

# Esthetic and Functional REHABILITATION: A Case Report

## Recreating a Patient's Smile

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### Abstract

Most people want to look beautiful. The ability to express feelings is fundamental to the quality of life, but expressing emotions is impossible without the freedom to smile.

A patient with an ill-fitting removable denture and a fixed, porcelain-fused-to-metal bridge sought care to improve her smile. This fixed bridge was removed and direct provisional restorations placed, followed by crown-lengthening surgery and implant placement, waiting 10 months for the patient to heal. We waited one month to check occlusal stability and patient satisfaction and then made the final precision impressions and master casts. We cemented the final restorations; lithium disilicate allowed the creation of an esthetic result without sacrificing strength with use of both full-anatomy and layered techniques. Dental implants make it possible to have non-removable teeth that can be integrated esthetically and functionally, allowing the recreation of tooth color, form, and structure to reestablish a patient's smile.

**Key Words:** microscope, implants, rehabilitation, transfer individualization, soft tissue management





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## Introduction

Much of dentistry today is about visual control during treatment. More and more we realize that it is impossible to treat what we cannot see, and it does not matter whether we are dealing with one tooth or a complex case. Macroanalysis of the face must be followed by microanalysis in the patient's mouth, and we must pay attention to the smallest of details. Our eyes have limits, and even with excellent eyesight, we cannot perfectly see things such as the fit of restorations, margin surfaces after preparation, cracks, and many other details that can play a big role in the treatment plan. This is why it is important to use magnification during all treatment steps.<sup>1</sup>

We do not have to be impossibly precise, but we must try to avoid mistakes to get the best possible result. The main issue in this case was to recreate the patient's smile.

Microsurgical techniques are becoming increasingly important in periodontal and dental implant surgery. Use of magnification provides more precise performance during surgical interventions with the use of fine microsurgical instruments and suturing materials.<sup>2,3</sup> This precision reduces surgical trauma and allows better approximation of wound margins, which allows for more predictable wound healing.<sup>4,5</sup>

Use of dental implants for replacing missing teeth in posterior regions has become a standard treatment that yields high tooth survival and success rates during long-term observation.<sup>6-9</sup> However, thorough restorative-driven treatment planning is a prerequisite for a successful outcome.<sup>10,11</sup>

## Case Presentation

The patient was a 57-year-old theater actress. Her chief complaint was that she was unhappy with her removable denture. She could not smile sincerely because of the esthetics, and she had functional problems while eating—chewing required much effort. She felt uncomfortable, and using the removable denture was too troublesome, so she stopped using it (**Figs 1 & 2**).

The patient had undergone dental treatment five years previously. After the treatment was finished, the patient had a new fixed, porcelain-fused-to-metal (PFM) bridge and a removable denture with interlocking components. She was not happy with the way she looked, did not like her smile, and lacked self-confidence (**Fig 3**).

## Diagnostic Findings

### Extraoral and Facial Findings

The vertical dimension of occlusion and lower third of the patient's face were lowered. The patient had an asymmetric facial appearance due to the loss of lip support, mainly on the buccal corridors. She had a medium smile line, showing 80 to 100% of the papillae. The gingiva around the PFM bridge was inflamed, with some bleeding on probing (**Figs 3 & 4**).

### Temporomandibular Joint and Mandibular Range of Motion

The patient had a normal range of motion and no joint sounds at external palpation. There was no muscle tenderness and no pain on opening or with lateral movement. Manipulation was easy, and the range of motion was within normal limits. There were no signs or symptoms of temporomandibular disorders.

### Intraoral Findings

The patient had a PFM bridge and long proximal contact areas on the anterior teeth. There was a violation of biologic width that caused bleeding and inflammation. The dentogingival complex was, on average, 3 to 4.5 mm.<sup>1,3</sup> The tooth proportion was inadequate; the central incisors were 8 to 9 mm long, so there was no harmony in the patient's smile.

### Dental Findings

All of the patient's maxillary teeth were missing except for #7-10. She also had gingival inflammation, and her teeth had little mobility as a result of functional overload. In general, however, her prognosis was excellent.

## Treatment Plan

The treatment plan began with a pretreatment interview and photographic series. The patient was given oral hygiene instructions.

Maxillary and mandibular casts and centric relation records were obtained and we performed facebow transfer and diagnostic wax-up planning. We removed the old PFM fixed partial denture and corrected the margin of preparation.

Direct provisional restorations were placed, followed by crown-lengthening surgery and implant placement, after which we waited 10 months for the patient to heal.

The laboratory technician produced a second set of provisional restorations. We waited one month to check occlusal stability and patient satisfaction. Then the final precision impressions were made, leaving the final esthetics and function to the laboratory technician, who fabricated the master casts. We cemented the final lithium disilicate restorations, gave the patient her nighttime appliance, and advised her concerning periodontal maintenance.



**Figure 1:** Initial portraits.



**Figure 2:** Initial profile portraits.



**Figure 3:** Maximum smile analysis.



**Figure 4:** Intraoral view shows inflammation and imprecise fit.

## Clinical Procedure

### Implant Positioning

After all the data were gathered, we started by removing the old PFM bridge and improving the margin of preparation.<sup>12</sup> Using a microscope at every stage of the treatment guaranteed better visual control and greater precision (**Fig 5**).

Three-dimensional implant positioning plays a crucial role in the success of prosthetic restorations so that they meet all functional, hygiene, and esthetic requirements. Therefore, a diagnostic wax-up was prepared and a radiographic stent was fabricated by using flowable composite (Latelux, Latus PE; Kharkov, Ukraine) as a radiopaque material. After cone-beam computed tomography (CBCT), a radiographic stent was modified into a surgical template; this allowed for intraoperative visualization of the planned reconstruction and was used as a reference for implant positioning (**Figs 6 & 7**).

The results of the CBCT study of the edentulous ridge in the distal maxilla revealed adequate bone height and width for uncomplicated and predictable implant placement. However, bucco-lingual reduction of the ridge width was visible in the regions of the canines and first premolars. Therefore, it was decided to place implants in the regions of the canines, second premolars, and first molars and to fabricate pontics in the region of the first premolars. Because of severe angulation of the alveolar ridge in relation to the prosthetic axis of #11, it was decided to place the implant in a restorative-driven position, which would result in apical fenestration of the buccal bone.

### Implant Insertion

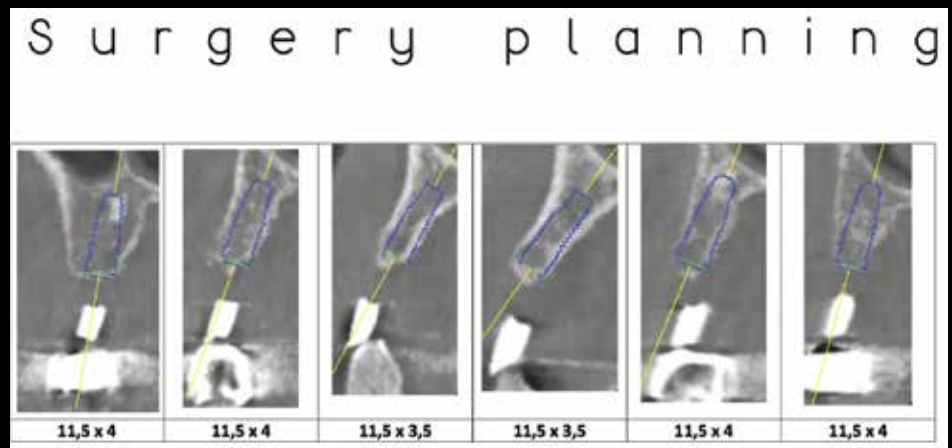
For implant insertion, a full-thickness flap was raised by using a crestal incision in the edentulous area, and the incision was extended through the sulcus of the adjacent teeth. Six dental



**Figure 5:** Removal of old PFM bridge reveals the amount of cement in the papillary zone.



**Figure 6:** Surgical guide created by means of wax-up.



**Figure 7:** Digital CT planning of implant placement.

implants (U-Impl Switzerland GmbH; Biel/Bienne, Switzerland) were placed in the positions of #3, #4, #6, #11, #13, and #14. A guided bone regeneration procedure was performed by using deproteinized bovine bone mineral (Bio-Oss, Geistlich Pharma AG; Wolhusen, Switzerland) as well as collagen membrane (Bio-Gide, Geistlich Pharma AG) to close the fenestration defect. Autogenous bone chips collected from the drill during implant bed preparation were placed as a first grafting layer and subsequently covered with deproteinized bovine bone mineral particles. Healing abutments were placed, and the wound was sutured according to a non-submerged protocol.<sup>13</sup> Surgical crown lengthening was performed in the region of ##7-10. We used non-absorbable 5-0 synthetic monofilament suturing material (Seralene, Serag-Wiessner GmbH; Naila, Germany). A standard postoperative regimen was prescribed; this included antibiotic prophylaxis with amoxicillin (Amoxil, Arterium Corp.; Kyiv, Ukraine) for five days, analgesics to control postsurgical pain (Nimesil, Corp. Group; Berlin, Germany), as well as 0.2% chlorhexidine digluconate (Paroguard, Hager & Werken GmbH & Co KG; Duisberg, Germany) rinse twice a day for plaque control. Postoperative wound healing was uneventful. Sutures were removed after 10 days (Figs 8-11).

#### Provisionals

After 10 months everything had healed, and it was possible to continue with the procedures (Fig 12). In this patient's treatment, the margin was set to 0.3 mm below the free gingival margin. A conventional method for taking impressions was used for the implants and adjacent tissues.



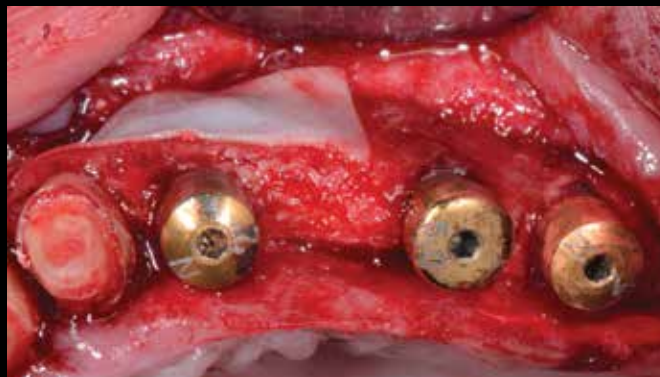
**Figure 8:** Surgical guide fabricated on the basis of the diagnostic wax-up.



**Figure 9:** Apical fenestration defect after placement of an implant in a restorative-driven position.



**Figure 10:** Use of autogenous bone chips and deproteinized bovine bone mineral particles to augment the fenestration defect.



**Figure 11:** Use of collagen membrane to cover the augmented area.

Narrow impression transfers were used with an open-tray method, and stone cast models were fabricated. A diagnostic wax-up was used to create optimal tooth dimensions for the teeth to be restored. Provisional restorations (Anaxdent GmbH; Stuttgart, Germany) were fabricated in the laboratory (**Fig 13**). The front four restorations were to be cemented on the patient's teeth by using a provisional cement (Telio CS Link, Ivoclar Vivadent; Schaan, Liechtenstein), and the distal six restorations were screw-retained on implants. Considerations for the selection of provisional materials were marginal adaptation, wear resistance and stability, color stability, ease of fabrication and maintenance, plaque retention, ease of polishing, durability, and retention. Provisional restorations permit the evaluation of function, phonetics, esthetics, tooth stabilization, occlusion, and tissue position. Our experience has shown that cervical contouring is the most predictable way to achieve esthetic integration of implants and restorations with soft tissues if there are delayed placement and restorations. On the model, the dental technician corrected the soft tissue and created a pontic, so we were able to copy the model and form the soft tissue in the mouth of the patient. Intraoral connection of the prosthetic component forces the surrounding tissues into the optimal configuration.

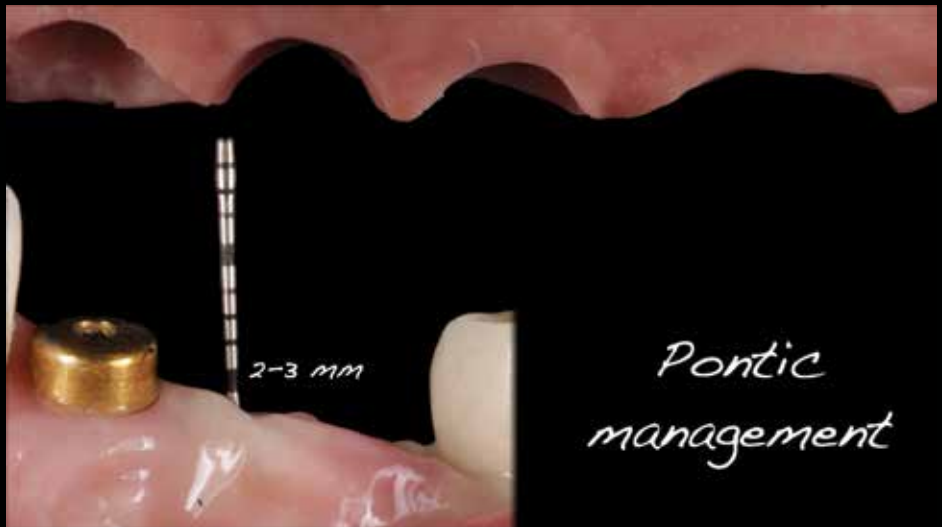
At the next appointment, we probed the bone so that we could manage the placement of the pontic. The most apical point of the pontic should be 2 to 3 mm away from the bone level (**Fig 14**). Using a round bur, we performed some soft-tissue correction and placed the provisional restoration. The pontic position in relation to the gingiva is especially important and can be corrected by removing or adding flowable composite on the provisional restorations (**Figs 15 & 16**).



**Figure 12:** Soft tissue 10 months after surgery.



**Figure 13:** Provisional restorations.



**Figure 14:** Pontic zone corrected with use of round bur and provisional restoration placed.

### Final Restoration

After one month, when the patient approved the esthetic look and comfort, we moved on with a final impression (**Figs 17 & 18**). To transfer all of the soft-tissue information, we used silicone (Express XT, 3M ESPE; St. Paul, MN) (**Figs 19-24**). We placed the provisional restoration connected to the implant analogs in silicone, and then removed the provisional crowns to obtain a model of the soft tissue in the silicone. After that, we connected transfers and used flowable composite to fill the individualized volume in silicone.

All of the transfers were individually fixed in the mouth. The front four teeth were retracted with 00 non-impregnated cord to avoid problems with polymerization of the impression material.<sup>14</sup>

For the final impression, we used a custom tray so that there would be an even amount of material around; a-silicone was used as the impression material (**Fig 25**).

For the canines and premolars, we constructed zirconium oxide abutments bonded onto a titanium base (**Fig 26**). For the molars, we used full-anatomy lithium disilicate bonded onto a titanium base. Different methods were used for the abutments to compare soft tissue response and condition in the future. Lithium disilicate (IPS e.max, Ivoclar Vivadent)<sup>15,16</sup> was chosen as the final material because it exhibits biomimetic behavior indistinguishable from that of nature.<sup>17</sup> For the anterior crown structural design, our aim was to create a full-contour lingual part of lithium disilicate, limit the incisal edge, create interproximal cutback, and layer feldspathic ceramics. For the premolars and molars, we used full-anatomy lithium disilicate to increase strength without having to compromise the esthetic integrity of the crowns (**Figs 27-31**).



**Figure 15:** Provisional restorations intraorally.



**Figure 16:** Occlusal view.



**Figure 17:** Modeling of soft tissue with provisional restorations.



**Figure 18:** Soft tissue after removal of provisional restoration shows the creation of volume.





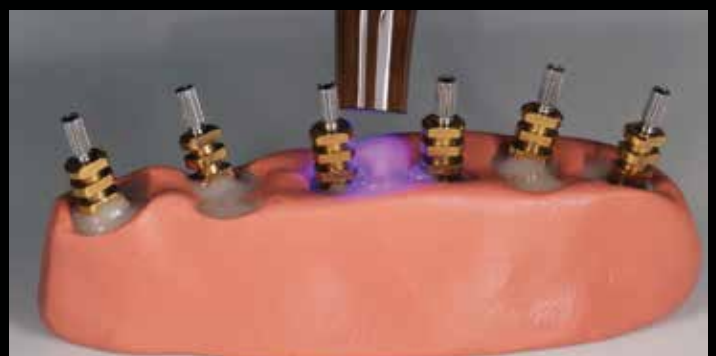
**Figure 19:** All of the soft-tissue information was transferred, with the provisional restoration screwed into the implant laboratory analogs.



**Figure 20:** Provisional restoration screwed into implant laboratory analogs placed inside silicone.



**Figure 21:** Transfers connected to implant analogs, with flowable composite used to individualize transfers.



**Figure 22:** Light-cured for 30 seconds.



**Figure 23:** Transfers are individualized.



**Figure 24:** Ready to take impression with all transfers in the mouth.



**Figure 25:** Impression with a-silicone.



**Figure 26:** Final lithium disilicate restorations.



**Figure 27:** Zirconia abutments in place.



**Figure 28:** Isolation of neighboring teeth and retraction.



**Figure 29:** Intraoral view after treatment.



**Figure 30:** The patient's maximum smile. Although there is a slight difference of zeniths of the central incisors, the patient refused additional correction because during maximum smile it is not visible.



**Figure 31:** Portrait view, before and after treatment.

## Discussion

In this case, the main goal was to switch from a removable construction to non-removable a permanent restoration to restore the patient's comfort, function, esthetics, and self-confidence. The first goal was to remove all of the structure that could cause inflammation and other problems. For surgery in this case, implants were placed according to Type IV implant placement in a fully healed ridge,<sup>18</sup> a benefit of which is mature soft tissue flap management. However, the typical limitation of Type IV implant placement in a fully healed ridge is insufficient bone volume. Despite the general tendency to develop vertical bone atrophy in distal maxillary regions as a result of both post-extraction ridge remodeling and maxillary sinus pneumatization,<sup>19,20</sup> this patient had sufficient bone height available. However, the bone width and alveolar ridge contours in the regions of the missing canines and premolars had some influence on our decision-making process.

In the current literature, there is still controversy regarding the adequate number, configuration, and distribution of implants in cases of multiple missing teeth. Nevertheless, investigators in prospective long-term clinical trials have confirmed the use of implant bridges supported by mesial and distal implants and a central pontic.<sup>21,22</sup> This finding led to our decision to place implants in the regions of the canines and second premolars and fabricate pontics to restore the first premolars where bone width and ridge configuration were compromised. Moreover, this method helps prevent the complications that sometimes occur with multiple adjacent implants in esthetic regions. Also, the dental technician can use the pontic contours to shape peri-implant soft tissues to achieve the optimum esthetic outcome.<sup>23</sup>



**Figure 32:** Final view. Now the patient can express emotions without any limitations.

In the region of the left canine, the ridge configuration in relation to the planned prosthetic axis presented two options: placing the implant in a compromised bone-driven position, or modifying the implant axis with the formation of an apical fenestration defect. Because there is ample evidence of success with the use of guided bone regeneration to reconstruct alveolar bone dehiscences and fenestrations around dental implants,<sup>24-26</sup> the second option was chosen to provide optimum restoration-driven implant placement.

For the final restorative material, we had a choice of PFM, feldspathic, zirconium oxide, or lithium disilicate restorations. Lithium disilicate gave us the ability to create an esthetic result without sacrificing strength with use of both full-anatomy and layered techniques.

## Summary

There are a variety of techniques and materials today to treat almost any clinical case and improve patients' smiles. Dental implants make it possible to have non-removable teeth that can be integrated esthetically and functionally. Modern ceramic materials allow the recreation of tooth color, form, and structure to reestablish not only a patient's smile, but also their self-esteem (**Fig 32**).

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