Surgical-orthodontic management of persistent closed lock of the TM joints

Surgical management of internal derangement in the temporomandibular joint traditionally involves disk repair or removal. Disks are often replaced with various types of autogenous, allogenic or alloplastic materials. The failure rates for such replacements are estimated at 10% to 20%. Current thinking suggests that permanent alloplastic interpositional grafts should be avoided. The following report describes the orthodontic/orthognathic surgical management of a patient with bilateral Silastic fossa implants.

Patrick K. Turley, DDS, MSD, MEd

Until the 1980s, surgical management of internal derangement in the temporomandibular joint usually involved disk repair or removal. Little consensus existed about the merits of various procedures, although most authors considered disk removal the treatment of choice.[1] Diskectomy is one of the oldest and best documented procedures for the TM joint.[2-3] Although avoided by many surgeons, favorable reports of long-term results lend credence to this type of surgery.[4-7]

The decision on whether or not to replace the disk was up to the individual surgeon, with various forms of autogenous, allogenic or alloplastic materials available. Autogenous grafts have been reported using cartilage, dermis, fascia, muscle and fat. Some surgeons prefer dermal grafts because of their reported advantages over fat, fascia, or muscle, especially their ability to withstand the stresses of TM joint function. Repair or replacement of the disk with autogenous dermal grafts has been reported to be highly successful.[7] Other authors, however, have observed partial or complete degeneration, necrosis, and residual foreign body reaction.[8] Patients receiving auricular cartilage as an interpositional material showed poorer results than those receiving disk removal alone.[3]

Alloplastic implants have been used to promote resurfacing and to prevent adhesions between the condyle and fossa, as well as articular degeneration, crepitus and pain.[8] Commonly used materials included Silastic sheeting, a laminate of Proplast with non-porous Teflon, and various metals. Proplast and metal implants were used permanently, while silicone rubber has been used both permanently and temporarily. Most implants are subject to wear and deterioration and may fragment or displace.[8] Although initial reports of Proplast/Teflon were positive, extensive evidence of its shortcomings is now available. Destructive tissue changes are commonly seen and include foreign body granulomatous reactions, lymphadenopathy,[9] reactive synovitis, and destructive arthritis.[10] Studies now indicate that Proplast/Teflon is no longer an acceptable implant material in the TM joint[8] and these implants have been recalled by the FDA.

In 1984 the American Association of Oral and Maxillofacial Surgeons conducted a symposium on TM joint surgery.[11] The success of various surgical procedures was discussed and failure rates for open TM joint surgery were estimated to be between 10% and 20%. Factors associated with failure were patient selection, misdiagnosis, and incorrect choice of surgical procedure. Current thinking suggests that the permanent alloplastic interpositional grafts now available should be avoided. A temporary silicone implant to reduce the formation of adhesions and to keep the joint recess open allowing the formation of a fibrous barrier is still commonly used for 6 to 12 weeks.

For cases with anteriorly displaced disks, microscopic disk preservation surgery may provide the best opportunity to restore normal anatomy to the TM joint.[1] Also used for anteriorly displaced disks, the condylotomy procedure allows the condyle to

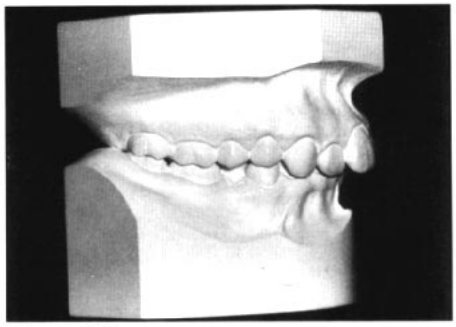

Figure 1A

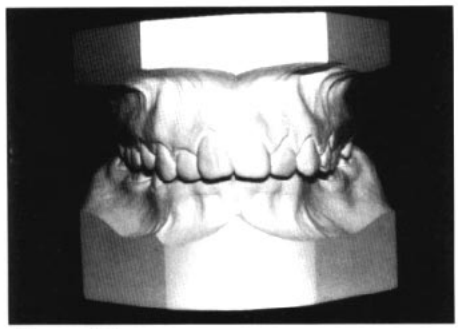

Figure 1B

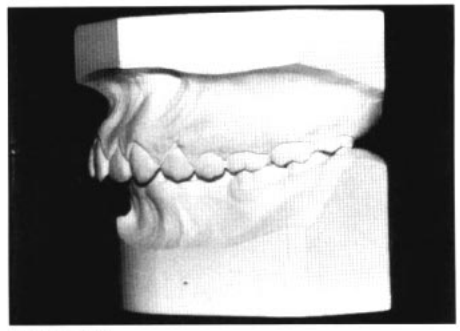

Figure1C

Figure 1A-E
Pretreatment dental casts

Figure 2A-C
Pretreatment intraoral photographs

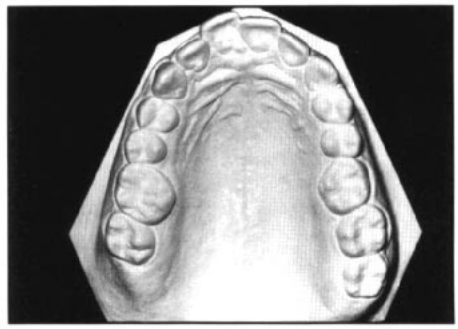

Figure 1D

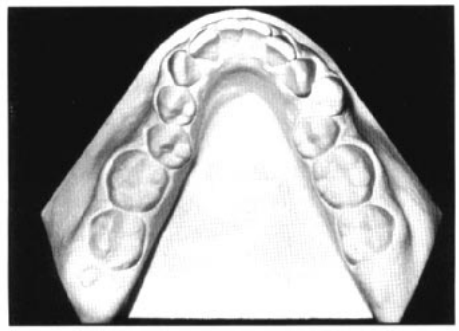

Figure 1E

Figure 2A

Figure 2B

Figure 2C

move anteriorly and inferiorly beneath a reducing disk, while the patient's occlusion is maintained with intermaxillary fixation. Designed to reestablish the disk to a more central, weight-bearing position of the TM joint, this procedure also has been proposed to treat acute displacement without reduction and recurrent luxation of the TM joint.[12]

With the development of TM joint arthroscopy, less aggressive management is now available. Arthroscopic examination of the superior compartment provides visualization of the synovial lining, meniscus, fossa, and eminence. Although arthroscopy does not provide the same range of surgical options as open procedures, lysis and lavage has been shown to eliminate adhesions, reduce inflammatory synovial products, as well as mobilize a painful hypomobile joint.[13] A 6 year multicenter study of 4,831 joints showed 90% of patients with good or excellent motion, reduced pain, ability to maintain a normal diet, and reduction of disability following TM joint arthroscopy.[14]

Patients with internal derangement of the temporomandibular joints are often candidates for orthodontic therapy. Coordinating orthodontic treatment with therapy for the TM joints can be difficult since the TM joint dysfunction and the therapies designed to remedy the dysfunction can impede orthodontic treatment and compromise the result. The following case report describes the orthodontic/orthognathic surgical management of a patient who had already undergone TM joint surgery.

History

This 23-year-old Caucasian female was referred for treatment of a Class II malocclusion by a dentist and an oral surgeon who specialize in the management of TM joint dysfunction. The patient's past medical history was non-contributory. She had a history of normal dental care and numerous posterior restorations. She presented with a history of clicking in the left TM joint that had progressed to intermittent locking and then to persistent closed

lock of the mandible. After 4 months of restricted opening, the right TM joint also started clicking and movement became restricted. Associated with the closed lock was muscle tenderness, fatigue, and headaches. An arthrogram showed changes consistent with degenerative joint disease. Conservative attempts at treatment were unsuccessful. After 5 months of continuous locking the patient underwent bilateral TM joint arthroplasty with meniscectomies and insertion of silastic fossa implants.

Diagnosis

The patient presented with a Class II molar and canine relationship that was more pronounced on the left side (Figures 1 and 2). There was 7.0 mm overjet and 100% overbite from the labial and lingual. The mandibular incisors were occluding in the palate and there was significant incisal wear on these teeth. There was only 2 to 3 mm arch length deficiency in the anterior maxilla, but approximately 8.0 mm of arch length deficiency in the mandibular arch. The mandibular arch was narrow and collapsed. A maxillary buccal crossbite existed in the area of the left first and second premolars and right second premolar. The maxillary and mandibular midlines were coincident but 2.0 mm to the right of the facial midline.

Cephalometric analysis revealed a mild Class II skeletal pattern (Figure 3). The maxillary incisor was proclined in relation to the NA plane while the mandibular incisor was angularly retroclined, but bodily well positioned in relation to the NB plane. The mandibular plane and lower face height were less than normal. Facial examination revealed a relatively straight profile (Figure 4). The patient had a relatively short nose with an average upper lip, everted lower lip, and good chin position. Lower face height was slightly shorter than normal.

All permanent teeth were present except the maxillary and mandibular right third molars. The full mouth radiographic series showed root structure and alveolar bone level within normal limits. Restorations were present in all erupted molars and one maxillary premolar. The initial TM joint series showed marked remodeling of the left TM joint (Figure 6). The anterior superior aspect of the condyle was flattened and there was loss of vertical joint space. Upon opening, a restriction in translatory motion was seen. The right joint appeared to be within normal limits.

The patient's oral hygiene was good (Figure 2). There was adequate attached gingiva anteriorly and posteriorly with some recession over the buccal aspect of the maxillary left first premolar. At the time of initial evaluation, maximum mandibular opening was 25.0 mm. Three months following

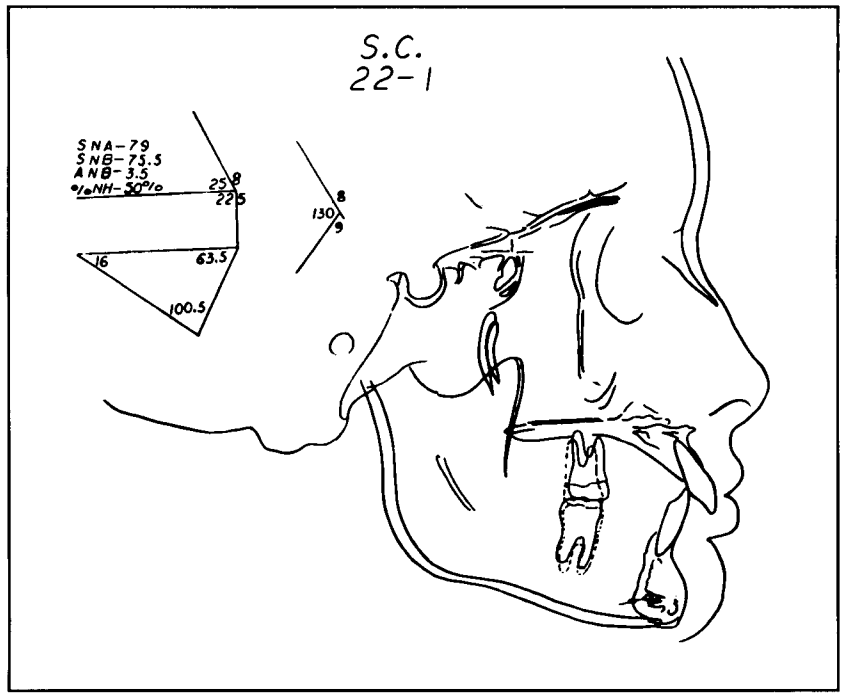

Figure 3

Figure 4A

Figure 4B

Figure 4C

Figure 3
Pretreatment cephalometric tracing

Figure 4A-C
Pretreatment facial photographs

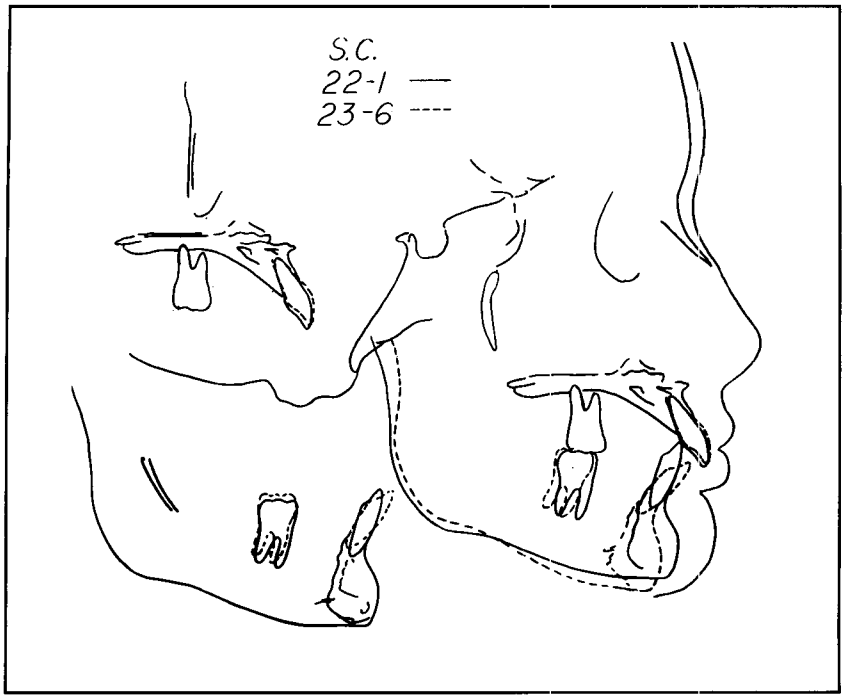

Figure 5

Figure 7A

Figure 7B

Figure 7C

FIgure 5
Superimposition of pretreatment and presurgical tracings show clockwise rotation of the mandible and proclination of the mandibular incisors.

Figure 6A-B
TM joint tomograms prior to joint surgery

Figure 7A-C
Presurgical facial photographs. Significant lip strain was apparent.

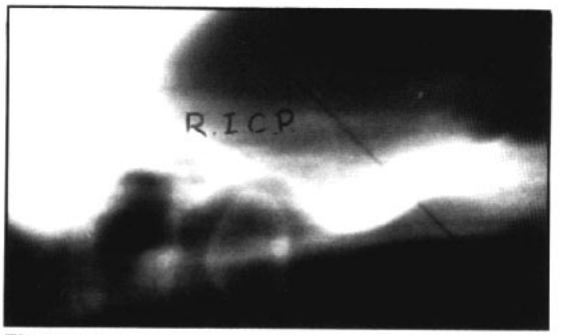

Figure 6A

Figure 6B

surgery, the patient was asymptomatic and had 40.0 mm of opening. After consultation with the referring dentists, active orthodontic treatment was initiated.

Treatment objectives

1. Establish a good, functional occlusion with no balancing interferences.
2. Reduce overjet and overbite.
3. Eliminate mandibular dental malalignment.
4. Eliminate buccal crossbites.
5. Maintain facial esthetics.
6. Maintain temporomandibular joint function.

Treatment plan

Facial analysis revealed the chin to be in good position, therefore retraction of the maxillary anterior segment was chosen to reduce the significant overjet. If maxillary first premolars were extracted and the patient treated orthodontically, maximum anchorage would be necessary. Because of the TM joint dysfunction, the referring oral surgeon strongly advocated an anterior osteotomy to decrease treatment time and to avoid extraoral anchorage. The extraction of maxillary first premolars with a maxillary osteotomy to intrude and retract the six anterior teeth was thus chosen.

To correct the mandibular arch length deficiency, a nonextraction approach was planned. Extractions and space closure in the mandibular arch could be difficult due to the deep bite, steep curve of Spee, and TM joint dysfunction. The arch was severely collapsed due to the Class II deep bite occlusion, hence, expansion of the buccal segments appeared

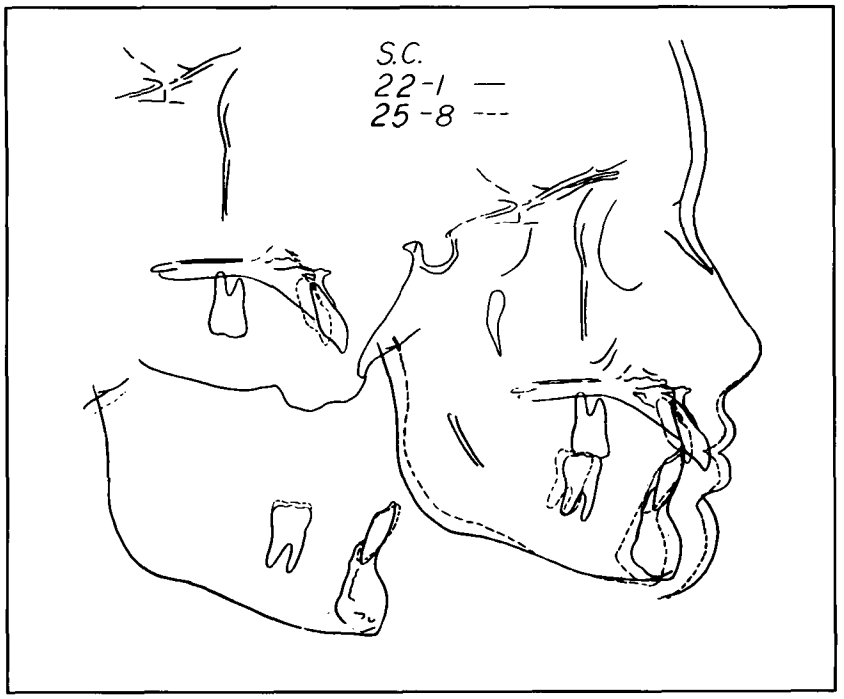

Figure 8

possible. To assist nonextraction alignment, a maxillary biteplate was used and a free gingival graft was placed in the mandibular anterior area to prevent recession due to anterior movement of the incisors. While maintaining maxillary width with the bite plate, intermaxillary cross elastics were used to help expand the mandibular arch. After aligning the mandibular arch, a maxillary osteotomy was performed with orthodontic finishing to follow. Upon removal of appliances, a maxillary circumferential retainer with an anterior biteplate was used. A mandibular removable retainer was placed in the lower arch. The prognosis for long-term stability was guarded due to the degenerative nature of the temporomandibular joint disease and the unpredictable response to the joint surgery.

Treatment progress

Edgewise appliances were placed in the maxillary arch and an anterior biteplate inserted. Mandibular appliances also were placed as were initial alignment wires. Intermaxillary cross elastics were worn to the maxillary buccal segments to assist mandibular arch development. Maxillary surgery was scheduled prior to complete alignment of the mandibular arch, due to the impending expiration of the patient's insurance coverage. Maxillary first premolars were extracted at the time of the osteotomy.

The patient was seen 2 weeks after surgery, and then failed the next appointment. She did not return until 2 months after the maxillary splint had been removed. At this time the overbite had increased and spaces had opened between the canine and

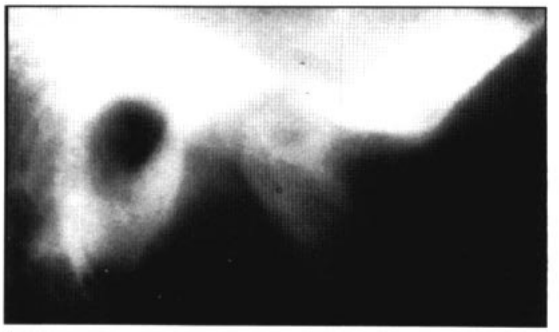

Figure 9A

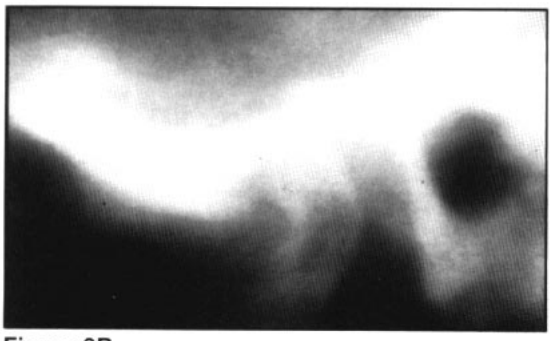

Figure 9B

Figure 10A

Figure 10B

Figure 10C

Figure 8
Superimposition of pretreatment and posttreatment cephalometric tracings.

Figure 9A-B
Posttreatment tomograms show extensive erosion and subchondral sclerosis of the condyle and fossa.

Figure 10A-C
Posttreatment facial photographs.

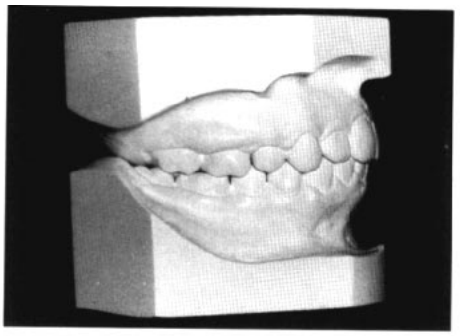

Figure 11A

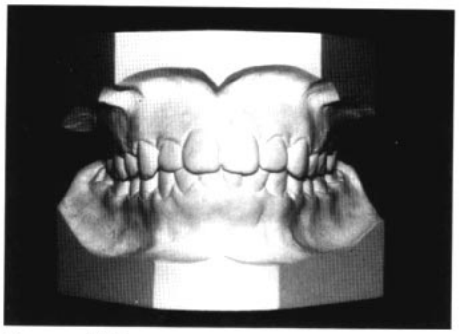

Figure 11B

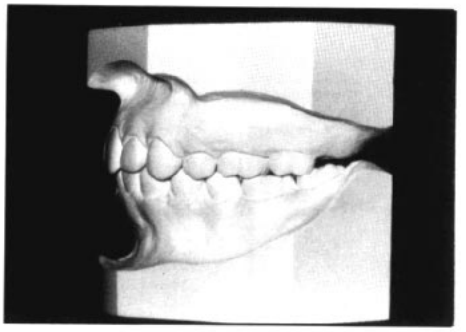

Figure 11C

Figure 11A-E
Posttreatment dental casts.

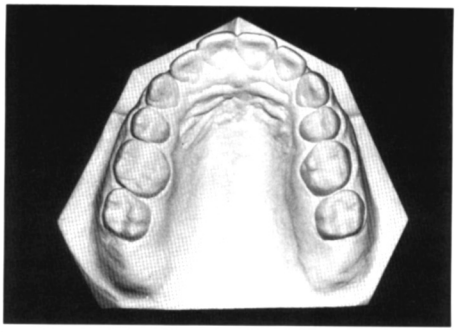

Figure 11D

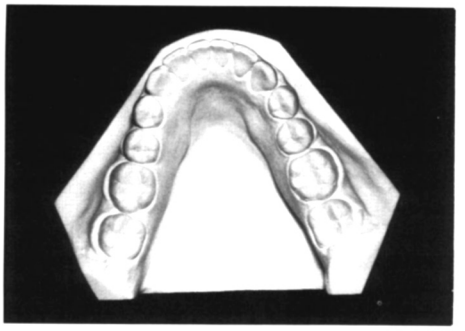

Figure 11E

Figure 12A-C
Posttreatment intraoral photographs.

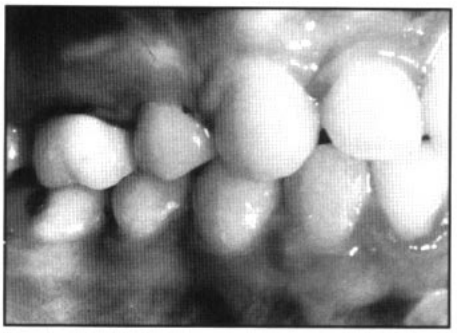

Figure 12A

Figure 12B

Figure 12C

second premolars. A utility arch was used to intrude the anterior teeth prior to retraction and space closure. Following space closure, the arch was aligned with an .016 nitinol overlaid on the utility arch. Final adjustments were done with rectangular wires and intermaxillary Class II elastics were used during the last 5 months. The patient was seen approximately once a month during the course of treatment with the only major interruption occurring following surgery.

Results

Evaluation of final orthodontic records indicates an excellent occlusal result (Figures 8-12). The lower arch responded well to nonextraction alignment and the overbite and overjet were reduced. Posterior interdigitation was improved and functional excursions were normal. Cephalometric superimpositions show significant downward and posterior movement of the mandible, probably a response to TM joint surgery (Figure 5). This response has increased the lower face height, which was slightly short prior to treatment. The mandibular incisor was intruded and proclined and the anterior maxillary osteotomy assisted intrusion and retraction of the maxillary incisors (Figure 8). Facial analysis reveals a pleasing profile after treatment (Figure 10). The upper lip appears thin in the lateral view but is within normal limits, especially in relationship to the smaller than average nose.

Intraorally, there is adequate attached gingiva throughout the mouth (Figure12). The free gingival graft is apparent upon examination and it appears that no recession over the mandibular incisors occurred as a result of treatment. The posttreatment full mouth series reveals some root resorption of the maxillary incisors. Alveolar bone level is adequate and root parallelism is reasonably good. Root proximity exists between the mandibular canines and first premolars.

Posttreatment tomograms show extensive erosion and mild subchondral sclerosis of the condyles (Figure 9). The mandibular fossa also shows exten-

Figure 13A

Figure 13B

Figure 13C

Figure 13A-C Intraoral photographs showing occlusion 6 years 6 months after treatment.

sive erosion, flattening and subchondral sclerosis. The superior joint space is reduced and a wire is visible on the lateral aspect of each joint. Upon opening, there is reduced translatory movement.

Retention

Following removal of appliances a maxillary circumferential retainer with an anterior biteplate was inserted. A mandibular spring retainer, extending from first premolar to first premolar, was used in the mandibular arch. The patient was seen at 5 weeks and again at 10 weeks, at which time space between the maxillary canine and second premolar was observed. The maxillary biteplate was increased to open the bite slightly while the labial bow was activated to close the space. In addition, the labial acrylic of the mandibular retainer was increased to contact the incisal edge of the maxillary incisors. The patient was then seen at 3 months and 6 months, and then at yearly intervals.

Final evaluation

Review of the patient's records more than 6 years after completion of treatment reveals an excellent occlusal and esthetic result (Figure 13). The posterior occlusion exhibits good interdigitation and acceptable functional excursive movements. Although the overbite has increased slightly, maintaining the maxillary bite plate has helped prevent the premolar extraction spaces from opening. In addition, the patient states that her TM joint symptoms decrease when wearing the bite plate. There has been no significant change in the occlusion even in the presence of abnormal TM joints. Progress tomograms (4 years 6 months posttreatment) show no significant changes since the end of treatment.

Prior to orthodontic treatment, the patient's maximum opening over a 5 month period was 25.0 mm. Conservative attempts to reduce the closed lock included application of heat, physical manipulation, and the use of an orthosis. When these methods failed, the patient was scheduled for bilateral TM joint arthroplasty with meniscectomy and insertion of Silastic implants. Had this patient presented for treatment only few years later, this type of surgery probably would not have been done. Arthroscopic surgery, a much more conservative procedure, would have been performed and may have had a greater chance at success. The TM joints are often stiff and sore in the morning with maximum opening presently at 32.0 mm. Joint function will continue to be monitored with removal of the implants probable.

Author Address

Patrick K. Turley
Section of Orthodontics
School of Dentistry
University of California
Los Angeles, CA

P.K. Turley is an Associate Professor in the Section of Orthodontics and Pediatric Dentistry at the University of California in Los Angeles.

He presented this case report in partial fulfillment of the requirements for certification by the American Board of Orthodontics.

References

1. Piper MA. Microscopic disk preservation surgery of the temporomandibular join. In: Disorders of the TMJ II. Arthrotomy: Oral Maxillofac Surg Clin North Amer 1989;1(2):279-301.
2. Lanz A. Discitis mandibularis. Zentralbl Chir 1909;9:289.
3. Hall DJ, Link JJ. Diskectomy alone with ear cartilage interposition grafts in joint reconstruction. In: Disorders of the TMJ II: Arthrotomy: Oral and Maxillofac Surg Clin North Amer 1989;1(2):329-340.
4. Silver CM. Long-term results of meniscectomy of the temporomandibular joint. J Craniomandib Pract 1985;3:46.
5. Ericsson L, Westessor. P-L. Long-term evaluation of meniscectomy of the temporomandibular joint. J Oral Maxillofac Surg 1985;43:253.
6. Tolvanen M, Oikarinen VJ, Wolf J. A 30-year follow-up study of temporomandibular joint meniscectomies: A report on five patients. Br J Oral Maxillofac Surg 1988;26:311.
7. Meyer RA. The autogenous dermal graft in temporomandibular joint disc surgery. J Oral Maxillofac Surg 1988;46:948.
8. Yih WY, Merrill RG. Pathology of alloplastic interopositional implants in the temporomandibular joint. In: disorders of the TMJ II: Arthrotomy: Oral and Maxillofac Surg Clin North Amer 1989;1(2):415-426.
9. Dolwick MF, Aufdemorte TB. Silicone-induced foreign body reaction and lymphadenopathy after temporomandibular joint arthroscopy. Oral Surg 1985;59:449-452.
10. Rosenthal DI, Rosenberg AE, Schiller AL, et al. Destructive arthritis due to silicone: A foreign body reaction. Radiology 1983;149-169.
11. Ad Hoc Study Group in TMJ Menisucus Surgery: 1984 Criteria for TMJ Meniscus Surgery. Chicago, American Association of Oral and Maxillofacial Surgeons, 1984.
12. Nickerson Jr JW, Veaco NS. Condylotomy in surgery of the temporomandibular joint. In: Disorders of the TMJ II: Arthrotomy: Oral and Maxillofac Surg Clin North Amer 1989;1(2):3030-3327.
13. Sanders B, Buoncristiani RD. Temporomandibular joint arthrotomy: management of failed cases in: Disorders of the TMJ II: Arthrotomy: Oral Maxillofac Surg Clin North Amer 1989;1(2):443-446.
14. McCain JP, Sanders B, Koslin ME, Quinn JD, Peters PB, Indresano T. Temporomandibular joint arthroscopy: a six-year multicenter retrospective study of 4,831 joints. J Oral Maxillofac Surg 1992;50:926.