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Original Article
บทวิทยาการ

Immediate implant placement combined with guided bone regeneration in the restoration of a maxillary central incisor: a case report

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Abstract

Objective To describe surgical and restorative procedures of immediate implant placement together with guided bone regeneration in the esthetic zone.

Materials and methods A Thai female was presented with an unrestorable loosening post and crown of maxillary right central incisor. The post was removed, and the root was submerged for 7 weeks in order to obtain optimal soft tissue healing before implantation. The implant was placed immediately after extraction and guided bone regeneration (GBR) was performed to correct the fenestration and dehiscence at the labial and palatal aspects. The interim restoration was immediately delivered. The provisional crown was inserted 7 months after implant placement. The final restoration was a screw retained all ceramic crowns on zirconium abutment.

Results At 15 months after loading, the treatment showed satisfactory results both clinically and radiographically. The final restoration blended naturally with surroundings. The periapical radiograph confirmed the complication-free and integration of the implant.

Conclusion Careful treatment planning including management of soft tissue, atraumatic tooth extraction, three dimensional implant positioning, contouring ridge augmentation, interim restoration, provisional and final restoration are imperative to achieve a successful result with an implant placed in the esthetic zone.

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Key words: *guided bone regeneration; immediate implant placement; provisional restoration*

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Introduction

To achieve the optimal functional and esthetic results with a dental implant in the anterior maxilla, careful treatment planning is crucial, from tooth extraction to final restoration. After tooth extraction, the bone-healing process can complicate treatment procedures and the esthetic outcome of implant placement[1-3]. The timing of implant placement has been classified into: late, early with partial bone healing, early with soft tissue healing, and immediate placement[4]. When there is adequate bone and soft tissue for implant primary stability, immediate placement and contour augmentation is recommended.[4]

The advantages of immediate implant placement are that the amount of bone is greatest at that time and the overall treatment duration and the number of surgery is reduced. Disadvantages are that the procedures are technically demandings, with a significant risk of esthetic complications. Thus, the clinician should be experienced. The esthetic risk assessments should be carefully considered prior to treatment[4].

Based on a review of the literature, the outcomes of immediate, early, and late implant placement are comparable. The average survival rates for immediate implants were 99%, 95.5%, and 93% for 1-3 years, 3-5 years, and more than 5 years, respectively.[5] However; gingival recession ≥ 1 mm has been reported in 8-40.5% of cases, especially in patients with a thin gingival biotype. Moreover, damaged labial alveolar plate, or labially malpositioned implants were also reported. Immediate implant placement with simultaneous guided bone regeneration (GBR) can maintain the bone volume and soft tissue contours. While this technique only requires a single surgical procedure, it is technically demanding.[5]

To achieve the optimal result when placing an implant with simultaneous GBR, there are important issues to be considered. The implant needs to be in the correct three-dimensional position[6], achieve primary stability, and the peri-implant bone morphology should allow for successful bone regeneration. Moreover, this procedure can be performed with minimal surgical intervention, providing a shortened healing-period, and low morbidity. With a proper case selection, the 1-year survival rate of immediate implant placement with simultaneous GBR is 100%.[7-8]

This paper presents a clinical case report of immediate implant placement with GBR at the maxillary central incisor area.

Materials and methods

A 58-year-old Thai female presented for the replacement of the maxillary right central incisor (11) due to an unrestorable loosened post and crown. The patient was generally in good health with no significant medical history. She demonstrated a medium to high lip line at a full smile (Fig. 1A). Intra-oral examination of the upper anterior teeth revealed a thick gingival biotype with an 8-10 mm band of attached gingiva. A periapical radiograph showed an overall widening of the periodontal ligament space and radiolucency between the crown and root at the mesial aspect of 11 (Fig. 2A). The 3D-CT of 11 demonstrated thin labial and palatal alveolar bone, and apical labial bone concavity (Fig. 3).

The diagnoses were; 11-marginal leakage of the post-core-crown, 21-endodontically treated tooth underfilled with voids, and a discolored composite filling, 12-discolored composite filling, and 22-faulty restoration.

A treatment plan was designed calling for the immediate implant replacement of 11, with simultaneous GBR, endodontic retreatment of 21 followed by a post-core-restoration, and finally all-ceramic crowns on 12-22.

In order to enhance the amount of soft tissue before extraction, the surgical procedure began by

Fig. 1 At full smile. A) before and B) after treatment.

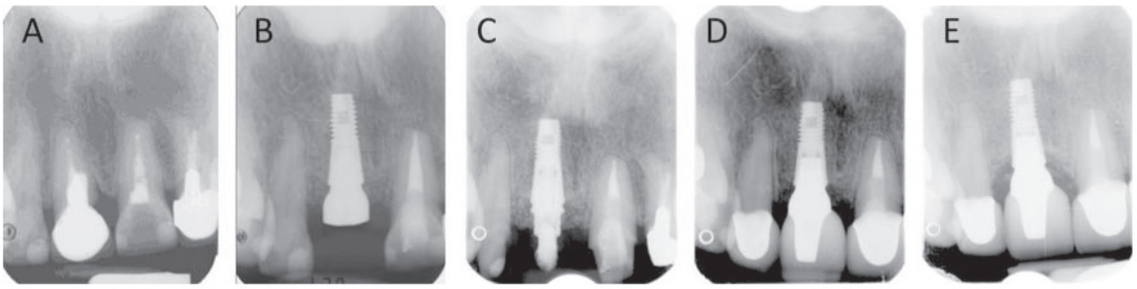

Fig. 2 Periapical radiographs, A) note the widened PDL at 11 and radiolucency between the crown and root at the mesial crown margin, B) 1 week after implant placement, C) 1 week after implant loading (7 months after implant placement), D) 6 months and E) 15 months after implant loading.

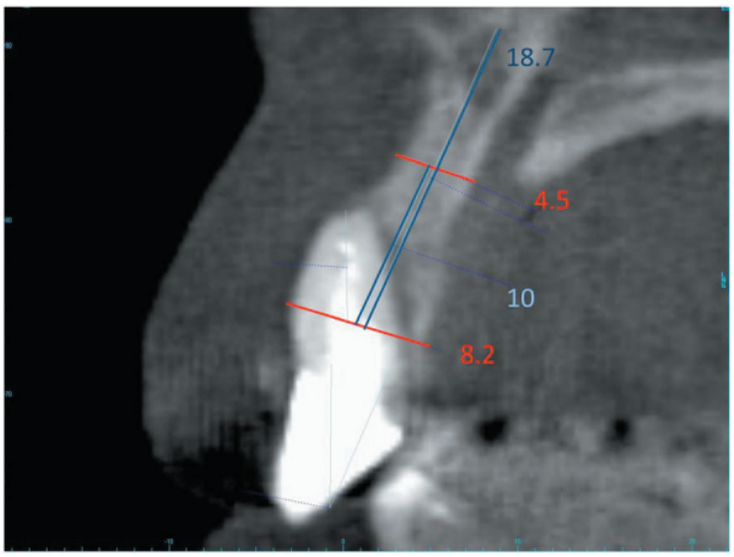

Fig. 3 Preoperative CT scan: The radiograph shows thin labial bone and an apical concavity.

reducing the height of 11 to the crestal bone level. A vacuum-formed retainer with composite-resin shaped as a tooth at 11 was delivered. After seven weeks of gingival healing (Fig. 4A and B), implant placement with GBR was performed. Briefly, a sulcular incision from 22 to 14 with a vertical releasing incision at the mesial of 14 was made and full thickness flap was raised. The root of 11 was carefully sectioned and removed (Fig. 4C). Thin labial bone, less than 1 mm-thick with 1.5-mm-diameter fenestration at the apex was observed. Socket preparation for immediate placement was performed. A 4.5x11 mm Osseospeed™ implant and 5.5x4 mm healing abutment (Astra Tech, Sweden) was placed slightly palatal in the socket, to a 3-mm-depth below the proposed crown margin (Fig. 4D). Primary stability was achieved using a hand-piece with the 35 Ncm-maximum torque and torque wrench. A 1.5 mm labial fenestration at the apex and a 3.5 x 8 mm-palatal-dehiscence were observed. Autogenous bone chips harvested from the nasal spine and bovine anorganic hydroxyapatite (Bio-Oss®, Geistlich AG, Wolhusen, Switzerland) were placed at both the labial and palatal aspects (Fig. 4E) and covered with a resorbable collagen barrier membrane (Bio-Gide®, Geistlich AG, Wolhusen, Switzerland) (Fig. 4F). The flaps were sutured. A vacuum-formed retainer was used as an interim restoration.[9] The patient was placed on amoxicillin for

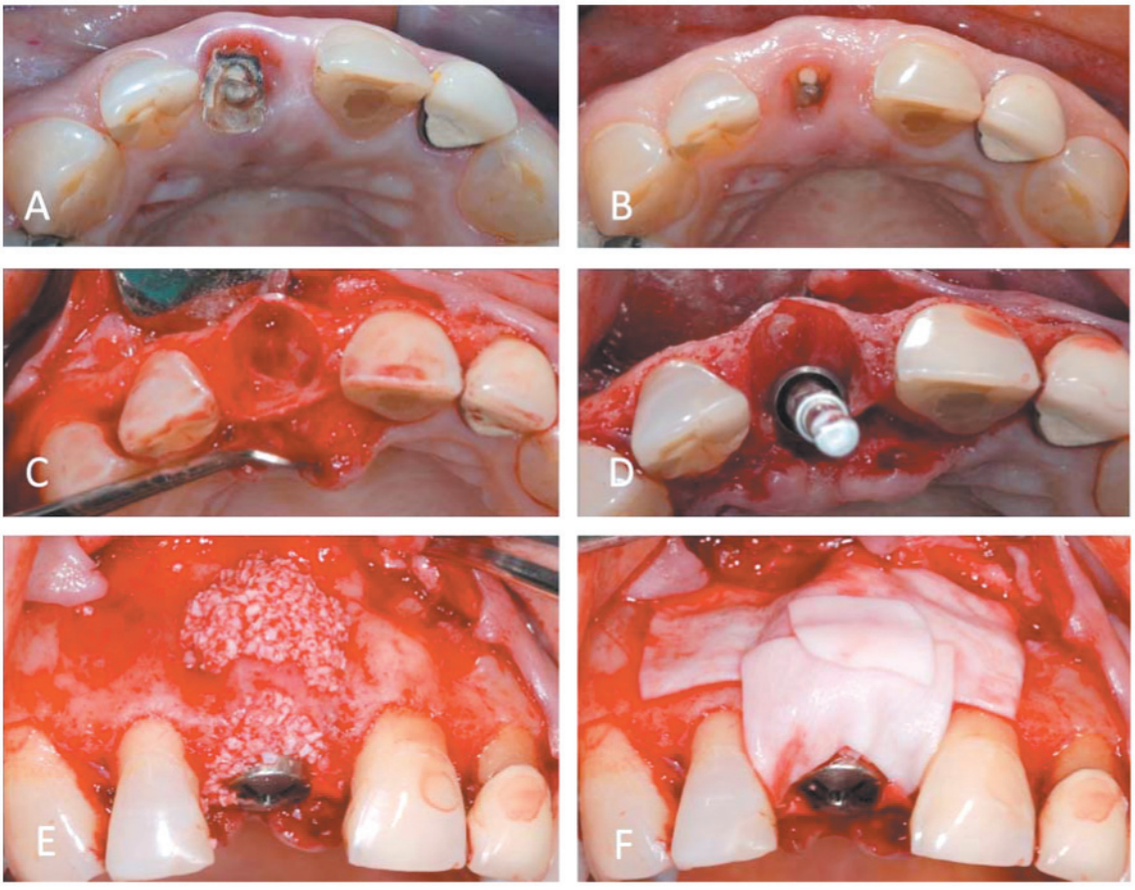

Fig. 4 Root retention and immediate implant placement with simultaneous GBR, A) immediately following post removal, B) 7 weeks postoperatively, the gingival tissue growing above the remaining root, C) thin labial and palatal bone wall of the socket of 11, D) the implant slightly palatal to the incisal edge of the adjacent teeth, E) the palatal and labial defects with autogenous bone and BioOSS, and F) a double layer of resorbable collagen barrier membrane (Bio-Gide®, Geistlich AG).

Fig. 5 The interim restorations. A) an acrylic tooth as an interim restoration at 11, and B) provisional crowns on implant 11 and teeth 12, 21, and 22.

7 days and 0.2% chlorhexidine digluconate mouthwash twice a day for one month. Ibuprofen and paracetamol were prescribed to be taken as needed. The sutures were removed two-week post operation. A periapical radiograph at one-week showed insignificant complication (Fig. 2B).

Three weeks post-surgery, an acrylic denture tooth (Major Dent, Major Prodotti, Italy), as an interim restoration at 11, was splinted to the adjacent teeth with Super-Bond C & B (Sun Medical, Shiga, Japan) (Fig. 5A).

Seven months after the surgery, a temporary acrylic denture with no pressure on the healing site was delivered and an implant level impression was taken. The provisional restoration was fabricated on a temporary abutment (TempDesign^{TM} 4.5/5.0 4.5 1 mm, Astra Tech, Sweden). A provisional crown was placed on implant 11 to guide and shape the peri-implant tissue (Fig. 5B). The corresponding periapical radiograph confirmed the complication-free tissue integration of the implant (Fig. 2C).

The maturation and stabilization of the peri-implant mucosa progressed for 7 months after the provisional crown was placed, and an individual impression transferring the emergence profile of the final provisional crown was taken (Fig. 6). The final all-ceramic restoration was fabricated over a 5.5 20° 3.5 mm Zirconium abutment (ZirDesign^{TM}, Astra Tech, Sweden). The screw-retained crown was tightened to 25 Ncm. The screw access was covered with resin composite.

Results

The screw retained all-ceramic crown blended naturally with the adjacent all-ceramic restorations (Fig. 1B, 7 and 8). The periapical radiographs at 6 and 15-months after loading showed the complication-free tissue integration of the implant (Fig. 2D and E).

Discussion

This case report outlines the treatment of an unrestorable tooth 11 by immediate implant placement concurrent with GBR. There are several points for discussion.

Because the patient did not want a removable prosthesis, a fixed partial denture or an implant were the treatments of choice. While a fixed partial denture can be delivered in less time than an implant, ridge resorption and difficulty in cleaning can adversely affect the long term prognosis. An implant can maintain the soft and hard tissue contours, facilitating proper hygiene. However a longer treatment time is required. Immediate implant placement can take advantage of the maximum amount of bone available, and GBR can be performed to maintain the ridge contours.

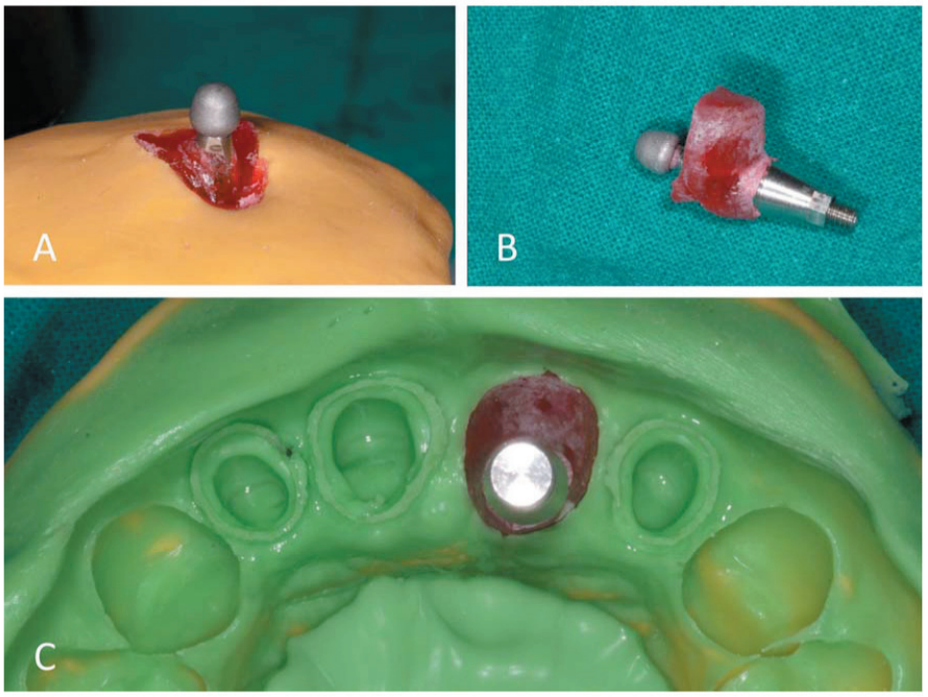

Fig. 6 Impression, A) an individualized impression transfering the emergence profile by use of an impression transfer and GC Pattern resin (GC Corp, Tokyo, Japan), B) modified implant transfer capturing the cervical shape of the provisional crown, and C) final impression with implant transfer and implant replica in place.

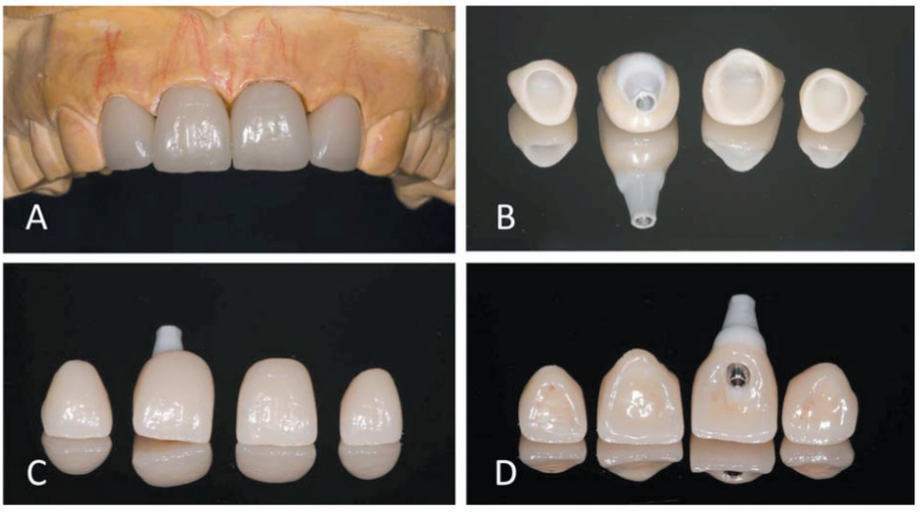

Fig. 7 All ceramic crowns, A) on the working model, B) internal view, C) labial view, and D) palatal view.

Soft tissue management at all stages of implant therapy is a critical concern. In this case, the tooth was reduced to 2 mm beneath the level of the gingiva. The tooth was then submerged to maximize the amount of keratinized gingiva facilitating primary flap closure. This would minimize the risk of membrane exposure during GBR. The optimal time for gingival healing varies from 2-10 weeks.[10-11]

Because the labio-palatal width at the crestal area was limited, a palatal dehiscence occurred during drilling. As initial stability of the implant was achieved, simultaneous GBR was performed using the Buser protocol to cover and contour both the labial fenestration and palatal dehiscence.[12] After immediate implant placement, there typically is a gap between the implant surface and the inner surface of the labial bone plate. The procedure for the proper management of this gap depends on the gap width. If the gap is less than 2 mm, or a 3-wall defect is present, a grafting procedure is unnecessary.[13-16] In contrast, when the gap is greater than 2 mm or a 3-5 mm wide dehiscence is present, treatment with a particulate bone graft and a membrane is needed[15,16] However, a previous study has shown that, regardless of the gap size, filling the gap with grafting material resulted in an excellent esthetic outcome.[17] When there is a dehiscence or fenestration of the labial bone plate, GBR utilizing a barrier membrane should be performed. The membrane

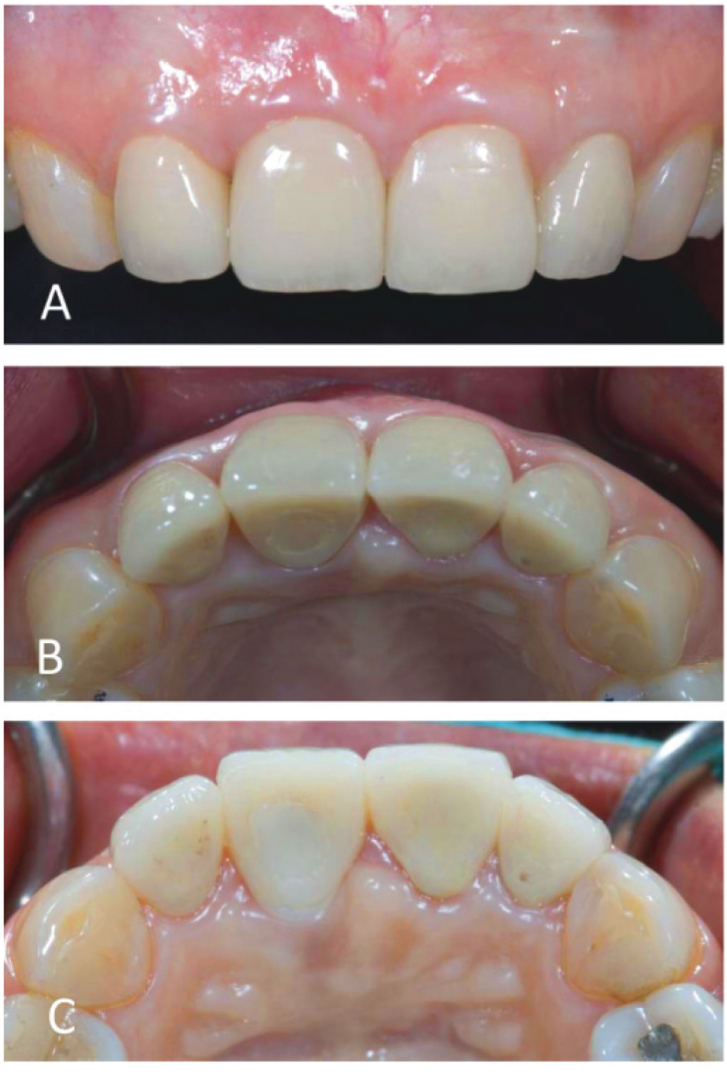

Fig. 8 All ceramic crowns 12-22 (intraoral), A) labial view, B) occlusal view, and C) palatal view.

prevents the down-growth of epithelial and connective tissue cells into the bone defect, allowing for a good clinical outcome.[5,7,8] The bone grafting material can act as a scaffold or for space maintenance during new bone formation. A resorbable collagen barrier membrane (Bio-Gide®, Geistlich AG, Wolhusen, Switzerland) placed as a double layer has been shown to generate better stability.[18]

There are many options, particularly for anterior teeth, for the interim restoration used after tooth extraction and implant installation. In this case, a vacuum-formed retainer with a pontic, a resin-bonded provisional pontic, and an acrylic partial denture were used in successive treatment phases. A vacuum-formed retainer was used during the initial healing phase, as this allowed no pressure on the grafted site.[9] This was inexpensive, easy to fabricate and gave no transmucosal loading. However, the function, esthetics, and phonetics of this retainer is limited, and the clear thermoplastic sheet is easily worn down. When soft tissue healing was stable, and a long-term interim restoration was needed, an acrylic tooth splinted to the neighboring teeth was used. This technique can be done chair side using Super-Bond C & B, resulting in no pressure on the tissue. However, the esthetics and durability can be compromised. Super-Bond C & B is a self-curing dental adhesive resin cement based on acrylic resin technology. For safety, a rubber dam was placed and the soft tissue did not contact the Super-Bond C & B. Super-Bond C & B bonds well to acrylic resin denture tooth, enamel, and resin composite.

After a 5-month healing period following implant placement, 12, 21, and 22 were prepared for crowns, and an acrylic partial denture was inserted. Care was taken to prevent the denture from transmitting uncontrolled loading to the grafted sites.

An implant provisional crown is recommended at esthetic sites in order to guide and shape the soft tissue before placement of the definitive restoration. The provisional crown can serve as a diagnostic tool for the proper contour of the final restoration and peri-implant soft tissue. It can take from 3-12 months before the maturation and stabilization of the soft tissue around the implant occurs.[19-22]

Conclusion

An immediate implant after tooth extraction can achieve good primary stability and an esthetic outcome. However, careful treatment planning including atraumatic tooth extraction, management of the soft tissue, three-dimensional implant position, contouring augmentation, interim restoration, provisional restoration, and final restoration are all very important factors in order to optimize success.

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รายงานผู้ป่วย การฝังรากเทียมทันทีหลังถอนฟันร่วมกับการเหนี่ยวนำการสร้างกระดูกในการบูรณะฟันตัดซี่กลางบน

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บทคัดย่อ

วัตถุประสงค์ เพื่ออธิบายถึงขั้นตอนการผ่าตัดและการบูรณะฟันโดยการใส่รากเทียมทันทีหลังถอนฟันร่วมกับการเหนี่ยวนำการสร้างกระดูกในบริเวณที่เกี่ยวข้องกับความสวยงาม

วัสดุและวิธีการ ผู้ป่วยหญิงไทยมาปรึกษาด้วยปัญหาครอบฟันและเดือยของฟันตัดซี่กลางบนขวาหลวมซึ่งไม่สามารถบูรณะเก็บไว้ได้ การรักษาเริ่มจากรื้อเดือยออกเหลือแต่ส่วนรากฟันทิ้งไว้ใต้เหงือกเป็นเวลา 7 สัปดาห์เพื่อให้เนื้อเยื่อเหงือกขึ้นมาคลุมรากฟันก่อนการฝังรากเทียม รากฟันถูกถอนออกพร้อมทั้งฝังรากเทียมทันทีและทำการเหนี่ยวนำการสร้างกระดูกบริเวณรูและรอยกระดูกเปิดแยกทางด้านริมฝีปากและเพดาน จากนั้นผู้ป่วยได้รับการใส่ครอบฟันเฉพาะกาลทันที 7 เดือนต่อมาผู้ป่วยได้รับการใส่ครอบฟันชั่วคราว จากนั้นทำการบูรณะฟันถาวรด้วยครอบฟันเซรามิคบนแกนเซอโคเนียมยึดกับรากเทียมด้วยสกรู

ผลการศึกษา ผลการรักษาเป็นที่พอใจทั้งทางคลินิกและภาพถ่ายรังสีเมื่อติดตามผลการรักษาหลังใส่ครอบฟันเป็นเวลา 15 เดือน ครอบฟันและเหงือกดูเป็นธรรมชาติเมื่อเทียบกับฟันและเนื้อเยื่อข้างเคียง ไม่พบความผิดปกติที่ภาพถ่ายรังสีรอบปลายราก

สรุป การวางแผนการรักษาอย่างรอบคอบตั้งแต่การเตรียมเนื้อเยื่ออ่อน การถอนฟันอย่างระมัดระวังเพื่อหลีกเลี่ยงการกระทบกระเทือน การวางตำแหน่งของรากเทียมทั้งสามมิติ การเสริมสร้างเค้ารูปสันกระดูก การบูรณะเฉพาะกาล การบูรณะชั่วคราว และการบูรณะฟันถาวร ล้วนเป็นปัจจัยสำคัญเพื่อให้ได้มาซึ่งความสำเร็จในการรักษา

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คำสำคัญ: *การบูรณะเฉพาะกาล; การฝังรากเทียมทันที; การเหนี่ยวนำการสร้างกระดูก*

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