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CLINICAL REPORT

# Staged orthodontic treatment in preparation for immediate implant placement: A clinical report with a 5-year follow-up

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## ABSTRACT

Anterior implant restoration is one of the most challenging restorative procedures, especially for sites with vertical and/or horizontal hard and soft tissue deformities. Orthodontic extrusion before implant placement may be the best means of overcoming vertical deficiencies. This article describes a modification to the standard technique, involving staged orthodontic extrusion and buccal root torque. The main advantage of this modification is that it encourages bone and soft tissue development, thereby allowing the patient to receive immediate or early implant treatment. A clinical procedure is presented to illustrate the modified technique that resulted in an esthetically pleasing and stable 5-year outcome. (J Prosthet Dent 2019;122:503-9)

Implant-supported restorations may be compromised by ridge resorption after tooth loss, an inevitable process.[1,2] In addition, previous periodontal disease often leads to horizontal and/or vertical ridge deficiency that may require bone augmentation before implant therapy.[3] Vertical bone augmentation is a technique-sensitive procedure and has higher complication rates than horizontal bone augmentation.[4-6] Thus, extrusion of the hopeless tooth has been recommended to overcome vertical deficits in the critical region to avoid long clinical crowns and asymmetrical gingival levels.[7-9]

As early as 1940, Oppenheim[10] demonstrated hard and soft tissue enhancement by forced eruption. Subsequently, molar uprighting and forced eruption for osseous defects also demonstrated that positioning the tooth with appropriate forces and eruption rates was accompanied by altered tissue architecture.[11-14] However, well-controlled clinical trials on orthodontic extrusion have been scarce.[15] Review articles from case series have concluded that orthodontic extrusion can be considered a valid treatment, but conclusions cannot be drawn regarding relative efficacy.[16] In addition, clear guidelines for its treatment protocol, such as the type of anchorage, magnitude of force, rate of tooth movement, duration of extrusion, and stabilization period are lacking. In fact, most of the procedures have been performed empirically.[17]

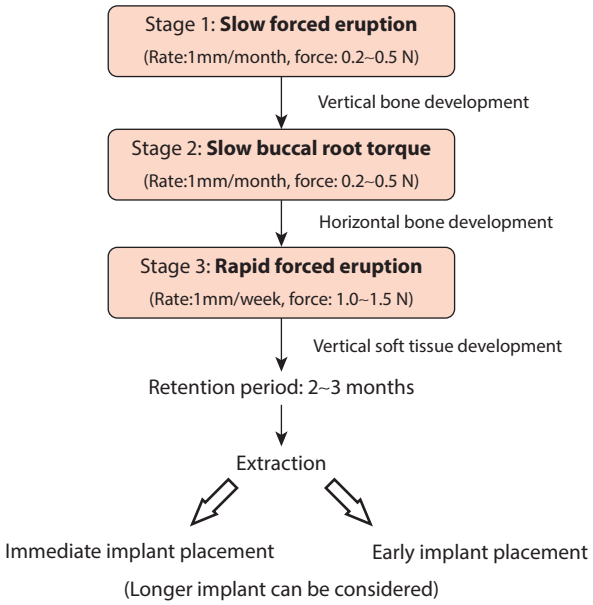


**Figure 1.** Workflow of modified technique.

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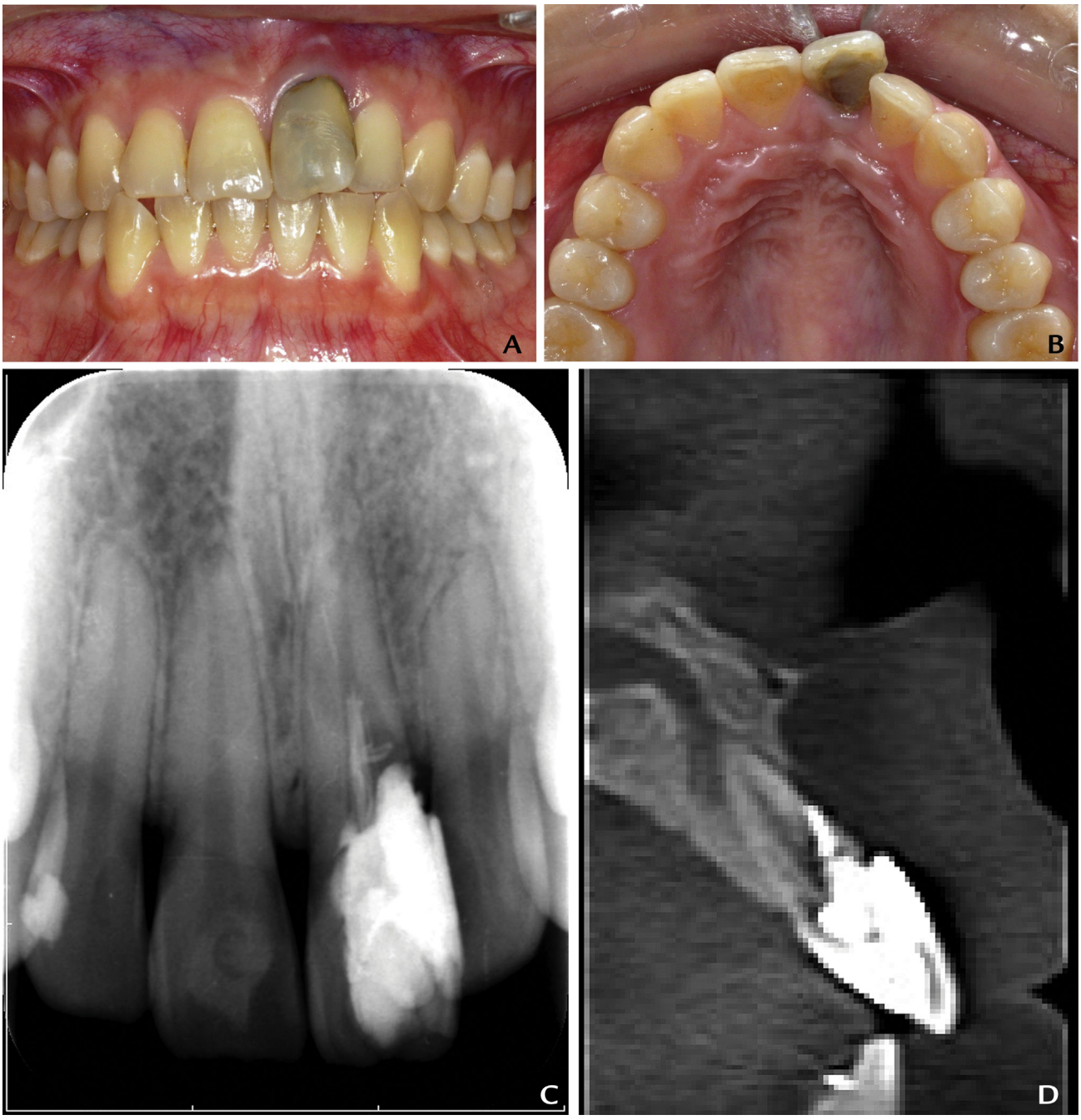


**Figure 2.** Maxillary left central incisor had gingival recession due to labial position. Tooth was discolored and had large restoration. A, Pretreatment frontal view. B, Pretreatment occlusal view. C, Periapical radiograph. D, Computed tomograph.

The workflow of the presented technique, derived from both a review of the literature and empirical evidence from the treatment described in this article, is shown in Figure 1. First, with the existing periodontal attachment apparatus, a slow forced eruption at a rate of 1 mm per month and a magnitude of force approximately 0.2 to 0.5 N can promote bone formation in a coronal direction. Korayem et al[16] pointed out that forces of approximately 0.2 N are suitable for anterior teeth, whereas forces of 0.5 N are appropriate for posterior teeth. The extrusive direction should be parallel to the labial bone to diminish its resorption.[15] Second, the root is moved buccally to gain more bone in a horizontal dimension. Finally, continued forced eruption occurs, but at a faster rate, that is, 1 mm per week, with a magnitude of force approximately 1.0 to 1.5 N, to obtain more soft tissues, including attached gingiva and interdental papillae.[18] The force should be continuous,

controlled, and light. Two to 3 months for stabilization are suggested for the reorganization of the tissues and the prevention of relapse.[15,17]

After extraction, an average or longer implant can be placed immediately or 1 to 2 months later as an early placement approach. The whole treatment time with orthodontic intervention is no longer than the time required with surgical bone augmentation.[16] Therefore, staged orthodontic treatment can be considered a routine implant site preparation.

## CLINICAL REPORT

A 23-year-old woman presented to the Department of Orthodontics at the National Taiwan University. The patient was systemically healthy, and the extraoral examination was unremarkable. An intraoral examination revealed that the maxillary left central incisor had subgingival caries, was labially flared, and had a high gingival level. The adjacent teeth were triangular, were highly scalloped, and had a thin gingival biotype (Fig. 2A, B). Radiographs showed vertical deficiency and a thin buccal bone plate (Fig. 2C, D). From these findings, the left central incisor was assessed as nonrestorable, with an implant-supported replacement having a high risk of poor esthetics.

A staged bone grafting procedure and orthodontic extrusion were offered as options before implant placement. The patient elected orthodontic extrusion because she wanted to reduce the surgical time and had high esthetic demands.

Staged orthodontic treatment was initiated from the maxillary right to the left canines, and an archwire with a step-down design was placed (Fig. 3A). The tooth was asymptomatic, and endodontic retreatment was not necessary. The patient was recalled regularly for reduction of the tooth structure to create interocclusal clearance for tooth movement and to closely monitor the periodontal condition of the tooth. During the extrusive treatment of the tooth, red, newly formed tissue appeared on the gingival margin (Fig. 3B).

To provide the required extrusion, orthodontic treatment was carried out for 5 months. The endpoint was to overcorrect the vertical defect by 2 to 3 mm from the ideal position because the gingiva was expected to move apically after restoration. The tooth was then stabilized for 3 months. Eight months later, the maxillary left central incisor was extracted atraumatically (Fig. 4A-C). An implant (Straumann Bone level SLActive, 3.3×10 mm; Institut Straumann AG) was placed, and simultaneous bone grafting was performed (Fig. 4D-G). Healing was uneventful, vertical deficiencies in soft and hard tissue architecture were overcome (Fig. 5), and a definitive metal-ceramic crown was delivered 13 months later (Figs. 5C, 6). The patient was satisfied with the pink and white esthetics obtained with the staged orthodontic treatment (Fig. 7)

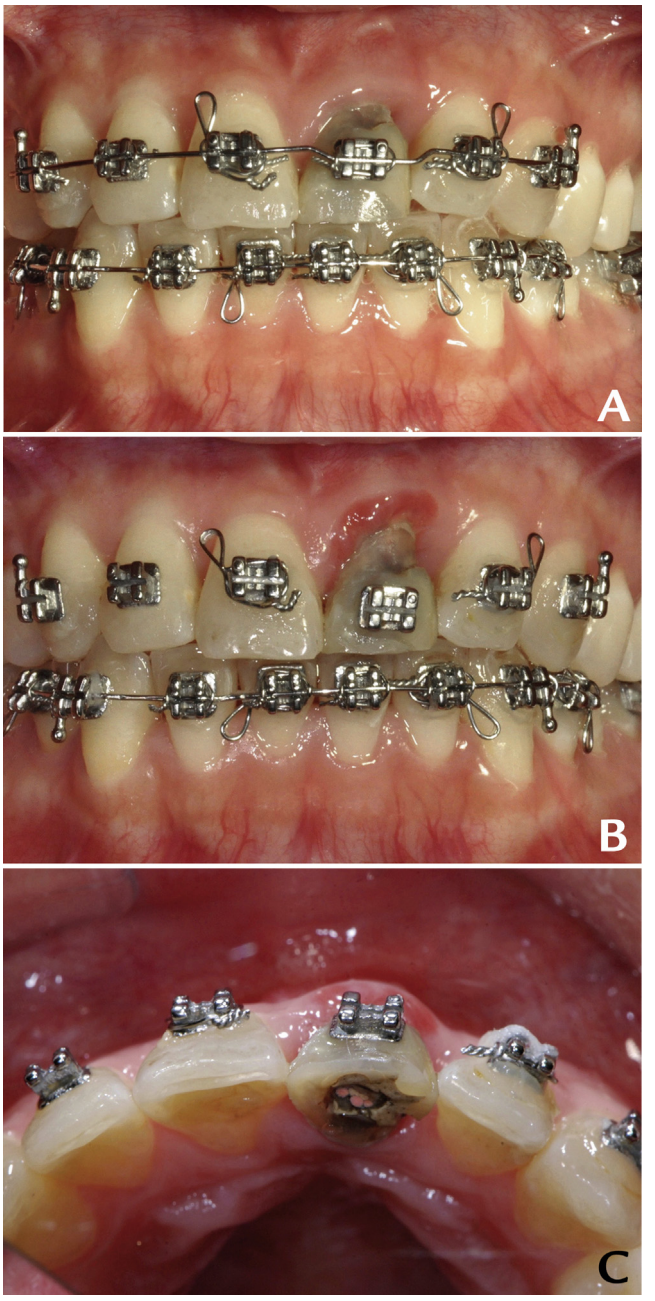


**Figure 3.** A, Orthodontic treatment for implant site development. B, Completed staged orthodontic extrusion and buccal root torque. Incisal edge reduced to gain space for tooth extrusion. C, Occlusal view shows wider ridge dimension.

## DISCUSSION

Implant-supported restorations in the esthetic zone are challenging. Esthetic analysis is a prerequisite, and if vertical and/or horizontal tissue deficiencies are present, adjunctive procedures, including the one in the present

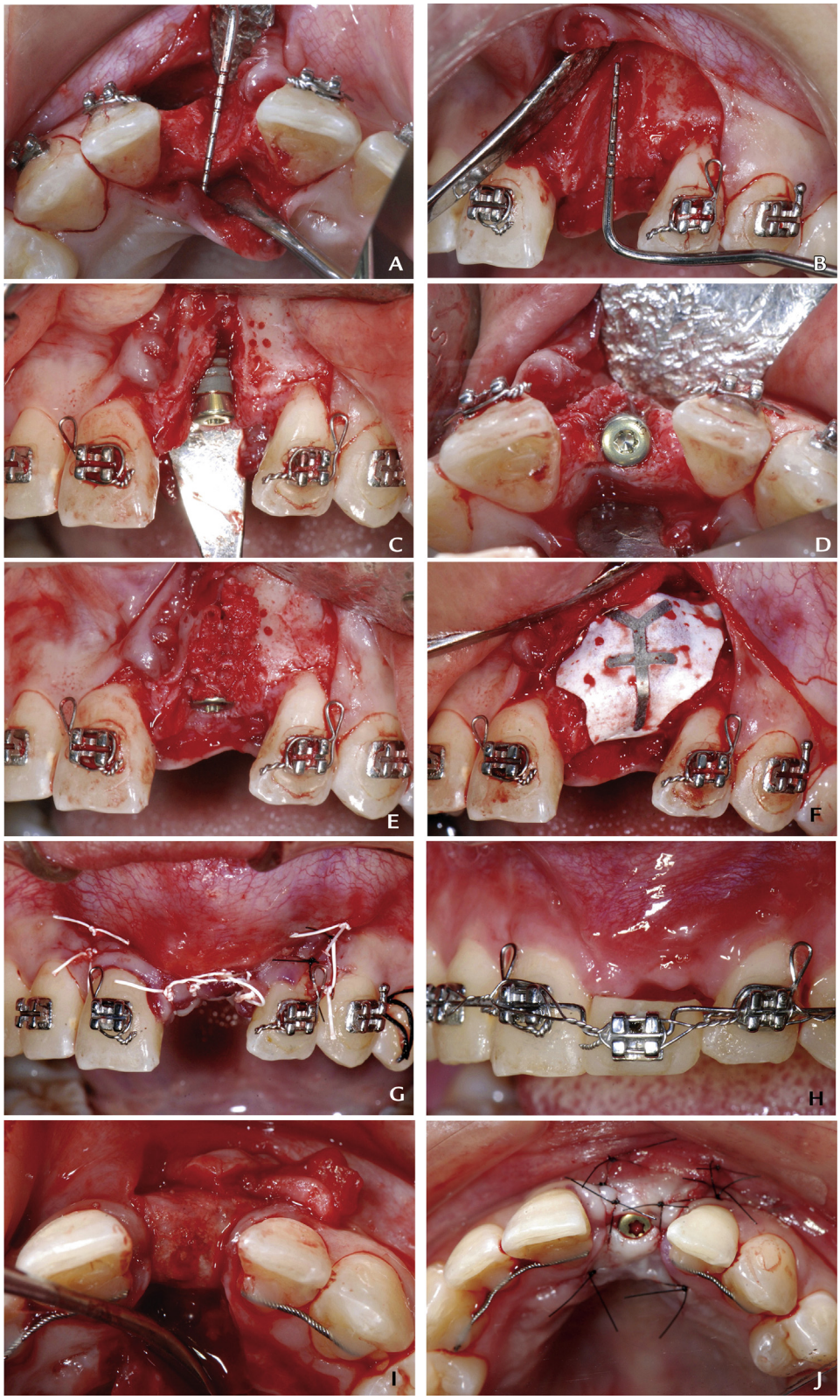


**Figure 4.** A, B, Three months after orthodontic treatment, implant surgery executed. C, D, Immediate implant placed with good primary stability. E, Only few threads exposed. F, Covered by autografts, xenografts, and Ti-reinforced cytoplast with sandwich technique. G, H, Primary closure achieved and healing uneventful for following 6 months. I, J, Adequate thickness of bone around implant during uncovering procedure.

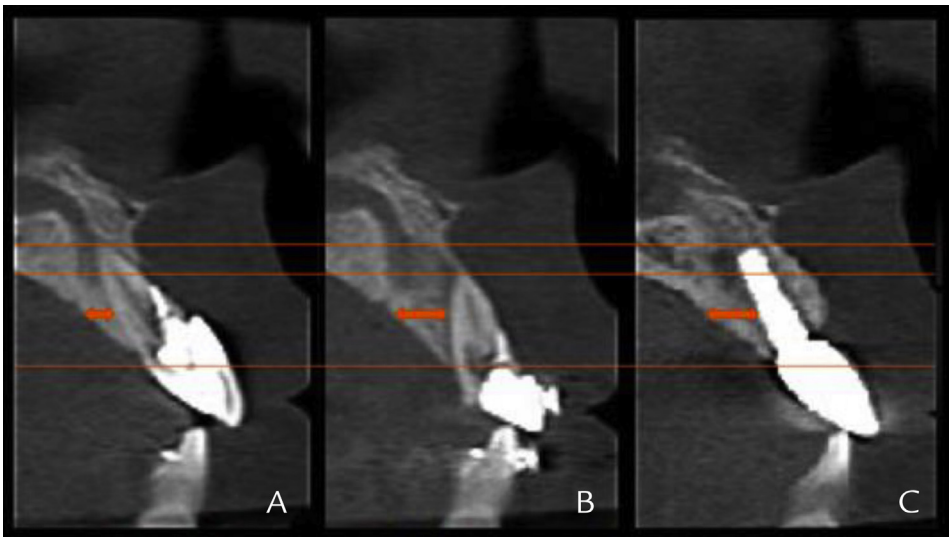


**Figure 5.** Computed tomographs. A, Initial situation. B, Completed staged orthodontic treatment. Width and height of ridge more favorable for immediate implant procedure. C, Five-year follow-up.

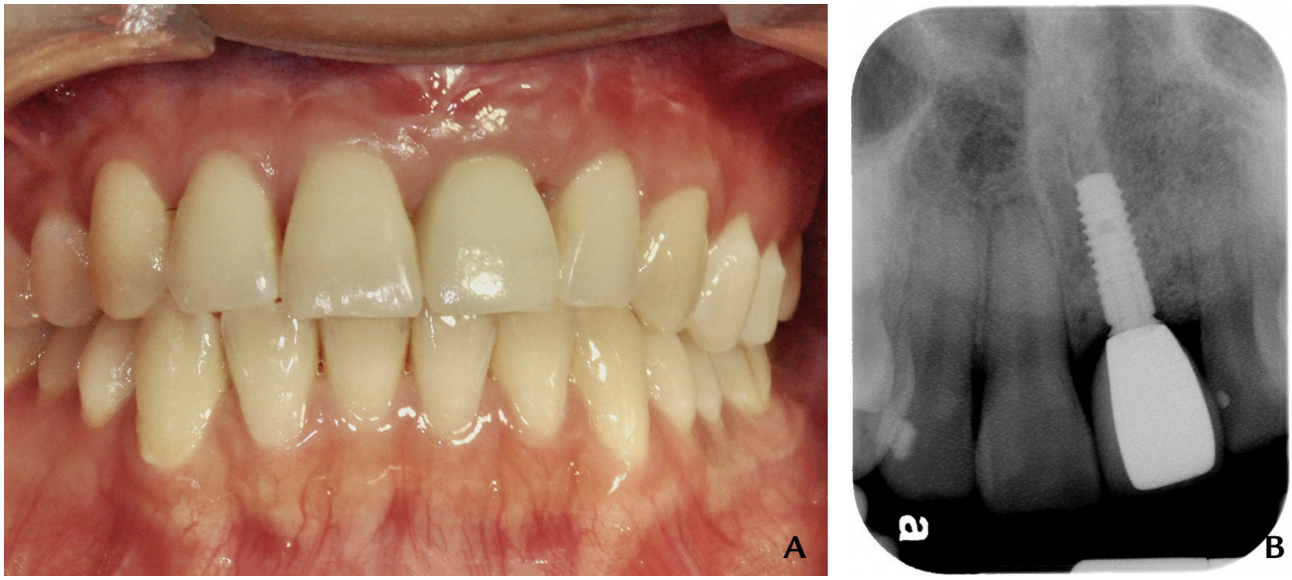


**Figure 6.** Five-year follow-up. A, Clinical view. B, Periapical radiograph.

report, are indicated. Vertical intrabony defects of adjacent teeth can be eliminated by means of extrusion.[12] In addition, the site is more likely to be suitable for immediate implant insertion since the socket is transformed from a type II into a type I defect,[7] which is more favorable for new bone formation.[19] The implant will gain more primary stability by engaging more bone and diminishing the amount of bone dehiscence. If the buccal bone plate is adequate, a flapless immediate implant procedure is also feasible.[20] In addition, the staged orthodontic treatment can provide an adequate safety zone around vital structures such as the mental foramen, nasopalatine nerves, and maxillary sinuses by developing more bone.[9] It is especially indicated for patients who undergo orthodontic treatment to correct malalignments of teeth such as root proximity and the loss of the mesiodistal space of the edentulous site (Table 1).[20]

Patients with uncontrolled chronic inflammation and no attachment apparatus are not candidates for orthodontic treatment.[19] Oral hygiene should be monitored, and a chlorhexidine mouth rinse is suggested.[20] One-third to one-fourth of intact apical attachment is required because the stretched attached fibers will promote hard and soft tissue depositions (Table 1).

In this report, an implant was placed in the maxillary left central incisor area after orthodontic treatment so that the site could be augmented

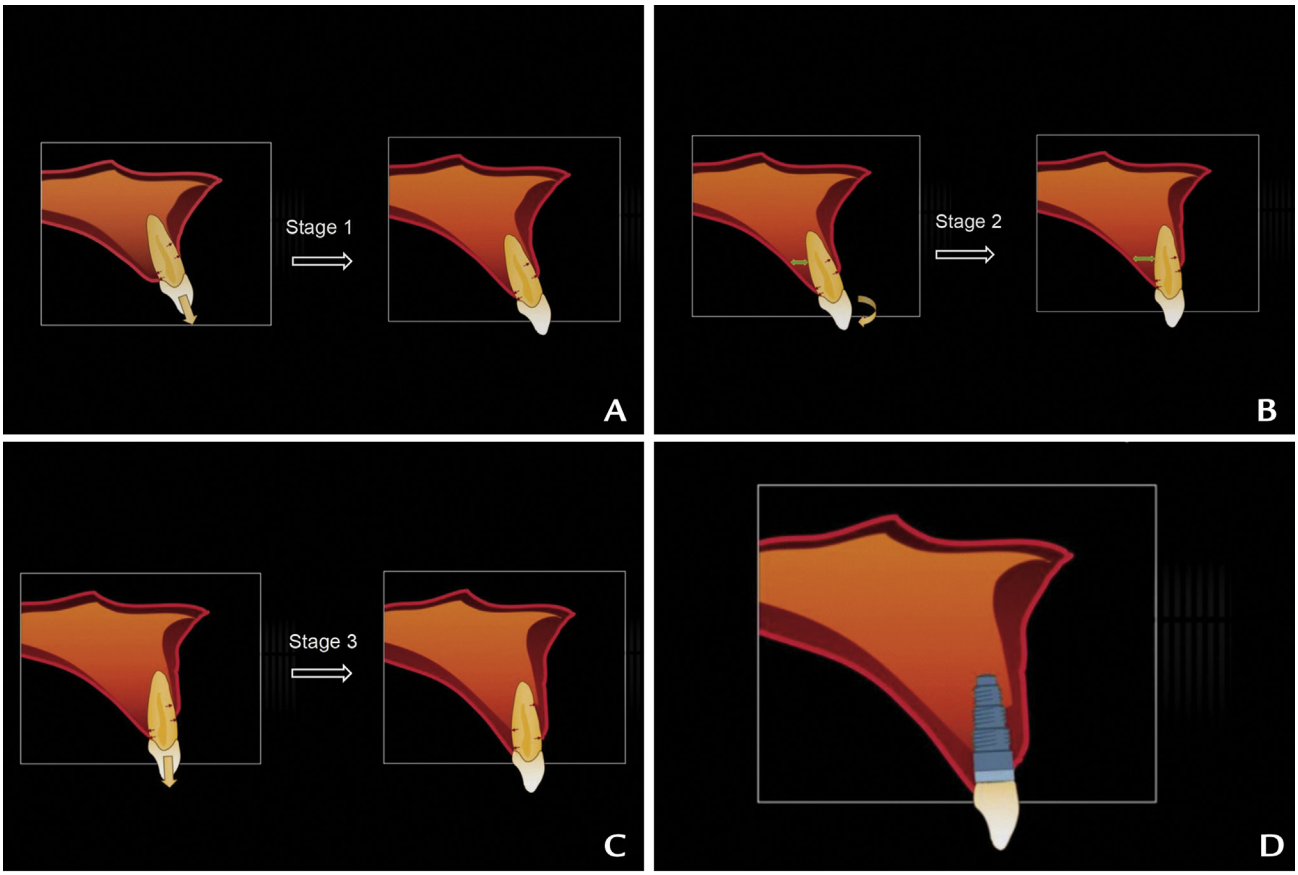


**Figure 7.** Schematic diagram of presented technique. A, Stage 1: slow forced eruption at rate of 1 mm/month with 0.2- to 0.5-N force. B, Stage 2: Slow buccal root torque with same rate and force. C, Stage 3: Fast forced eruption at rate of 1 mm/week with 1.0- to 1.5-N force. D, Implants placed immediately or with early approach because ideal soft and hard tissue volume developed.

**Table 1.** Implant site development through staged orthodontic extrusion and buccal root torque

| Indications | Contraindications |
|---|---|
| - Vertical soft and hard tissue deformities | - Uncontrolled chronic inflammation |
| - Immediate implant | - Poor oral hygiene |
| - Site close to anatomically vital structures | - Loss of intact apical attachment (at least 1/3 to 1/4 attachment in place) |
| - Resolution of vertical angular bony defects of adjacent teeth | - No occlusal clearance |
| - Avoidance of extensive bone augmentation and soft tissue grafting procedure | - Root ankylosis |
| | - Hypercementosis |

predictably with only a few threads needing to be covered. Symmetrical gingival levels with no signs of inflammation were observed clinically, and the thick labial bone was confirmed radiographically after 5 years.

## SUMMARY

The modified orthodontic technique presented can transform a defective site into an ideal site, with adequate bone and soft tissue profiles in width and height for implant placement. A hopeless tooth was manipulated to prepare the implant site through orthodontic treatment, leading to an excellent and stable outcome after 5 years.

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## Noteworthy Abstracts of the Current Literature

### Subpontic osseous hyperplasia: comprehensive review of the literature and presentation of new case history

Brooks JK, Powers LK

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**Purpose.** To increase awareness of subpontic osseous hyperplasia (SOH), an uncommon benign mass found underneath the pontics of fixed partial dentures (FPDs) and occasionally in implant-supported dental prostheses.

**Material and methods.** A PubMed search in the English-language literature was conducted for case reports and case series of SOH. Demographic information gleaned from these publications included patient age and gender, lesion sites, outcomes, comorbidities, symptomatology, and periodontal involvement. To exemplify the findings of SOH, a clinical investigation of a 73-year-old affected woman has been detailed.

**Results/Conclusions.** With the inclusion of this featured case, 71 patients with 80 affected sites were identified with SOH and served as the basis for the provided database. To date, this aggregation of cases represents the largest collection to undergo clinicopathologic review. SOHs appeared as dome-shaped radiopacities and tended to exhibit increased osteosclerosis with increased duration. The average age at discovery was 57 years, and SOH was found somewhat more often in women. Lesions were more likely to occur in the left posterior mandible. Affected patients may experience increased difficulty maintaining adequate oral hygiene, potentially leading to periodontal disease or discomfort. Overgrowths should be surgically removed when satisfactory oral hygiene measures have been compromised, when there are atypical clinical or radiographic presentations, or with incident symptomatology.