

Interdisciplinary Management of a Patient with a Skeletal Deformity

Patients with a skeletal aberration that results in a malocclusion are not uncommon in our patient population.¹⁻⁴ Several treatment options exist for these patients, from undertaking no treatment at all to performing complex orthodontics, orthognathic surgery, and restorative therapies. A practitioner cannot simply use Angles' classification of occlusal relationships (i.e., Class I, normal molar and cuspid relationship; Class II, retrognathic molar and cuspid relationship; and Class III, prognathic molar and cuspid relationship) as the criteria for whether or not treatment is indicated, but must learn to evaluate the impact of the occlusal relationship on that specific patient esthetically, functionally, and biologically in order to determine if treatment is indicated.⁵ There are many patients with Class II and Class III relationships who do not need treatment. At the other extreme are patients whose esthetics, function, and biologic health are extremely compromised, and in spite of the patient and practitioner's desires to use a conservative treatment approach, nothing short of surgically correcting the skeletal deformity will solve the problem.

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CASE REPORT

The patient is a 29-year-old female who lost her anterior teeth in a traumatic accident and is currently wearing a removable partial denture to replace them. In addition, she has undergone extensive restorative dentistry to manage caries on her existing dentition; temporary crowns are present that have worn through to the underlying preparations on the maxillary right 2nd premolar and 1st molar, as well as the mandibular right 1st premolar, 2nd premolar, 1st molar and 2nd molar (Figures 1 through 3).

Her treatment goals are to eliminate the removable partial denture, have a pleasing smile, and restore the posterior teeth that she knows are a problem. She stated that she has been to several dentists, but no one has offered a solution to all of these concerns, and several haven't wanted to perform any treatment. The challenge in treating this patient is identifying all the problems that currently exist, determining which need treatment, weighing the different treatment options, presenting them to her, and then sequencing a treatment plan.

WHERE TO BEGIN

Patients such as this can be overwhelming because of the number of

problems that exist and the inter-relationships of their solutions. So often, practitioners start to focus on what they may do to solve one concern and then jump to another, and another, and become very confused in the process. The key is to follow a logical sequence that remains the same for every patient and which, ultimately, addresses all patients' problems. It is important to note that this planning sequence will remain consistent for all patients, but the treatment sequence chosen will vary for each patient and be based upon the urgency of the patient's different problems.

Step 1: Esthetics

The starting point for every treatment plan is to esthetically evaluate and plan tooth position, starting with the maxillary arch. This is done in the same sequence as setting a maxillary denture, starting with the maxillary centrals and then laterals, moving posteriorly and ending with positioning of the gingival levels. For this patient, an evaluation of the maxillary centrals' incisal edge position at rest and in a full smile showed that it could be moved coronally 1 mm to 2 mm from the incisal edge position of the existing partial denture.⁶ Using this new central position as a reference, the laterals,

canines, premolars, and molars can be positioned to create a pleasing occlusal plane and smile line. The management of the occlusal plane is a significant problem in this patient because of the over-eruption of the maxillary posterior teeth. It will be necessary to move the occlusal plane apically on the premolars and molars anywhere from 3 mm to 6 mm, depending upon the tooth (Figure 4). In addition, the buccal-lingual position of the maxillary teeth must be evaluated to create a pleasing arch form. In this patient, the maxillary arch form and buccal-lingual position are acceptable. Following the identification of the desired tooth position, it is necessary to identify the desired gingival levels. This is done to create pleasing width-to-length ratios of teeth and pleasing gingival display.⁷⁻⁹

In this patient, the gingival levels of the anterior teeth are acceptable, but the posterior teeth will need their gingiva positioned apically several millimeters to match the change in the positions of the teeth. While there



Figure 1. View of the patient's initial smile.



Figure 2. The patient's maxillary arch. Note the wear through the existing provisionals.



Figure 3. The patient's mandibular arch. Again, note posterior wear.

are several other esthetic refinements to be considered in managing patients, tooth position and gingival levels are the critical areas to address first in the treatment plan.

Esthetic summary

1. Lengthening maxillary centrals 1 mm to 2 mm
2. Apically position maxillary premolars and molars
3. Apically position gingiva on maxillary premolars and molars

Step 1 has resulted in a correctly positioned and esthetically pleasing maxillary arch. Notice the methods of correcting tooth position have not been chosen yet, because it is still necessary to evaluate the other areas of the treatment plan prior to selecting the treatment options to be used.

Step 2: Function

This step evaluates the existing condition of the temporomandibular joints (TMJ), muscles of mastication, and teeth and identifies what changes will be necessary to create an acceptable occlusal relationship against the previously altered maxillary arch from Step 1. This patient's TMJ and muscles of mastication are symptom free and normal from examination. Following the TMJ and muscle assessment, it will be necessary to mount models on an articulator using a facebow and centric relation record in order to proceed with the functional treatment planning.¹⁰ After the mounting, start by evaluating the position of the mandibular incisors relative to the posterior occlusal plane and esthetically in the patient. The mandibular incisors were acceptable esthetically in their position. Following the evaluation of the lower anteriors esthetically, evaluate the mandibular occlusal plane. The mandibular incisors and mandibular left posterior were level, while the mandibular right posteriors were apical to the occlusal plane and needed to be lengthened coronally (Figure 5).

Following an evaluation of mandibular tooth position, evaluate mandibular gingival levels to see if any alterations in gingival height are necessary to correct crown length. In this patient,



Figure 4. Note the significant over-eruption of the maxillary posterior teeth.



Figure 5. Note mandibular occlusal plane



Figure 6. Note the Class III molar and cuspid relationship.

the mandibular gingival levels on the posteriors will need to be moved apically to create adequate crown length, especially on the mandibular molars.

Once the desired mandibular tooth position and gingival levels are identified, evaluate the occlusal relationship of the mandibular arch to the maxillary arch. This is ideally accomplished using the mounted models. This patient has a Class III molar and cuspid relationship on both sides, making it impossible to gain any anterior contact (Figure 6). To correct this, it will be necessary to alter the position of the maxilla or mandible, or alter the length of the lower arch by extracting some mandibular teeth and closing the arch down.

Functional summary

1. Raise lower right posteriors to level occlusal plane
2. Alter gingival levels on mandibular molars to correct crown length
3. Correct anterior-posterior relationship of maxilla to mandible

Step 3: Structure

Structural treatment planning involves evaluating the current condition of the teeth, how they will be restored, and how missing teeth will be replaced. It is helpful to separate the condition of the teeth into 3 categories: 1) those that need treatment now because of active disease; 2) those that will need treatment in the future due to aging restorations; and 3) those that will only need treatment to alter their appearance.



Figure 7. Initial panoramic film of the patient.



Figure 8. Cephalometric film showing maxillary hypoplasia.



Figure 9. Facial profile shows the deficiency of the maxilla that will be enhanced by a maxillary advancement.

This patient's remaining teeth all fit into category 1 or 2, with the teeth in the existing temporaries needing treatment now and the others needing treatment sometime in the future due to the old restorations and high caries history. In addition, structural treatment planning evaluates areas of missing teeth and options available for replacing them. The patient's desires are to eliminate the removable partial, so the incisors could be replaced with a fixed partial denture or an implant retained prosthesis.

Structural summary

1. Remove and replace all existing temporaries
2. Restore any other teeth with active caries
3. Ultimately restore any other questionable teeth
4. Replace incisors with a fixed partial denture or implants

Step 4: Biology

Biologic treatment planning is concerned with evaluating the health of the gingiva, bone, pulpal status, and any other biologic concerns the patient may have, such as oral hygiene and nutrition. The primary biologic concerns in this patient are oral hygiene, a high caries rate, and gingivitis. The pulpal status is vital on all the teeth except #4, #13, and #21, which have existing successful endodontic therapy. In addition, a radiographic assessment revealed no periodontal defects, nor did probing depths support that any defects are present (Figure 7).

Biologic summary

1. Nutritional evaluation concerning sugar intake and caries
2. Need to improve oral hygiene for caries risk and reduce gingival inflammation

MOVING FORWARD

Once the problems are identified and it becomes obvious restorative dentistry alone cannot solve the treatment needs of the patient, it becomes critical that an interdisciplinary treatment plan and sequence be developed. To accomplish this, the patient will need to see each potential therapist for

examination and to obtain any record necessary which isn't already available. Following evaluation by the other therapists, a patient like this requires a face-to-face round table discussion among all the therapists to distill the treatment plan to its final form, outline the sequence of treatment, and identify who is responsible for each phase of treatment. This is then written down so that each therapist has a copy, and ultimately the patient will receive one, also. Only after this meeting can the final treatment be presented to the patient. Usually this is done by the restorative dentist, who also presents the restorative fees. The patient will then see the other therapists to have any questions about their therapy reviewed and their fees quoted. Following the patient's acceptance, the sequence is started, with everyone knowing his or her timing and responsibility.

CHOOSING THE METHOD OF TREATMENT

Once the esthetic, functional, structural, and biologic outcomes are indentified, it is possible to develop a logical plan for this patient.

Esthetically, the major challenge is the over erupted posterior teeth. The options for treating this would be: 1) significant crown lengthening, endodontics, and restoration to a more apical level; 2) palatal implants and orthodontically intrude the posterior teeth; and 3) maxillary osteotomy impacting the maxillary posteriors to the correct position. Since we have now evaluated the functional needs of the patient, and one of the goals functionally is to correct the anterior-posterior relationship of the maxilla and mandible, the maxillary osteotomy could also move the maxilla anteriorly to correct the occlusal relationship, as well as the esthetics. All that remains is to evaluate if moving the maxilla will benefit or hurt the patient's facial appearance. Evaluating a cephalometric head film and the patient-in-profile shows the maxilla to be hypoplastic, so the maxillary osteotomy was chosen to correct the maxillary tooth position and occlusal relationship (Figures 8 and 9).

The structural evaluation found several areas of caries under old restorations and very short clinical crowns on several posterior teeth. To manage the teeth structurally, the decision was made to perform osseous crown lengthening to place the gingiva apical to any caries, followed by re-restoration. In addition, the patient desired a fixed form of tooth replacement for her incisors. She was presented with the alternatives of a fixed bridge or

implant-supported restoration and chose the implants. Although 4 incisors are missing, only 2 implants will be used in the lateral incisor position, and a 4-unit implant-supported bridge will be placed. The alternative was to consider adjacent implants in the central incisor area and cantilevered laterals. The use of 4 implants wasn't considered due to the difficulty of managing the soft tissue esthetics around 4 adjacent anterior implants.¹¹

Biologically, the primary concern was the caries and gingival inflammation. The treatment plan chosen was nutritional counseling, oral hygiene instruction, root planing, and home fluoride rinses.

SEQUENCING

Although the planning process always follows the same steps, the sequence of treatment varies significantly from patient to patient and is negotiated among the treating clinicians. For this patient, the biologic concerns over caries and gingival inflammation were paramount, so the first step was several sessions with the dental hygienist for nutritional counseling, oral hygiene instructions, scaling and root planing, and to institute a fluoride rinse.

Following this, the remaining treatments to be sequenced were: posterior crown lengthening to expose sound tooth structure; the maxillary osteotomy to correct the maxillary tooth position and the occlusal relationship; a diagnostic wax-up; provisionalization of all the teeth and final restoration; placement of implants at the #7 and #10 area; and placement of a 4-unit fixed implant supported bridge. Depending upon the patient, these treatments could be sequenced in a number of different ways. The key is to organize the sequence into the most logical order possible so that each treatment facilitates the next in order.

We chose the following sequence and rationale for this patient:

1. Biologic treatment with hygiene.
2. Crown lengthening of all posterior quadrants to expose sound tooth structure and facilitate margin placement of restorations (Figure 10).



Figure 14. Shell temporaries fabricated from the diagnostic wax-up prior to tooth preparation.

A major consideration was when to perform the orthognathic surgery. The choices were prior to temporization using a splint to position the maxilla correctly, or after temporization using the temporaries to determine the correct maxillary position. The thought was that a more accurate occlusal and esthetic result would be obtained if the temporaries were placed first, preceding the surgery. This also had the benefit of ensuring that all caries were controlled under any old restorations.

3. Mount a new set of models following the crown lengthening to ensure an accurate diagnostic wax-up (Figure 11).
4. Model surgery to position the maxillary model in the desired position esthetically and occlusally. This step should be performed by the orthodontist or surgeon because they know what is possible (Figure 12).
5. Diagnostic wax-up on the models following the repositioning of the maxillary model (Figure 13).
6. Construction of shell temporaries from the diagnostic wax-up trimmed to the gingival margin of the wax-up to facilitate their position clinically (Figure 14).

Once the laboratory phase is complete, the next sequence of treatment is critical. The temporaries were made to create an ideal occlusion after the maxillary surgery. This means that since they are being placed prior to surgery, the only occlusion will be on the patient's molars, and she will have an exaggerated open bite following temporary placement. For this reason,



Figure 10. Lateral view after crown lengthening demonstrating exposed sound tooth structure.



Figure 11. New models mounted on an articulator following crown lengthening.



Figure 12. Model surgery done to position the maxillary model in the desired position.



Figure 13. A diagnostic wax-up to idealize the esthetic and occlusal relationship following model surgery.

the orthognathic surgery is performed days after the temporaries are placed.

7. Prepare maxillary arch and place a 1-piece maxillary provisional; prepare mandibular posteriors and place



Figure 15. Maxillary arch preparation prior to placement of the shell temporaries.



Figure 16. Maxillary arch and mandibular posteriors temporized prior to jaw surgery. Note intentional creation of an exaggerated anterior open bite.



Figure 17. View following placement of brackets to aid surgeon and maxillary osteotomy. Note occlusal relationship created by the combination of the provisionals and orthognathic surgery.



Figure 18. Final restoration, including implant supported fixed partial denture across #7 through #10.

posterior temporaries (Figures 15 and 16).

8. Next day: orthodontic brackets placed on all teeth. This is not done to move the teeth, but rather to facilitate fixation of the occlusal relationship prior to plating of the maxillary position by the surgeon.
9. Third day: maxillary osteotomy using temporaries to correct position (Figure 17).

Following the maxillary surgery, the patient will heal for 2 to 3 months before the final surgical step, which is placement of the implants at the #7 and #10 areas. This was not done the day of the orthognathic surgery in order to allow for an evaluation of the final esthetic and occlusal relationship of the maxilla before choosing the final implant location.

10. Implants placed in the #7 and #10 areas.
11. Complete restoration of all teeth and implants (Figures 18 through 20).

Conclusion

This case report illustrated the process of interdisciplinary treatment planning and treatment of a patient requiring several different disciplines to manage her care. Although these cases can initially seem overwhelmingly complex, the greatest challenge is simply in the planning stages. Once the plan is integrated, each therapist performs the same procedures they do on a daily basis. And, while certainly not all patients are motivated or have the resources for such complex treatment, for those who proceed, it is truly life altering.

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Figure 19. View of the patient's pre-treatment smile.



Figure 20. View of the patient's smile postoperatively.