A retrospective study on separate single-tooth implant restorations to replace two or more consecutive maxillary posterior teeth up to 6 years follow up

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Abstract

Material and methods:

Multiple implants may be restored with splinted or non-splinted implant-supported restorations. This retrospective study was aimed to evaluate the performance of separate single-tooth implant restorations replacing two or more consecutive maxillary posterior teeth up to 6 years. Total of 20 cases (1.5 to 6 years follow-up) were selected according to selection criteria and all cases were successful. It can be concluded that separate single-tooth implant restorations in posterior maxilla are predictable if carefully prescribed.

Introduction

Two or more consecutive posterior teeth can be separately restored by single-tooth implant restorations or by splinted multiple implants restoration. The decision whether or not to splint adjacent implants in partially edentulous mouths has always been a source of controversy. Progressive improvements in implant body design and surface modifications and more stable implant-abutment connection together with platform-switching concept have resulted in reduced marginal bone loss around the implant. Because of the improvements, single-tooth implant restoration has shown optimally maintained marginal bone levels although more harmful loads are given to the single implant. Such biomechanical advancements implying splinted restorations can be replaced with separate single-tooth implants, which provide more aesthetics, hygiene and passive fit. However, there have been only a few studies reporting the clinical results in multiple single-tooth implant restorations [1-3]. The purpose of this study was to examine retrospectively the performance of separate single-tooth implant restorations to replace two or more consecutive maxillary posterior teeth up to 6 years follow up.

Materials and methods

This retrospective descriptive study included cases treated with dental implants from January, 2011 to December, 2016. The inclusion criteria for cases were all implants those had been placed for partially edentulous maxillary posterior areas and restored using single fixed implant-supported prostheses that had been in function for at least 1 year. All patients had signed the informed consent in which the nature of implant treatment was explained detail and use of photographs and radiographs for the research purpose. All implant procedures including planning, surgery and prosthodontic works were performed by single implant prosthodontist. Decisions for choice of implant diameter and length, bone augmentation and surgical technique modifications were made according to individual requirement with proper treatment planning considering biomechanical principles. Mytis Arrow implant system (BrainBase Co. Ltd., Tokyo, Japan) was used for all cases (10 - 12 mm in length, 4.0 mm or 4.6 mm in diameter) and Arrow Bone Beta (BrainBase Co. Ltd., Tokyo, Japan) was used as augmentation material as necessary. Maxillary sinus augmentation was performed by socket lift approach in cases where available bone was less than 10 mm. Prostheses were fabricated according to accepted prosthodontic principles for dental implant restorations. Follow-up visits were arranged for six months interval.

Data was collected and divided into three main categories: patient demographics, implant and prosthetic information and bone grafting information. Patient demographics included sex and age. Implant information included implant type, dimensions, date of implant placement, re-entry and prosthesis insertion, type of prosthesis.

Results

Case no.	age	gender	side	Implant number	Bone augmentation	Duration
1	60	Male	Right+ Left	2 + 2	yes	6 years
2	63	Female	right	3	yes	5 years
3	65	Male	left	2	no	5 years
4	60	Female	left	3	yes	5 years
5	65	Male	right	2	no	5 years
6	61	Male	right	2	no	5 years
7	55	Female	right	2	yes	4 years
8	58	Female	left	3	no	4 years
9	55	Male	right	2	no	4 years
10	70	Female	left	3	no	3 years
11	65	Male	left	2	no	3 years
12	40	Male	right	2	yes	2 years
13	58	Male	left	3	yes	2 years
14	48	Female	right	2	no	2 years
15	67	Female	left	3	no	2 years
16	70	Male	left	2	yes	2 years
17	61	Female	right	3	yes	2 years
18	32	Female	right	2	yes	2 years
19	30	Female	left	2	no	2 years
20	46	Male	right	3	no	1.5 year

Table 1. List of twenty cases treated with dental implants in maxillary posterior region restored with un-splinted separate single crown restorations

Altogether 20 cases were included in the data collection selection criteria. Age of the patients ranged from 30 to 70 years and there was equal sex distribution. All twenty cases performed well without any clinical and radiographic evidence of peri-implant tissue changes through maintenance period. The follow-up duration ranged

from 1.5 to 6 years. The number of implants was either two or three in each case. Bone augmentation was performed in 9 cases [Table 1]. It can be noted that about 50 % of posterior maxilla necessitated bone augmentation in addition to implant placement. In those cases, prosthetic rehabilitation was initiated 3-4 months after healing period. All cases were restored with cemented single porcelain-fused to metal crowns.

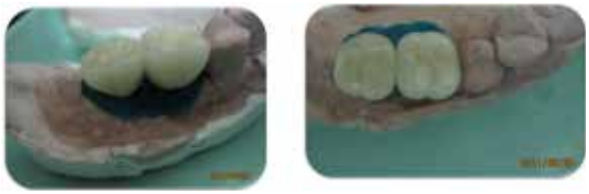

Figure 1. Separate single crown restorations on laboratory casts

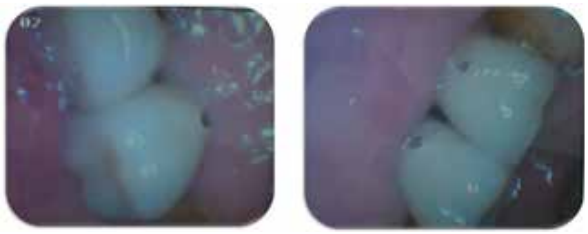

Figure 2. Clinical appearance of separate single crown restorations and healthy mucosa from palatal view

Figure 3. Panoramic radiograph showing stable crestal bone levels around implants after 6 years

Discussion

Many clinicians believed that splinting the crowns on adjacent implants in a form of fixed implant-supported partial denture would favor the distribution of functional forces applied to implants more uniformly. This may reduce potential overloading of crestal bone and lead to fewer prosthetic and implant complications such as prosthesis loosening, implant fracture and implant failure. Grossman et al (2005) suggested that implants be splinted if there are a reduced number of natural occlusal stops, steep anterior guidance planes, para-functional oral habits, implants arranged around an arch, implant restorations including canines, fully edentulous maxilla and/or, compromised retention and resistance forms of prosthetic components (to increase retention form for cemented prosthesis) [4]. Misch (1999) suggested that the use of a splinted prosthesis decreases the number of implants needed with economic implications for the patient [5]. Balshi et al (1996) also reported that splinted prostheses were associated with less prosthetic screw loosening, 8% for splinted vs. 48% for non-splinted [2]. Cement-retained splinted prostheses require less strong cement, which in turn allow for future retrievability of the prosthesis according to Misch et al (2005) [6]. In addition, a multi-unit prosthesis may be preserved if one of the supporting implants fails and has to be removed. Since dental implants are unable to move in response to eccentric forces, unlike natural teeth, implants are vulnerable

to lateral forces. Two posterior implants splinted together may help to protect against the deleterious effects of eccentric loading, and distribute forces over a greater implant surface area.

On the other hand, one of the main arguments not to splint adjacent implants is that inter-proximal hygiene may be more difficult to accomplish. Lindhe et al (2008) suggested that plaque accumulation between implants may lead to peri-implant mucositis or peri-implant crestal bone loss with subsequent complications [7]. Furthermore, Guichet et al (2002) pointed out the difficulty in fabrication and delivery of a passively seating splinted prosthesis on multiple implants [8]. Occasionally a splinted implant-supported prosthesis may not completely seat on one or more implants.

Since implants placed in posterior maxilla are subjected to greater functional loads and owing to reduced bone density of posterior maxilla, it is crucial to follow standard surgical and prosthodontic considerations in the treatment sequence; modification of surgical technique such as underpreparation and bone condensing, bucco-lingually narrow crowns with low occlusal table and avoidance of excursive occlusal contacts. In the present study, all non-splinted single implants survive so far until follow-up period varying from 1.5 to 6 years. A meta-analysis of literature was undertaken by Lindhe et al (1998) in order to estimate survival of implants supporting either fixed partial dentures (IS-FPD) or single crowns in partially edentulous patients. After 1 year, the success rate was 85.7% for IS-FPD and 97.2% for single implants. The survival rate after 6-7 years for IS-FPD was 93.6% vs. 97.5% for single implants [9]. In addition, Kwon et al (2010) demonstrated that splinted implants appeared to be associated with greater crestal bone loss [3]. Cochran (2009) reported that after 5 years of loading, single implant units experienced 2.64 mm of bone loss while implants in splinted restorations had 2.90 mm of bone loss (cumulative difference of 0.26 mm) [10]. These findings proved that splinted implant-supported prostheses result in more crestal bone loss than non-splinted prostheses. In the present study, the radiographs showed no appreciable crestal bone resorption. The challenge with non-splinted restorations is that there are numerous inter-proximal contacts that require meticulous adjustments. It should be noted that individual crowns with excessively tight contacts can produce a similar clinical situation to a non-passively fitting framework in a splinted prosthesis. Nevertheless, the evidence is accumulating on the fact that splinted implants show more crestal bone loss [11]. However, future longitudinal study should be conducted to compare the outcome of splinted versus non-splinted separate single-tooth implant restorations for two or more consecutive maxillary posterior teeth.

Conclusion

Separate single-tooth implant restorations to replace consecutive teeth are predictable and clinically successful in the posterior maxilla provided that proper treatment planning, careful surgical and prosthodontic works and regular maintenance are employed.

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