Application of Collagen Matrix in Peri-Implant Dehiscence Defect: A Case Series

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During implant placement, dehiscence defects can result in complications such as mucosal recession and peri-implantitis. Whereas guided bone regeneration (GBR) is a common approach to managing these defects, it is often complex and time-intensive. This case series evaluates an alternative method using a collagen matrix (Collagen Graft2) applied to peri-implant dehiscence defects without GBR. Through three case series, this approach effectively preserves buccal contour, enhances gingival thickness, and supports bone regeneration, leading to favorable peri-implant conditions. These findings suggest that collagen matrix application is a viable and less invasive option for treating peri-implant dehiscence defects; however, further studies are required to validate these results.

Key Words: esthetic, collagen matrix, dehiscence defect, dental implant

Introduction

A dental implant should be placed in the alveolar ridge with adequate circumferential bone walls, which improves the osseointegration and completion of bone healing to have successful long-term stability.[1] However, there are unfavorable cases in which dehiscence-like bone defects are caused by unsuccessful regenerative procedures for various reasons.[2,3] Most bone defects occur on the buccal side, which can induce instability under peri-implant diseases and conditions, including mucosal recession and peri-implantitis.[4] Alveolar bone resorption is a common consequence of tooth extraction with the buccal bone being the most absorbed vertically and horizontally.[5] An alveolar ridge preservation technique immediately after tooth extraction has been used to prevent bone resorption and to maintain horizontal and vertical alveolar ridge forms using bone graft materials, membranes, and soft tissue grafts.[6] If resorption occurs after extraction, alveolar ridge augmentation procedures, such as guided bone regeneration (GBR), are widely used to reconstruct the ridge.[7,8]

Gingival phenotype is a term used to describe the thickness of the gingiva, and its relationship with biological width and alveolar bone thickness can affect surgical clinical outcomes.[9] A thick gingival phenotype is usually resistant to gingival recession, and this enables better postoperative esthetic outcomes than a thin gingival phenotype.[10] When dentists encounter buccal dehiscence defects in dental implants, they are at the crossroads of decision making regarding bone augmentation or other methods. Due to the significant time and effort required for bone augmentation, patients often prefer quick and easy treatments. In addition, desirable bone regeneration may not be achievable via GBR in cases with low bone regenerative potential, such as those with insufficient bony walls and improper implant fixture positioning.[11] Although the quantity and quality of alveolar bone are significant, appropriate vertical and horizontal gingival thicknesses have proven to be one of the success criteria for dental implants. In the presence of thin gingiva, modification of gingival phenotype from thin to thick might contribute to desirable esthetic outcomes by preventing gingival recession and maintaining peri-implant health.[12] Various techniques, such as subepithelial connective tissue graft, have increased gingival thickness. Less complex methods, such as applying collagen matrix, have also attracted interest recently.[13–15]

In this case series, we report 3 cases of collagen matrix application to the peri-implant dehiscence defect site. These cases show the potential to achieve proper buccal contour, gingival thickness, and bone regeneration, leading to favorable peri-implant conditions.

Case Report

This report presents 3 cases in which a collagen matrix, Collagen Graft2 (CG2) (Genoss Co, Ltd, Suwon, Korea), was applied to buccal bone defects of dental implants without bone grafting, resulting in stable soft tissue volume and good clinical outcomes.

Case 1

A 75-year-old woman visited for dental implant placement in the missing region of the mandibular right first premolar (tooth #44). On the radiograph, the vertical bone height was sufficient (Figure 1a); however, a buccal defect was observed clinically (Figure 1b) and classified as Sibert classification class I. After implant

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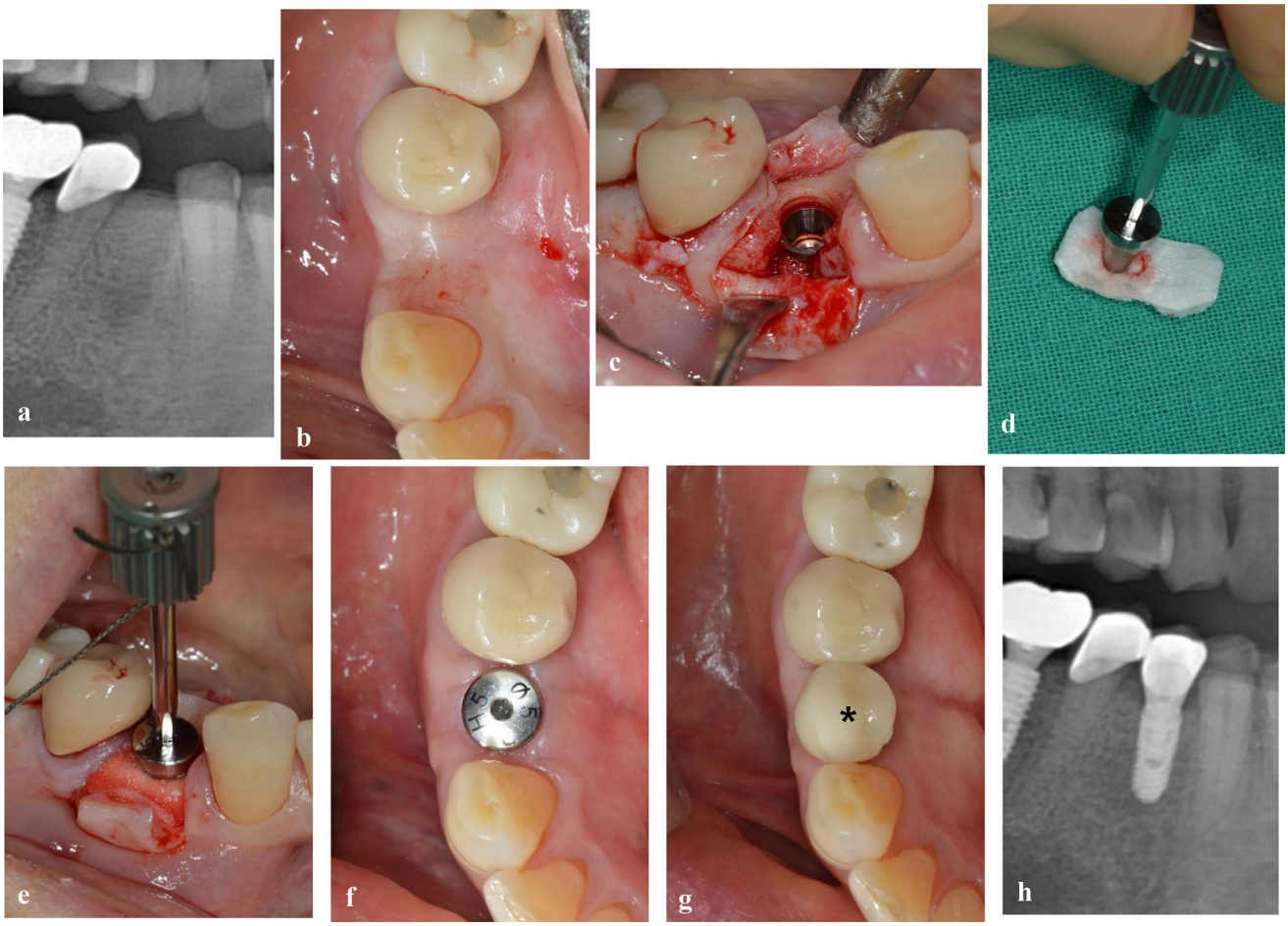

Figure 1. Case 1. (a) Radiography shows the missing site of tooth #44 with sufficient bone height. (b) A buccal defect is observed at the missing site in the clinical photograph. (c) After implant placement, the implant fixture is partially exposed because of the buccal defect. (d) After trimming Collagen Graft2 (CG2) into proper sizes, CG2 is plugged into the healing abutment (HA). (e) HA with CG2 is connected to the implant fixture. (f) 2 weeks after surgery, the soft tissue is healed well, and the buccal contour is reconstructed from concave to convex. (g) The buccal contour is maintained well until 2 years of recall checks after prosthesis installation (asterisk). (h) No specific complication is observed on radiography.

placement, the fixture was naturally exposed on the buccal side (Figure 1c). Because the fixture exposure was confined to crestal bone, CG2 was applied around the healing abutment without bone grafting (Figure 1d and e). Two weeks after surgery, soft tissue healing was good (Figure 1f). Despite some absorption, the buccal contour was maintained well until 2 years after the recall check after the prosthesis installation (Figure 1g). The peri-implant bone condition was favorable (Figure 1h).

Case 2

A 76-year-old woman requested dental implant placement in the missing region of the maxillary right premolars (teeth #14 and #15). On the radiograph, the vertical bone height was sufficient for implant placement (Figure 2a), and the soft tissue healed well after tooth extraction (Figure 2b); however, when the flap was elevated, the ridge had a concave shape because of bone resorption, especially on the buccal side (Figure 2c), which was classified as Sibert classification class I. Therefore, the implant fixture was partially exposed after placement (Figure 2d). After the cover screws were inserted, CG2 was applied to the concave and exposed defect sites without bone grafting (Figure 2e), and the flap was closed (Figure 2f). Three months after surgery, the ridge healed well, and bone regeneration was observed that covered the buccal bone defect and cover screws (Figure 2g). The healing abutments were connected to the fixture, the prosthesis was delivered (Figure 2h), and the peri-implant condition was maintained well until the 1-year checkup (Figure 2i).

Case 3

A 42-year-old woman visited with a chief complaint of gingival pain and sensitivity in the gingiva surrounding the maxillary lateral incisor (#12) (arrow, Figure 3a). Based on the signs of gingival inflammation, dark color, and friable gingival texture, it could be inferred that the buccal bone was resorbed and the implant fixture was exposed. After elevation of the gingival flap, a partially exposed implant fixture and buccal bone resorption were confirmed (Figure 3b). Because the fixture was positioned buccally, bone regeneration was complex with GBR; therefore, only CG2

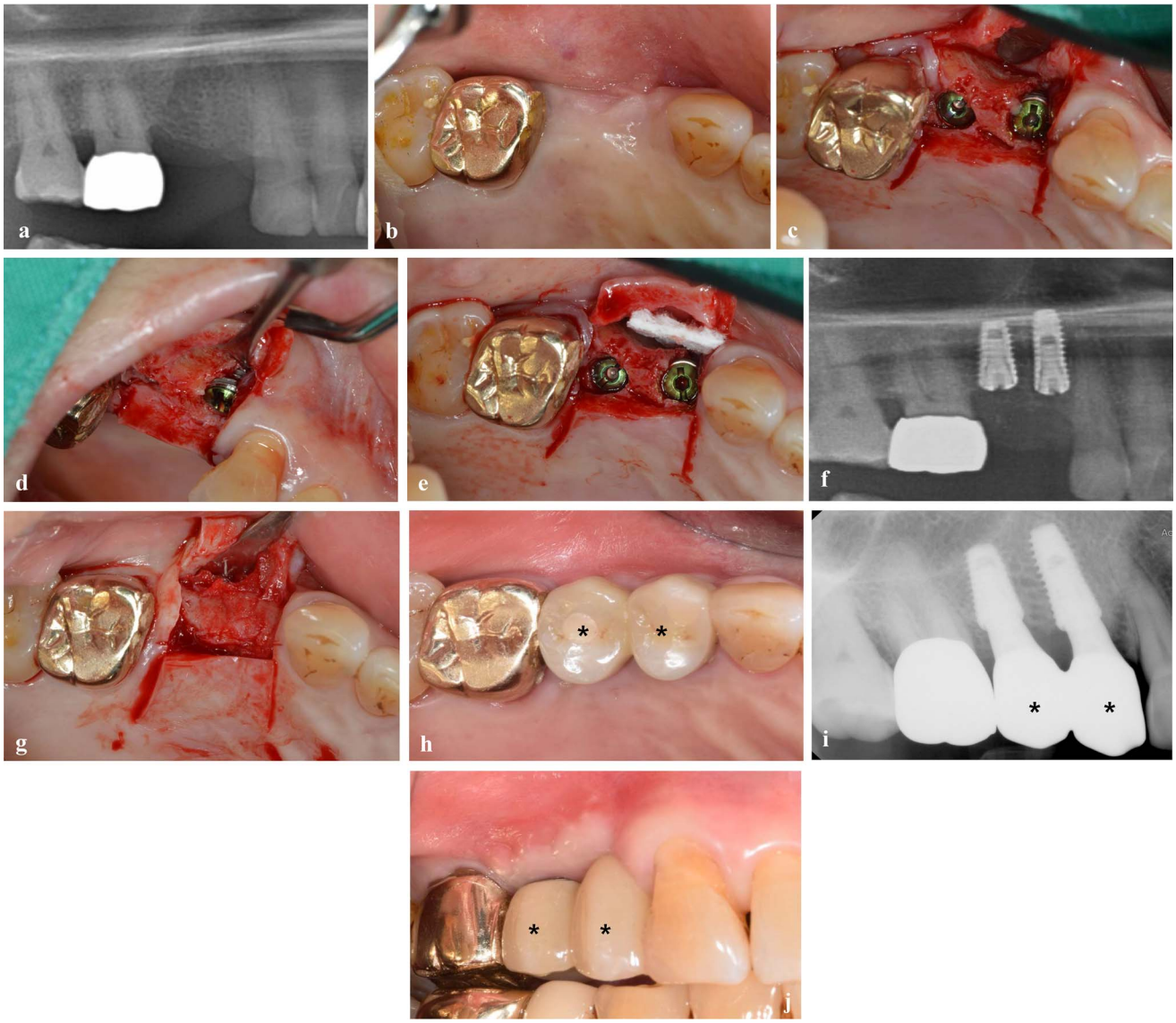

Figure 2. Case 2. (a) Radiography showed the missing sites of teeth #14 and #15. (b) Well-healed ridge 4 months after tooth extraction. (c, d) A buccal bone defect is observed, and the implant fixture is partially exposed. (e) Collagen Graft2 is applied to the buccal defect site. (f) Implants are placed well. (g) When the flap is elevated for the connection of the healing abutment, vertically and horizontally well-regenerated bone was observed. (h, i, j) Implant prosthesis is delivered and maintained well (asterisk).

was applied to the defect site to create a thick and stable gingiva after decontamination of the fixture surface with EDTA, hydrogen peroxide, and chlorhexidine (Figure 3c). Two weeks after surgery, gingival healing was good (Figure 3d), and there was no discomfort. The final prosthesis was delivered (Figure 3e), and the thick and firm gingiva was maintained well after 1 year of final prosthesis delivery (Figure 3f).

Discussion

This report describes 3 cases of CG2 application for dental implant dehiscence defects. Although there were bone defects around the dental implant, CG2 application enabled the creation of a stable buccal contour with gingival thickness (case 1, Figure 1), unexpected bone regeneration without a bone graft (case 2, Figure 2), and recovery of esthetics and gingival health (case 3, Figure 3). The application method was simple, and the treatment time was reduced by bypassing the bone graft.

Complete osseointegration around the implant fixture is necessary; therefore, GBR with bone graft materials and barrier membranes has been used to increase alveolar bone height and width.[1] In the past, the traditional unmodified implant surface was unfavorable for osseointegration;[16] GBR was required to place long and wide implants. However, short and narrow implants are currently being used stably owing to the development of implant surfaces, and there is a risk of surgical complications in GBR or medically compromised patients who have difficulty in complicated bone regeneration surgery; therefore, more straightforward

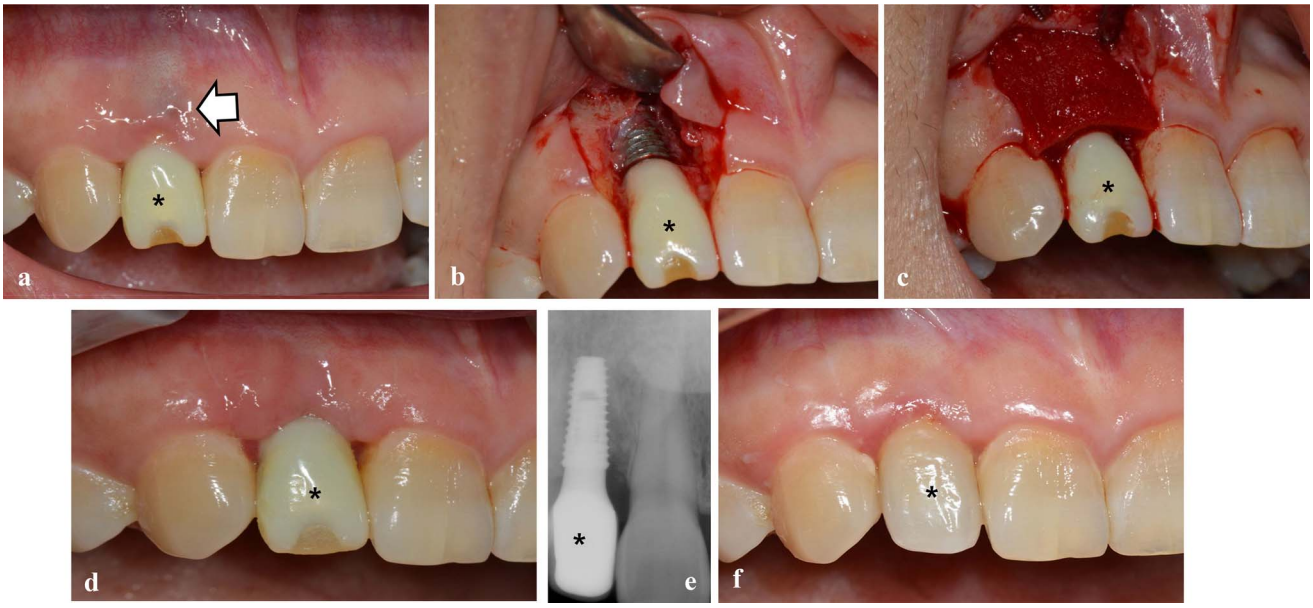

Figure 3. Case 3. (a) Gingival inflammation and implant fixture-like dark color are observed (arrow). (b) When the flap is elevated, peri-implant bone defect with fixture exposure is observed. (c) Collagen Graft2 is applied to the defect site after the fixture surface decontamination. (d) 2 weeks after surgery, gingival healing is good. (e, f) Peri-implant bone and soft tissue conditions seem favorable until 1 year of follow-up after prosthesis installation (asterisk).

surgical methods are in the spotlight.[17,18] In line with this trend, to the extent that peri-implant dehiscence defects do not significantly affect implant stability, soft tissue augmentation is widely used to create a thick phenotype rather than bone regeneration. For soft tissue augmentation, subepithelial connective tissue grafts are widely accepted as the gold standard; however, pain at the donor site, the requirement of a skilled clinician, and increased operation time are disadvantages. Therefore, various alternatives have been introduced, and collagen matrices have been used with good clinical outcomes.[19,20]

Based on stable buccal contour maintenance (case 1, Figure 1), we had a firm impression of bone regeneration without bone materials between the fixture and CG2. There was some evidence from case 2 (Figure 2) showing considerable bone regeneration at the defect site with only CG2, which was studied as a mediator in periodontal tissue regeneration.[21] Considering the basic principle of guided tissue regeneration and the prevention of epithelial cell migration to the bone defect using a barrier membrane, it is not unexpected that the bone was formed naturally and not solely by CG2 application.[22] The peri-implant defect morphology can potentially determine regenerative therapeutic outcomes.[23] Peri-implantitis presents a more severe and aggressive pattern in buccal sites than in lingual areas.[24] The proximity of dental implants to the cortical bone and bone architecture might play a crucial role in the severity and frequency of alveolar bone loss at the buccal sites.[25] Similarly, in case 3 (Figure 3), the leading cause of gingival inflammation and fixture exposure was the proximity of the dental implant to the buccal wall. This phenomenon usually occurs during immediate implantation into the anterior region.[26] Thin, narrow buccal bones that remain at implant placement are absorbed over time, and the thin gingiva facilitates inflammation and exposes the implant fixture.[27]

Conclusion

Based on this case series, collagen matrix application to peri-implant dehiscence defects without bone graft material is a reliable and easy treatment option to create a stable peri-implant condition with increased gingival thickness and decreased operation time when bone resorption is not severe. To improve scientific evidence, more prospective studies with long-term follow-up are needed.

Abbreviations

CG2: Collagen Graft2
GBR: guided bone regeneration

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Note

The authors declare no conflicts of interest. Sungtae Kim and Hee-seung Han contributed equally as first authors.

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