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Distally Tilted Implant for Management of Long Span Kennedy Class I - Clinical Evaluation - Preliminary Study

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ABSTRACT

Purpose: the aim of this study is to evaluate the clinical outcome of using distally tilted implant for management of mandibular long span kennedy class I cases. **Materials and methods:** six patients with mandibular long span kennedy class I and maxillary completely edentulous arch were selected for this study. They received distally tilted implant at the area of the first premolar. Then were then divided into two groups. Group I received a mandibular full arch fixed implant tooth supported bridge while group II received a mandibular implant assisted RPD. Clinical evaluation was done at time of prosthesis insertion (T0), after 1 year (T1) and 2 years (T2). **Results:** Plaque scores and gingival scores significantly increased with advance of time for fixed group (p=.002) and removable group (p<.001). At T1 and T2, removable group recorded significant higher plaque scores and gingival scores than fixed group.

INTRODUCTION

Partially edentulous population is increasing because of increased life expectancy, an increasing aging population, and more teeth being retained within this population.[1, 2] Fixed dental prostheses (FDPs) have traditionally been the gold standard to treat partial edentulism. However, when there is no abutment tooth distal to the edentulous space or in a long-spanning edentulous space, FDP therapy is contraindicated. When these patients would have had no other treatment choice in the past but to receive a removable partial denture (RPD).

RPD treatment is minimally invasive, and allows cost-effective and timely care for partially edentulous patients. When replacing lost hard and soft tissues to provide esthetic support, for long-term transitional prosthesis for a terminal dentition, and when restoring long edentulous spans. [1]

The use of partial removable dentures (RPDs) may have harmful effects on the oral tissues. These effects are observed with a particularly high frequency when the RPDs are designed in acrylic, without occlusal rests, but have also been reported in connection with the use of cobalt-chromium skeleton dentures.[3,4]

The problem with new dentures is related to the difference in resilience of the supporting structures. When exposed to an occlusal load the normal abutment tooth will be intruded in the region of 0-01 and 0-07 mm+[5] whereas the saddle supporting tissues can be displaced approximately 10 times more.[6] This is believed to cause a rotation of the denture.

Frequently, dental implants today provide the best practice alternative. Osseointegrated dental implants are often placed in the posterior mandible, mostly for support of fixed restorative prostheses. However, posterior implants are subjected to anatomical, surgical, and biological difficulties, and poses a challenge to the dental team.[7-10]

To avoid these procedures and to utilize preexisting bone in the most effective way, angled implants (tilting of implants) is a well-documented alternative, with no apparent clinically significant difference in success rates compared with axially placed implants.[11]

The rational of using tooth-implant connection is to gain support from the tooth or implant, proprioception of the tooth may help to reduce applied stresses to the implants.[12-14] Celso Hita-Carrillo has classified the methods of connection into two main groups: Rigid and nonrigid connection. Nonrigid connections could be in the form of attachment or intermobile element (IME)[15] Nonrigid attachments should be avoided as they increase the incidence of tooth intrusion. [13, 14, 16-18] The pontic should be of short span.[16, 17]And to eliminate or minimize lateral forces and unbalanced tooth contacts in centric and excursive movements.[16, 19, 20]

MATERIALS AND METHODS:

Six partially edentulous patients with mandibular long span kennedy class I were selected for the study from the outpatient clinic of Prosthodontic Department, Faculty of dentistry, Mansoura University, Egypt. Patients with mandibular long span kennedy class I The patients were informed about the treatment options and written informed consents were obtained from all participants. The study protocol was approved by the ethical committee of faculty of dentistry Mansoura University.

Double scan protocol was done to construct surgical template. Each patient was exposed to cone beam CT scan. On the cone beam CT, measurements of bone height, thickness and angulation were made and implants length and diameter were determined. A teeth supported stereolithographic surgical stent with two sleeves corresponding to the predetermined implant positions and full-seating verification window was constructed. A universal surgical kit was provided with the stereolithographic surgical template for using it during osteotomy preparation. Participants were administrated prophylactic antibiotic (500 mg amoxicillin and potassium clavulanate equivalent to 125 mg of clavulanic acid*) one day before implant placement and continued 7 days after surgery. -Participants were asked to rinse their mouth with chlorohexidine mouthwash just before surgery and continue rinsing their mouth 7 days after surgery.

SURGICAL PROCEDURES

Bilateral nerve block with bilateral infiltration in canine regions were performed using local anesthesia. Then, Stereolithographic template was seated in patient mouth over the teeth noticing teeth adaptation through the verification window (fig.1) then positioning drill was used through the holes in the buccal surface of the template to drill the bone through the mucosa in the buccal

surface of the ridge to create a bone channel through which the template was fixed to the ridge by 2 long pins. A circular tissue punch was inserted into the hand piece with external irrigation at low speed (100 rpm) and used to cut the soft tissue down to the crest of the ridge. A curette scaler was used to release tissue plug and expose the site of the implant. Depth drills of increasing diameters (available in the universal kit provided by the radiologist) that fits the diameters of the hand sleeves accurately were used to prepare final depth of the implant osteotomies. The final drill of the implant system was used to finish the osteotomy preparation after removal of surgical guide. Drilling was done by the use of low speed (800 RPM) high torque (35 NCm) hand piece and external irrigation to avoid overheating. Needle with sterile saline solution was used for socket irrigation and removal of any debris. The implants were introduced under completely aseptic conditions. The implant was slowly threaded into the final position using torque wrench until it was slightly under the crest with a minimum torque of 40 ncm noticing the implant hex in relation to the 30° angled multiunit abutment. (fig.2) Post-operative panoramic x-rays were made to verify implant position and orientation after insertion. Post-operative medications included: systemic Antibiotic (500 mg amoxicillin and potassium clavulanate equivalent to 125 mg of clavulanic acid), analgesic (Non-steroidal anti-inflammatory drugs) and chlorohexidine mouthwash were prescribed to all participants for one week post-operatively. Participants were informed to apply ice packs in the first 24 hours. And to eat soft diet (eg. milkshakes, fruit juices, mashed potatoes, soups, and soft pasta) and avoid hard foods (eg. popcorn, granola, and nuts) which may become lodged in the surgical site. Regular follow-up visits (twice/ week for 3 weeks and once/week for 3 months) to verify oral hygiene practice till osseointegration occurs.

Final prosthesis fabrication.

Three months after implant placement crestal flap was made to expose the implant's covering screw. Multiunit abutment were attached to the implant and covered with healing cap. Ten days later the patient was recalled for taking the impression. Multiunit open tray transfer were attached to access abutment to take abutment level impression. For group I: Preparation of the natural teeth for metal-ceramic bridge was made. Retraction cord was placed and addition silicon rubber base impression was made. Titanium abutment were attached to multiunit analogue and record block was fabricated for jaw relation record. (fig.3) Cast was then scanned and Fixed

metal-ceramic bridge was fabricated. Try-in and cementation of the final bridge was done with glass ionomer permanent cement. Digital periapical x-ray was taken to evaluate complete seating and removal of excess cement. Group II: addition silicon impression was recorded. Multiunit ball topping were attached to multiunit analogue on the cast and scanned for metallic framework designing and fabrication. Try-in of the metallic framework was done followed by jaw relation recording. Indirect pick-up of the ball housing was done on the lab. Multiunit ball topping was then screwed to access abutment. (fig.4) Final insertion of the RPD was done with occlusal adjustment to remove any occlusal interference.

All patients were clinically evaluated at time of insertion (T0), after one year (T1) and after 2 years (T2).

Fig. 1 stereolithographic stent fixed with pins

Fig. 2 30° distally tilted implant in place.

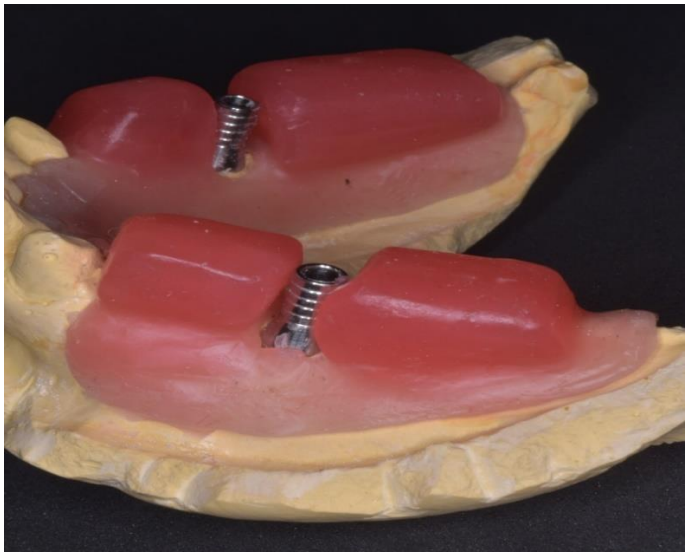

Fig. 3 Titanium abutments screwed to the analogue and record block fabricated.

Fig. 4 Multiunit ball top attached intraorally to multiunit access abutment.

RESULTS:

A. Plaque scores

- Clustered bar chart showing the median of plaque scores for groups at different observation times are presented in figure 5.

- Plaque scores significantly increased with advance of time for fixed group (p=.002) and removable group (p<.001). Multiple comparisons between each 2 observation times are

presented in the same table. For fixed group, there was a significant difference between T0 and T1 and between T0 and T2, however, no significant difference was observed between T1 and T2. For removable group, there was a significant difference between each 2 observation times.

- There was a significant difference in PI between groups at T1 (p=.008) and T2 (p=.001) (table 3). No difference in plaque score between groups was noted at T0.

- At T1 and T2, removable group recorded significant higher plaque scores than fixed group.

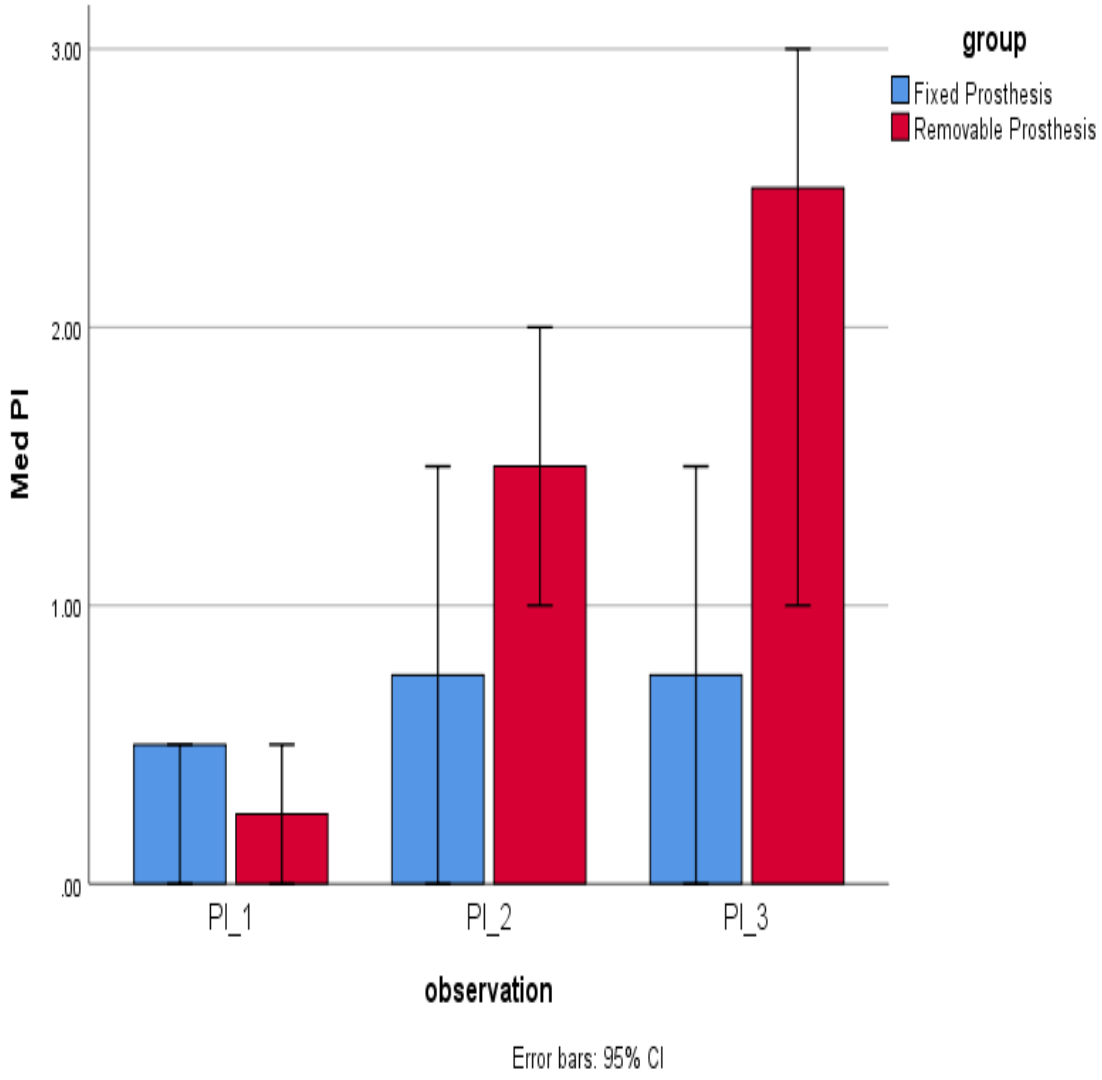

Fig. 5: Medians of plaque scores for groups at different observation times

B. Gingival scores

- Clustered bar chart showing the median of gingival scores for groups at different observation times are presented in figure 6.

- Gingival scores significantly increased with advance of time for fixed group (p=.001) and removable group (p<.001). Multiple comparisons between each 2 observation times are presented in the same table. For fixed group, there was a significant difference between T0 and T1 and between T0 and T2, however, no significant difference was observed between T1 and T2. For removable group, there was a significant difference between each 2 observation times.

- There was a significant difference in GI between groups at T1 (p=.039) and T2 (p=.001) (table). No difference in gingival score between groups was noted at T0.

- At T1 and T2, removable group recorded significant higher gingival scores than fixed group.

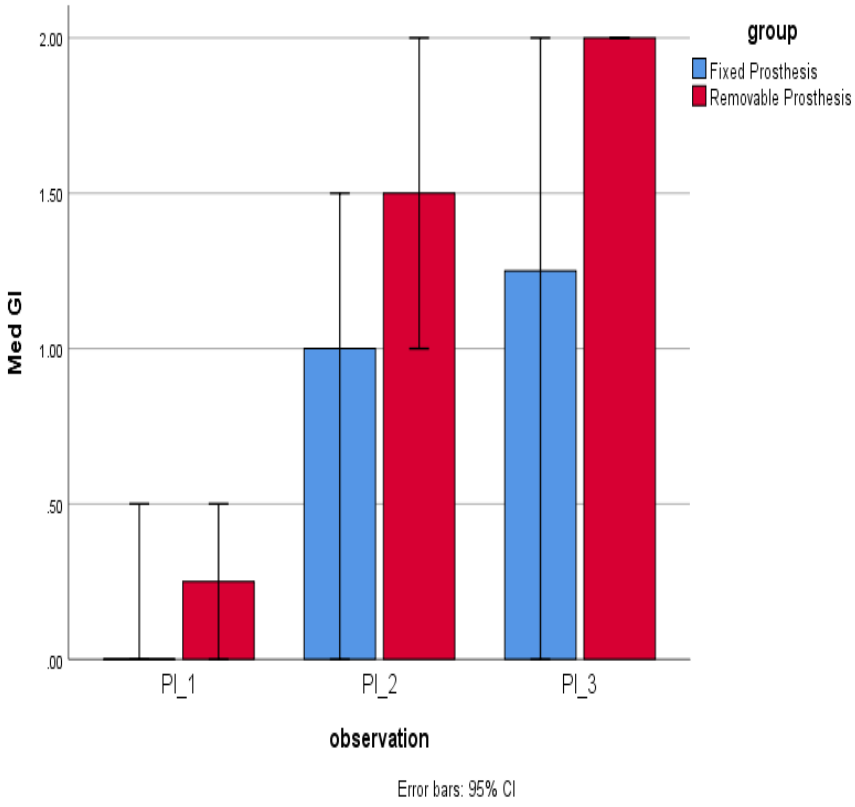

Fig 6: Medians of gingival scores for groups at different observation times

C. Probing depth

- Clustered bar chart showing the median of pocket depth for groups at different observation times are presented in figure 7.

- Pocket depth significantly increased with advance of time for fixed group (p<.001) and removable group (p<.001). Multiple comparisons between each 2 observation times are presented in the same table. For both groups, there was a significant difference between each 2 observation times.

- There was no significant difference in PD between groups at all observation times.

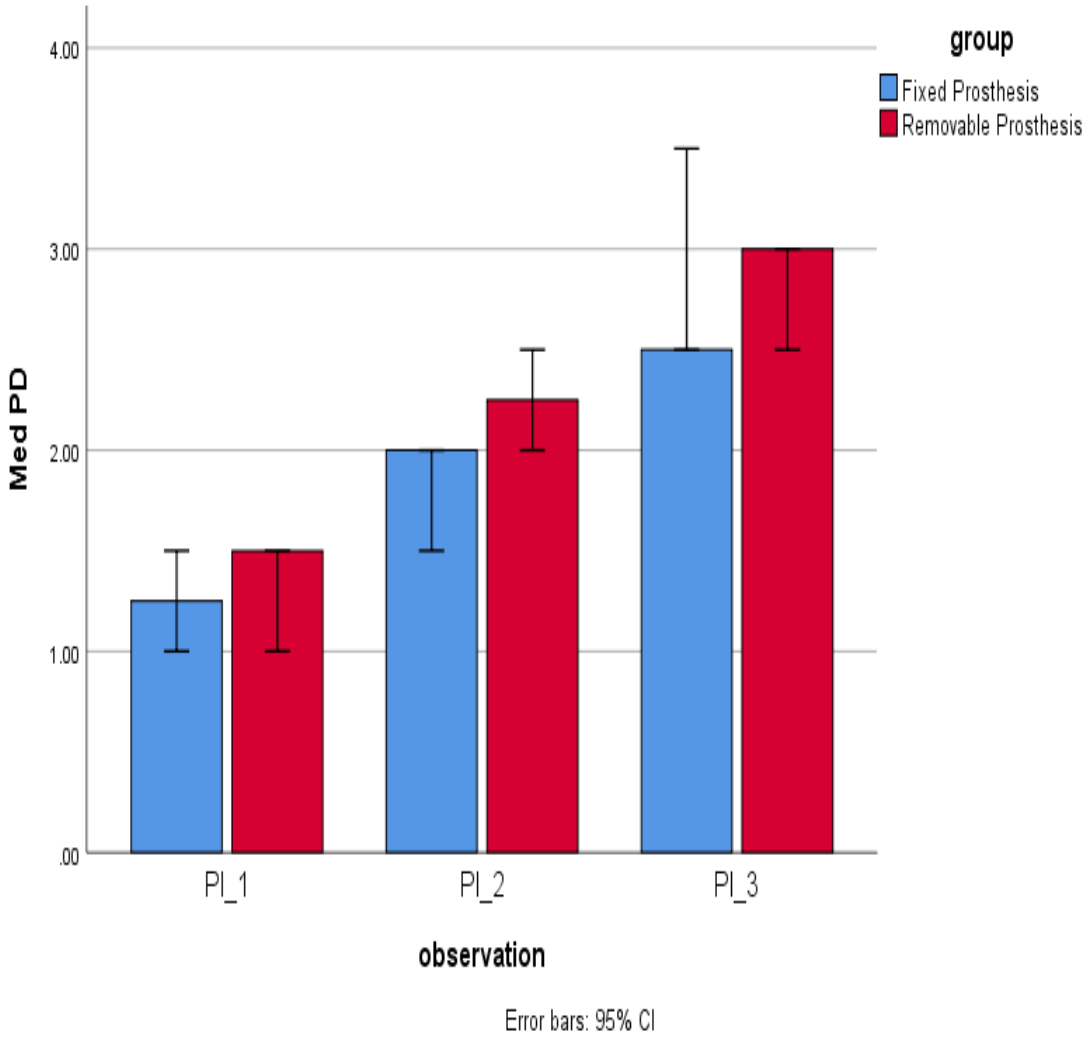

Fig 7. Median of PD between groups at different observation times.

DISCUSSION:

This study concerned about a new proposal for rehabilitation of mandibular long span Kennedy class I patients using a distally tilted implant. Regarding the clinical and radiographic outcomes. This new proposal for rehabilitation may be a viable treatment option but still requiring further follow-up evaluation to validate its use in implant dentistry.

Plaque scores and gingival scores significantly increased with advance of time for fixed group (p=.002) and removable group (p<.001) corresponding to low levels of oral hygiene habits. The causal relation between plaque and gingivitis was previously explored: Pontoriero et al.[21] explored the conditions of an experimental gingivitis model in their study of 20 partially edentulous patients who were treated with implants and subsequently refrained from oral hygiene for a period of 3 weeks. The authors observed an increase in mucositis severity, including inflammation of the soft tissues and an increase of ±1 mm in peri-implant pockets.

Pocket depth significantly increased with advance of time for fixed group (p<.001) and removable group (p<.001). With no significant difference between groups and highest median pocket depth score was for the removable group at T2 with score of 3 which still in the normal probing depth around implants. Bra¨gger et al.[22] defined 'peri-implantitis' as sites with probing pocket depth more than 5 mm.

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