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Peri-implant gingival tissue changes following immediate placement of maxillary anterior single implant with a collagen-coated xenograft: A 1-year follow-up result

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Purpose: This prospective study is aimed to evaluate the peri-implant gingival tissue stability following tooth extraction and immediate implant placement by the use of a collagen-coated xenograft (Bio-Oss Collagen, Geistlich, Switzerland) in the gap which occurred between the implant and the walls of the fresh extraction socket.

Materials and Methods: Fifteen patients without medically compromised factors were selected and immediated implant placement followed by tooth extraction on the maxillary anterior single tooth area. Also, bone graft was performed in the gap between implant surface and inner aspect of the alveolar crest by using a collagen-coated xenograft without labial flap elevation. In 15 patients, peri-implant gingival tissue changes were evaluated clinically and radiographically at presurgical examination (T0), immediately after implant placement and provisionalization (T1), 6 months (T2), and 1 year after implant surgery (T3).

Results: All the implants remained in function at 1 year after implant surgery and have no signs of inflammation. There were no significantly changes about the bone level, papilla level, gingival margin level.

Conclusions: Our study showed that favorable implant success rates and peri-implant tissue response on the maxillary anterior area could be achieved by immediate implant with insertion of a collagen-coated xenograft in the extraction site. **(JOURNAL OF DENTAL IMPLANT RESEARCH 2014;33(1):18-22)**

Key Words: Bone graft, Collagen-coated xenograft material, Immediate implant placement

INTRODUCTION

Single implant installation in anterior maxilla is highly predictable and successful in terms of hard tissue response and implant success rates following conventional implant installation method[1]. Recently, many patients expect highly esthetic result especially in anterior region of implant installation in the shortest time span and minimal invasive treatment. Consequently, to counteract their demand of faster and less invasive treatment methods, immediate implant placement and provisionalization has been produced. Kan et al. have been reported about implant placement in combination with immediate placement and they suggested that favorable implant success rates, peri-implant tissue responses, and esthetic outcomes can be achieved with immediate placement and provisionalization in maxillary anterior single implants[2]. Wilson et al. stated that the use of barrier membrane is not necessary if the distance between the implant surface and surrounding bone walls is below 1.5 mm[3]. Although, this protocol has obvious advantages, immediate implant installation may not prevent post-extraction site from remodeling process. According to Araujo et al[4], in the animal test, the placement of an implant in the fresh extraction site failed to prevent the re-modeling that occurred in the walls of the socket. Among the factors to decide on esthetics regarding maxillary anterior area, the prediction and research about

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amount of buccal bone loss after extraction on maxillary anterior tooth is very important. Several studies have observed the healing of the extraction socket and the placement of an implant in the fresh extraction site after extraction of the maxilla anterior tooth. Nevin et al. reported that the buccal bone of maxillary anterior area become clearly visible in the controlled group and grafting bone right after extraction is effective to reduce the buccal bone loss more or less[5]. The edentulous alveolar process undergoes substantial bone remodeling, including peri-implant tissue, which is highly important for esthetic treatment. Clinicians should be aware of these changes to satisfy patient's needs and get predicted outcome. Cosyn et al. have stated the treatment seems a valuable and predictable treatment option for well-selected patients in the mid-long term as shown by almost full papillary re-growth and a low risk for advanced midfacial recession on 3-year results of a case series of immediate single-tooth implants in the anterior maxilla[6]. This prospective study is aimed to evaluate the peri-implant gingival tissue stability following tooth extraction and immediate implant placement by the use of a collagen-coated xenograft (Bio-Oss Collagen, Geistlich, Switzerland) in the gap which occurred between the implant and the walls of the fresh extraction socket.

MATERIALS AND METHODS

Fifteen patients without medically compromised factors were selected and immediated implant placement followed by tooth extraction on the maxillary anterior single tooth area. After surgery, provisionalizal restoration was cemented. The gingival margin of provisional restoration have not impinge on gingival tissue. In 15 patients, peri-implant gingival tissue changes were evaluated clinically (Fig. 1) and radiographically (Fig. 2) at presurgical examination (T0), immediately after implant placement and provisionalization (T1), 6 months (T2), and 1 year after implant surgery (T3). Definitive restoration was delivered at T2. These patients were treated according to the placement and provisionalization of dental implant (GSIII, Osstem, Korea) immediately after tooth extraction. Also, bone graft was performed in the gap between implant surface and inner aspect of the alveolar crest by using a collagen-coated xenograft (Bio-Oss collagen) without labial flap elevation. The mesial papilla level (MPL) and distal papilla level (DPL) were recorded at T0, T1, T2 and T3. The levels were recorded by means of an acrylic stent provided with direction grooves. Papilla level (mesial and distal) was defined as the distance from the top of the groove to the top of the papilla measured to the nearest 0.5 mm using a manual probe. Marginal bone level change was measured using sequential periapical radiographs. As performed at presurgical examination, a periapical radiograph using the long-cone paralleling technique was taken at each time intervals. Each X-ray holder (XCP Bite Blocks, Dentsply, USA) had been individualized with an occlusal jig (Futar D Fasts, Kettenbach Dental, Germany) in order to standardize the procedure. The periapical radiographs were taken by a digital intraoral sensor. By comparing the radiographs, changes in marginal bone levels at the

Fig. 1. Comparison of clinical photos of presurgical examination (T0), immediately after implant placement and provisionalization (T1) and 1 year after implant surgery (T3) of midcrown gingival height.

Fig. 2. Comparision of periapical radiograph of presurgical examination (T0), immediately after implant placement and provisionalization (T1) and 1 year after implant surgery (T3).

mesial and distal aspect of the implant were determined (Fig. 3).

RESULTS

All the implants remained in function at 1 year after implant surgery. After 1 year, all the implants was virtually free of signs of inflammation. The mean mesial and distal marginal bone level changes at T2 in relation to T1 were significantly smaller than those at 1 year after surgery (Table 1). Changes of interproximal papilla level were shown to have decreased height between T0 and T2. This was shown that a bone resorption gradually generated until the definitive restoration is delivered. However, the mean mesial and distal papilla level changes at 1 year after implant surgery were significantly smaller than those observed at T1 and T2. It means that the interproximal papilla regained between T2 and T3. The largest alterations in the middle of crown gingival height level of the peri-implant mucosa occurred during the six months of healing, a mean loss of 0.63 mm. At T3, the middle of crown soft tissue recession was on average 0.64 mm. There were no significant changes in middle of crown gingival height between T2 and T3. In contrast, the horizontal level change of facial gingival tissue at T3 was significantly greater than those at T2 (Table 2).

Fig. 3. Periapical radiograph showing the measurement of mesial and distal marginal bone level (arrow).

DISCUSSION

The immediate implant installation after tooth extraction is now a common procedure with a success rate similar to implants placed in a conventional method. According to Covani et al. implants placed into fresh extraction sockets showed 97% of success rate in a 4-year prospective study[7]. Several studies were also reported that the immediate implant installation after extraction is a valuable and predictable option in terms of success rates and esthetic outcomes. Covani et al. reported that implants placed immediately after tooth extraction showed the mean value of vertical bone resorption is 0.8 mm after the first 6 month. And it can be done without any regenerative procedures[7,8].

Nevertheless immediate implant installation may not prevent post-extraction site from remodeling process. Arajuo et al. observed histological examination of 5 beagle dogs' implant placement in fresh extraction sockets. After 12 weeks of the placement of implant, buccal bone crest was located above 2 mm apical of the SLA level[4,9]. According to another review article, immediate implants show an increased risk for mid facial recession. To reduce the risk for advanced mid facial soft tissue recession a number of prerequisites have been described[10].

In order to preserve the dimension of the ridge after tooth extraction, the use of various graft or filler materials such as autografts, allografts have been advocated. Arajuo et al. placed autologous bone chips harvested from the buccal

Table 1. Changes in marginal bone levels in relation to T1.

	T2	T3
Mesial bone level (mm)	−0.23±0.54	−0.65±0.65*
Distal bone level (mm)	−0.41±0.61	−0.59±0.70*

Mean±S.D. *significant marginal bone level changes by Mann-Whitney test.

Table 2. Changes in soft tissue dimensions in relation to T0.

	T1	T2	T3
Mesial papilla level (mm)	−0.34±0.51	−0.66±0.61†	−0.32±0.67‡
Distal papilla level (mm)	−0.31±0.69	−0.52±0.76	−0.30±0.46‡
Midcrown gingival height (mm)	−0.57±0.45*	−0.63±0.74†	−0.64±0.64
Midcrown gingival width (mm)	−0.71±1.91*	−1.13±1.03†	−1.45±0.93‡

Mean±S.D. *significant soft tissue loss in comparison to T0 by Mann-Whitney test. †significant soft tissue loss in comparison to T1. ‡ significant soft tissue loss in comparison to T2.

mandible of 5 beagles, in the fresh extraction, and compared with that of the results of collagen-coated. It was observed that autologous bone chips placed in the fresh extraction sockets will neither stimulate new bone formation nor prevent ridge resorption that occur during healing. Extraction site with a xenograft showed surpassing results of the bone's volume. But the composition of the bone showed difference. In autologous bone, Bone marrow occupy more, while in case of xenograft, CT and graft particle occupied more[11]. One graft material, comprised of deproteinized bovine bone mineral has been used in attempts to preserve the dimension of the alveolar ridge after tooth extraction. Carmagnola et al. divide the three treatment groups. In group A, the extraction sockets were covered with a Bio-Gide membrane (Geistlich) and in group B the extraction sockets were filled with a Bio-Oss (Geistlich). The extraction sockets in group C were left to heal spontaneously. Biopsies from the extraction sites were collected at the time of implant installation, and through the biopsy results, Carmagnola et al[12] investigated the healing of human extraction. Samples from group A showed large amounts of lamellar bone and bone marrow and small proportions of woven bone. Sites grafted with a Bio-Oss were comprised of connective tissue and small amounts of newly formed bone surrounding the graft particles. Only 40% of the circumference of the Bio-Oss particles was in contact with woven bone. Sites from group C were characterized by the presence of mineralized bone and bone marrow.

In one recent animal experiment[13], it was demonstrated that the placement of Bio-Oss Collagen® in the gap between an implant and the buccal bone walls of the extraction socket modified the hard tissue healing process by providing some additional hard tissue at the entrance of the previous socket and improved the level of marginal bone-to-implant contact and prevented soft tissue recession.

Arajuo[14-15] observed the healing procedure of extraction socket after inserting collagen-coated xenograft by Biopsy. The presence of Bio-Oss collagen failed to inhibit the processes of modeling and remodeling process that took place in the socket walls following tooth extraction. However, it apparently promoted hard tissue formation, particularly in the cortical region of the extraction site and the dimension of the hard tissue was maintained and the profile of the ridge was better preserved.

The results of the present our study showed favorable implant success rates and peri-implant tissue response could be achieved with our procedure. The vertical level of interproximal papilla and facial gingival tissue were maintained to be relatively stable and subsequent papilla regeneration can occur over time following our procedure. The insertion of a collagen-coated xenograft might prevent the vertical height of facial gingival tissue, however not the horizontal width of facial gingival tissue.

Our results show that the additional bone graft and connective tissue graft might be needed to maintain the horizontal width of facial gingival tissue.

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