Case Report 1

Complete Transition from Failing Restorations to Implant-Supported Fixed Prostheses in a Patient with Scleroderma

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ABSTRACT

In a case involving a patient with scleroderma, the authors demonstrate how to treatment plan and sequence the transition from a failing restored dentition to complete implant-supported fixed prostheses with sequential extractions and implant placements. The article also presents surgical and prosthodontic considerations for a complete-mouth implant-supported fixed rehabilitation while achieving optimal esthetics without compromising function in patients with this condition. Sequential treatment provided the patient with fixed provisional restorations during treatment in multiple, short surgical appointments with less psychosocial trauma. This case posed treatment challenges due to limited oral access, unpredictable disease progression, and limited data on the success of treatment with endosseous dental implants in these patients.

Scleroderma is a chronic disease that causes fibrosis of connective tissue, blood vessels, and internal organs.[1] Thought to be autoimmune, this rare condition appears during middle age and mostly affects women (4:1).[2] Although some manifestations can be effectively treated, scleroderma is not yet curable. Tightening and hardening of the skin and mucosa is common. Thus, patients with scleroderma often present with a narrowing oral aperture and rigid tongue, making routine dental treatment a challenge. Constricting distortion of denture border extension areas, mucosal ulcerations due to thinning mucosa, and restrictive dexterity limit the use of removable prostheses.[3]

Sjögren's syndrome, a chronic autoimmune condition, can occur with scleroderma. Sjögren's syndrome typically starts with the exocrine glands, such as salivary.[4] Both Sjögren's syndrome and scleroderma change salivary gland function, giving rise to xerostomia. The increased risk of cervical caries and periodontal disease due to xerostomia and the limited ability to maintain adequate oral hygiene further complicate dental treatment planning for these patients. Thus, dental clinicians should consider the progressive nature of the disease when treatment planning long-term care.

The success rates of endosseous dental implants used in the replacement of missing teeth are well documented.[5-7] A continual discussion exists on whether implant therapy is more effective compared to the restored compromised dentition.[8-11] However, dental implants are believed to have better prognoses than restoration of biomechanically compromised teeth in patients with high risk for caries.[11,12] Moreover, despite the limited evidence on the success of implant-supported therapy in these patients, dental implants have been successfully used.[13-15] This article describes and illustrates the sequential replacement of extensively restored and structurally compromised carious dentition with complete-mouth implant-supported fixed restorations while achieving optimal esthetics and function for a patient with scleroderma. Proper communication among all team members involved in the treatment planning and execution is vital to a successful outcome.

CLINICAL PRESENTATION

A 71-year-old Asian woman presented for a comprehensive dental treatment. Her medical history included diagnoses of scleroderma, Raynaud's phenomenon, and Sjögren's syndrome in 1992. At the initial dental examination, she did not report the use of any medications. Findings from a salivary flow test helped confirm xerostomia.

Her dental history included a complete-mouth rehabilitation with a recent replacement of multiple anterior restorations (Figure 1). Her failing restorations had become extensive due to recurrent caries and structural compromises. Six months prior to her initial examination, teeth Nos. 6 and 13 had fractured at the gingival level due to secondary caries (Figure 2).

Observations from the extraoral examination indicated relative facial symmetry, a convex facial profile, asymptomatic temporomandibular joints, asymptomatic muscles of mastication and muscles of facial expression, and a slight deviation of the maxillary dental midline to the left side as compared with her facial midline. The patient had a low smile line, with 60% of maxillary central incisors displayed (Figure 3).[16] Her maximum mouth opening was approximately 40 mm; however, the lateral labial movement was limited due to perioral tissue constriction.

An intraoral examination revealed generalized failing metal-ceramic and cast gold crowns due to rampant recurrent caries. Early loss of periodontal attachment around several teeth and generalized gingivitis were noted. The edentulous areas of the maxillary left and mandibular right segments presented with Seibert Class I and Class III residual ridge deficiencies, respectively.[17,18] In addition, a skeletal and dentoalveolar Angle Class II malocclusion with bimaxillary protrusion was observed. Radiographic analysis indicated short roots, residual root tips, recurrent caries, and highly pneumatized maxillary sinuses (Figure 4). The patient's progressing medical condition produced a xerostomic oral milieu and had affected her dexterity. This significantly contributed to the development of recurrent caries. In addition, the progression of the tightness and rigidity of her orbicularis oris muscles limited access for dental treatment.

Fig 1. Frontal view of the patient's preoperative dentition in maximum intercuspal position.

Following a complete diagnostic work-up, a decision was made to extract all remaining dentition and provide a replacement with implant-supported restorations. A conventional approach providing removable interim prostheses after full-mouth extraction would have been difficult to manage given the xerostomia and narrowing oral aperture.[19] A transitional approach was required to provide fixed interim prostheses and minimize surgical chairtime per visit. Although other options to address the transition from teeth to implants were available,[12] the use of sequential extractions and subsequent implant placement was selected. This strategy facilitated the maintenance of the hard- and soft-tissue topography and simplified guidance for implant surgery. Such a treatment approach was thought to also enhance the patient's psychosocial comfort by retaining some teeth with fixed interim prostheses rather than rendering her totally edentulous and having to wear interim complete dentures.[20] In addition, quadrant treatment would minimize appointment times to facilitate her tolerance for the procedures. The disadvantages of this approach included an extended treatment time and additional close maintenance of the interim restorations.

TREATMENT PLAN

The interdisciplinary treatment sequence was planned as follows:

1. Extractions of teeth Nos. 3, 5, and 6.
2. Bilateral maxillary sinus augmentations.
3. Maxillary arch: Extractions of teeth Nos. 8 and 11 while using teeth Nos. 2, 7, 9, and 10 and a single transitional implant (Nobel Biocare, www.nobelbiocare.com) between sites corresponding to teeth Nos. 11 and 12 as temporary abutments for a fixed interim restoration.
4. Mandibular arch: Extractions of teeth Nos. 19, 22, 27, 29, and 31, and using teeth Nos. 18, 23 through 26, and 28 as temporary abutments for fixed interim restorations.
5. Placements of first-phase implants at sites corresponding to teeth Nos. 6, 8, 11, 12, 20, 22, 27, and 29.
6. After healing, use of first-phase implants for fixed interim restorations and extractions of remaining dentition, except tooth No. 2.
7. Placements of second-phase implants at sites corresponding to teeth Nos. 4, 5, 9, 13, 21, and 28.
8. After healing, use of all implants for fixed interim restorations.

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9. Delivery of definitive implant-supported metal-ceramic fixed partial dentures as follows: sites corresponding to teeth Nos. 4-5-6-7p-8, 9-10p-11-12-13. Sites corresponding to teeth Nos. 29-28, 27-26p-25p-24p-23p-22, and 21-20.

The prosthetic design entailed shortened dental arches with restorations for 20 teeth with one premolar and one molar.[21] The occlusal vertical dimension (OVD) was to be maintained as presented because the patient had severe horizontal and vertical anterior overlap, as well as a skeletal and dental Class II malocclusion. Planned changes in tooth length and gingival levels were accommodated with proper implant platform positioning at the time of surgery (Figure 5). The authors decided to maintain her maxillary midline because it was not obviously noticeable as long as her midline was parallel to her facial midline.

The number and distribution of implants were selected based on the definitive prosthesis design and the difference in bone quality between the arches. The treatment plan included the use of eight endosseous implants in the maxillary arch and six endosseous implants in the mandibular arch.

PHASE I

Bilateral sinus augmentations were performed using the Caldwell Luc window technique with a composite of autogenous and allograft bone (Puros®, Zimmer Dental, www.zimmerdental.com). Extractions of teeth Nos. 3, 5, and 6 were performed simultaneously. After augmentation, first-phase long-term interim restorations were delivered. Abutments for the first-phase interim prostheses were teeth Nos. 2, 7, 9, 10, and one temporary implant (IPI, Nobel Biocare) at sites corresponding to teeth between Nos. 12 and 13 for the maxillary arch and teeth Nos. 18, 23 through 26, and 28 for the mandibular arch. Interim polymethyl methacrylate (PMMA) shells were relined with autopolymerized PMMA after extractions of teeth Nos. 8, 11, 19, 22, 27, 29, and 31.

After 2 months of healing, first-phase implants were placed at sites corresponding to teeth Nos. 6, 8, 11, 12, 20, 22, 27, and 29. Endosseous dental implants (NobelReplace™, Nobel Biocare) were selected based on implant sites and future restoration tooth types. Implant positioning was determined with a surgical guide based on information from the diagnostic wax-up (Figure 6).[22] In order to maintain a long-span fixed interim prosthesis on the maxilla, a reinforced lingual cast base metal framework was fabricated and incorporated into the PMMA provisional shell.[23] After the extractions, the interim restorations were modified to support the soft tissue with the use of ovate pontics (Figure 7).

PHASE II

After 4 months of osseointegration, the interim restorations were transitioned from teeth to implants in both arches. Interim abutments were fabricated and modified using an indirect laboratory-processed composite resin material (Sinfony™, 3M ESPE, www.3MESPE.com). The remaining dentition was prepared to the gingival level while relining the interim restorations (Figure 8 and Figure 9). On the same day, extraction of all remaining maxillary teeth except tooth No. 2 was completed. The second phase of implant surgery followed immediately with placement in sites corresponding to teeth Nos. 4, 5, 9, and 13 (Figure 10). Extractions and implant placement for sites corresponding to teeth Nos. 21 and 28 were performed 1 week later.

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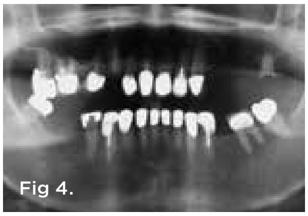
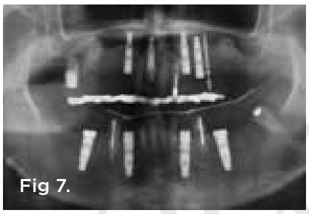
Fig 2.

Fig 2. Preoperative full-mouth periapical radiographs.





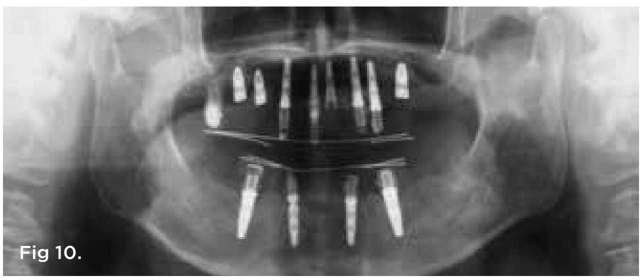


Fig 3. Patient's preoperative frontal smile view. Note patient's low smile line. **Fig 4.** Preoperative panoramic radiograph. **Fig 5.** Frontal view of diagnostic wax-up. **Fig 6.** Implant placement surgery on No. 8 site. **Fig 7.** Panoramic radiograph showed the first phase of implants placed and long-term provisional restorations supported by remaining teeth. **Fig 8 and Fig 9.** Lateral views of provisional abutments placed and one remaining tooth to support the second phase of provisional restorations. Most of the teeth were ground to the gingival level prior to the second phase of implant placement and extractions. **Fig 10.** Panoramic radiograph revealed that transitional provisional restorations were supported by implants and tooth No. 2.

PHASE III

Four months after the last phase of implant surgery, master impressions for interim restorations were made using vinyl polysiloxane (Aquasil®, DENTSPLY Caulk, www.caulk.com) impression material. A full-contour wax-up was fabricated, and the authors realized that there were cantilever effects on maxillary incisor teeth due to remodeling of hard and soft tissue after extractions and implant placements. Due to the patient's skeletal Angle Class II and bimaxillary protrusion, repositioning of the maxillary incisors lingually was possible, which improved her lip mobility and smile line. The maxillary incisors were maintained vertically but repositioned 4-mm horizontally (lingually) without altering the OVD. Shallower anterior guidance and Class I canine relationship with shallow horizontal and vertical overlaps were designed after repositioning the maxillary anterior teeth (Figure 11).

All implants were used to fabricate laboratory-processed Phase III cement-retained maxillary and mandibular fixed interim prostheses (Figure 12). The patient's comfort, occlusion, function, and esthetics were evaluated and confirmed prior to fabricating the definitive prostheses (Figure 13 and Figure 14).

Individual CAD/CAM custom titanium abutments were designed to support the definitive cement-retained implant-supported restorations. The abutments were waxed, scanned, and milled from titanium alloy (Procera®, Nobel Biocare). Studies demonstrated that this alloy has a high resistance to corrosion and increased mucosal attachment as compared to gold alloy (Figure 15 and Figure 16).[24,25] Compared to screw-retained restorations, the advantages of a cement-retained prosthesis are better passive fit, less screw loosening, more conventional and simplified fabrication of the implant prosthesis,[26] no screw access hole to interfere with esthetics and occlusion,[27] and lower probability of porcelain fracture.[28,29] Also, with the usage of interim cements, the questionable retrievability of cement-retained restorations could be resolved.[29,30]

Splinting implants reduces the total number of implants and treatment costs and also allows for better stress distribution.[31-33] This is especially important in sites where bone augmentation procedures have been performed earlier.[34] However, the complexities of fabricating long-span splinted bridges include distortion during waxing, investing, casting, soldering, and firing porcelains.[35-37] For this particular case, the fixed partial dentures were fabricated as two segments for the maxilla and three segments for the mandible.[31] Cross-arch splinting for the mandibular arch is often avoided due to the mandibular flexure during functional movement.[38] Splinted restorations may hinder oral hygiene procedures. Combined with the constricting oral aperture, this was already a challenge for this patient. It was important to develop a customized oral hygiene regimen that would be easy to follow and specific to her dexterity.[39]

Centric relation records were reconfirmed during the try-in of the metal frameworks. Tissue impressions at the pontic sites were made using an autopolymerized acrylic resin (Pattern Resin™ LS, GC America, www.gcamerica.com) (Figure 17).

Cement-retained definitive restorations were fabricated and delivered. During the bisque bake try-in appointment, the marginal fit was verified clinically and the occlusion was adjusted and refined after the definitive abutments were secured. The occlusal scheme was a mutually protected occlusion with a shallow anterior guidance and shallow canine guidance for the lateral excursions.[40,41] Internal connection implant systems and splinted prosthesis may reduce the likelihood of screw loosening for canine implants on lateral excursions.[42]

Each abutment was torqued to 35 Ncm, and the screw access holes were sealed with vinyl polysiloxane impression material (light body, Aquasil). Interim cement (Temp Bond® NE, Kerr Corp., www.kerrdental.com) was used as the luting agent for the cement-retained definitive restorations (Figure 18 through Figure 21).

DISCUSSION AND CONCLUSION

Dental treatment for a patient with scleroderma and Sjögren's syndrome can be daunting for the interdisciplinary team. Because there is limited data regarding success rates of implants in such patients, the clinician and patient are challenged when making a decision to transition from teeth to implant-supported fixed restorations. An additional issue in this case was the progressing limitation of the oral opening. Thus, clinicians should consider the current symptoms, progression, and long-term consequences of the disease. The increasing difficulty of access to the oral cavity and a high caries risk may also influence treatment planning. The patient presented with acceptable vertical opening (40 mm) and unilateral extension of her perioral muscles; however, bilateral extension of her perioral musculature was limited. Despite this, the authors were able to perform procedures such as Caldwell Luc sinus augmentation unilaterally due to a reasonable amount of flexibility on one side of her perioral muscles. However, for procedures such as making impressions of her provisional restorations, the authors had difficulties fitting the trays into her mouth due to her limited bilateral extension of the perioral musculature. To overcome this, the authors had to transfer her provisional restorations onto master casts and duplicate them for provisional restoration casts.

To provide the best long-term prognosis for this patient, replacement of all her teeth with implant-supported fixed


Fig 11.

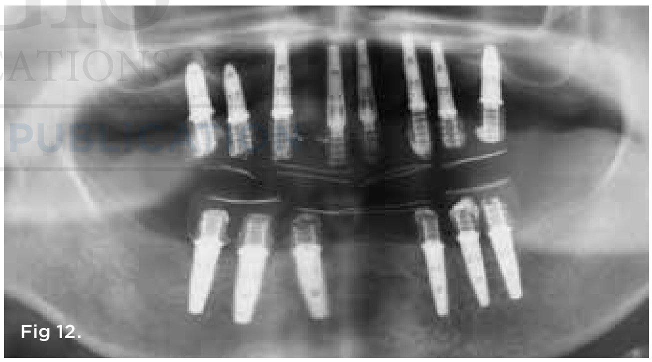


Fig 12.


Fig 13.


Fig 14.

Fig 11. Frontal view of the full-contour wax-up. Angle Class I canine position was achieved after the maxillary incisors were repositioned lingually (4 mm horizontally). **Fig 12.** Panoramic radiograph indicated that provisional restorations were fully supported by implants. **Fig 13 and Fig 14.** Patient's frontal and lateral views of smile with provisional restorations supported by implants. A more esthetic display of the teeth was achieved.


Fig 15.


Fig 16.


Fig 17.


Fig 18.


Fig 19.

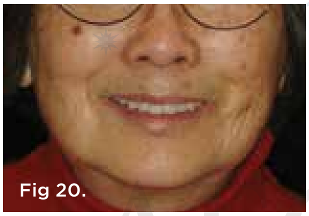


Fig 20.

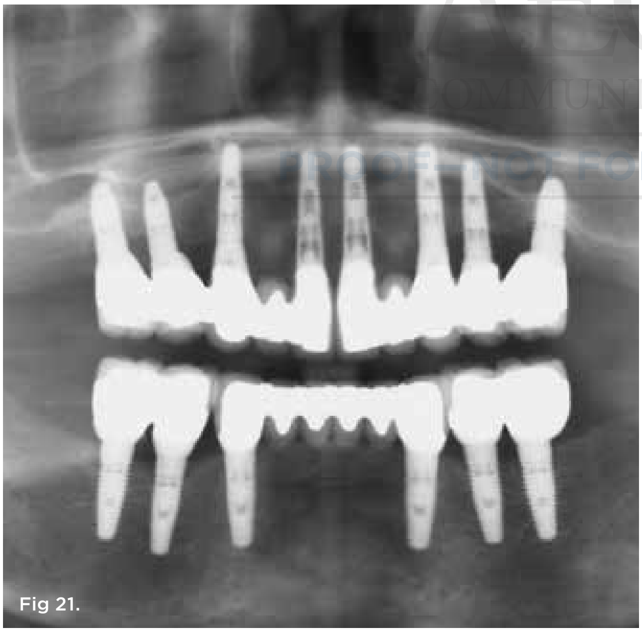


Fig 21.

Fig 15. Frontal view of titanium-milled individual abutments in casts. **Fig 16.** Frontal intraoral view of titanium-milled individual abutments trying-in. **Fig 17.** Frontal view of maxillary/mandibular relationship records with metal substructures trying-in. **Fig 18.** Frontal view of definitive restorations in casts. **Fig 19.** Frontal view of postoperative smile. **Fig 20.** Postoperative view of the patient's smile. A decision was made to maintain her existing dental midline even though it was not coincident with her facial midline. **Fig 21.** Postoperative panoramic radiograph.

restorations would be needed. While the sequential extraction of teeth and implant placement prolongs the treatment period, these multiple shorter appointments are more comfortable for a patient with significant perioral rigidity. The patient reported positive psychological benefits of this transitional approach and satisfaction with the esthetics and function provided by the interim restorations.

This article presented a successful transition from teeth to implant-supported restorations for a patient with scleroderma. The treatment result indicates that dental implant replacement of teeth in these patients is a viable treatment option. Although good communication between the medical and dental teams was essential for achieving an optimal outcome, understanding the long-term medical manifestations of a chronic disease and how it may affect the patients and their families is equally important. Additional reports of implant survival and success in patients with chronic diseases and their experiences would be important to the clinician in making decisions for treatment planning and supportive dental care.

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