CR, Fundamentals of esthetics, Chicago, IL: Quintessence Publishing Co. Inc., 1990.
3. Phillips K, Kois JC, Aesthetic peri-implant site development. The restorative connection. *Dent Clin North Am* 42: 57-70, 1998.
4. Schincaglia GP, Nowzari H, Surgical treatment planning for the single-unit implant in esthetic areas. *Periodontol 2000* 27: 162-82, 2001.
5. Adell R, Eriksson B, Lekholm U, et al. A long-term follow-up study of osseointegrated implants in the treatment of totally edentulous jaws. *Int J Oral Maxillofac Impl* 5(4): 347-59, 1990.
6. Roblee RD, interdisciplinary dentofacial therapy, a comprehensive approach to optimal patient care. Quintessence Publishing Co. Inc., 17-43, 1994.
7. Chiche FA, Leriche MA, Multidisciplinary implant dentistry for improved esthetics and function. *Pract Periodont Aesthet Dent* 10(2): 177-86, 1998.
8. Smalley W, et al Osseointegrated titanium implants for maxillofacial protraction in monkeys. *Am J Orthod Dentofac Orthop* 94: 285-95, 1988.

9. Douglas J, Killinay D, Dental implants used as orthodontic anchorage. *J Oral Implantol* 13: 28-38, 1988.

10. Kokitch V, Managing complex orthodontic problems. The use of implants for anchorage. *Semin Orthodont* 2: 153-60, 1996.

11. Smalley WM, Implants for tooth movement. Determining implant location and orientation. *J Esthet Dent* 7: 62-72, 1995.

12. Smalley WM, Implants for tooth movement. A fabrication and placement technique for provisional restorations. *J Esthet Dent* 7: 150-4, 1995.

13. Magne P, Belsler U, Bonded porcelain restorations in the anterior dentition: a biomimetic approach. Quintessence Publishing Co. Inc., 57-99, 2002.

14. D'Addona A, Nowzari H, Intramembranous autogenous osseous transplants in aesthetic treatment of alveolar atrophy. *Periodontol 2000* 27: 148-61, 2001.

15. Jansen C, Weisgold A, Presurgical treatment planning for the anterior single tooth implant restoration. *Compend Cont Educ Dent* 16(8): 746-62, 1995.

16. Hochwald DA, Surgical template impression during stage one surgery for fabrication of a provisional restoration to be placed at stage two surgery. *J Prosthet Dent* 66: 796-8, 1991.

17. Chee WWL, Treatment planning and soft-tissue management for optimal implant esthetics. A Prosthodontic perspective. *J Calif Dent Assoc* 31(7): 559-63, July 2003.

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