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Relaxed Implant Bed in Immediately Loaded Maxillary Kennedy Class IV Implant Supported Overdenture: Split-Mouth Clinical Study

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Abstract **Aim:** The contemporary research planned to assess the outcomes of implant placement after 2 weeks relaxing of the surgical beds in immediately loaded maxillary implant-supported Kennedy Class IV overdenture with minimally invasive approach. **Materials and Methods:** 10 patients with missing four or six maxillary anterior teeth opposed by restored or natural dentition were selected. Permitting the strategy of splitting mouth, within the same individual, left side is designated as treatment group (I), and the right serves as the control (II). For Group I (Study group), mucoperiosteal flaps were reflected and drillings were done using 2- and 3.5-mm diameter drills successively to the proper depth marked on the drill (10mm). Profuse irrigation and frequent cleaning of the drills were performed. The mucoperiosteal flaps were repositioned and sutured over the empty hole. After two weeks from the osteotomy, punch technique with 4.0mm diameter tissue punches was applied to expose the previously prepared implant bed of the left side and implants were inserted in place. For group II (control group), Flaps were reflected at the maxillary right side, implant beds were prepared, and implants were inserted immediately. The implants and the abutments in both sides were ready in this stage to be loaded immediately with the denture. 2mm-high locators were chosen, screwed on the implants. Maxillary removable partial overdentures were then evaluated and adjusted to pick up the metal housing using autopolymerizing polymethylmethacrylate. Finally, dentures were inserted, and patients were educated and motivated about the importance of oral hygiene. Assessments were done regarding the clinical assessment of soft tissues, implants' mobility, patient satisfaction and radiographic assessments were done directly after implant drilling, and insertion, and after one, three, six and nine months, to assess marginal bone loss. Statistical analysis of the results were done using Wilcoxin-Signed Rank test. **Results:** Results showed that soft tissue healing was better for group I rather than for group II throughout the whole follow up periods. A 100% success rate throughout the follow up periods with no signs of movement in the implants for all patients in both groups is a strong indicator of the success and stability of the dental implant procedures. 100% of patients had good scores regarding retention of the prosthesis, 83% good score regarding stability and comfort, and 66% good score regarding ability to chew food. No poor score was reported. While there may not have been immediate differences in marginal bone loss in both groups after one month, distinctions became apparent over a longer follow-up period after three, six, and nine months, with increased bone loss in control group throughout these evaluation periods. **Conclusion:** The use of implant-retained overdenture in long class IV Kennedy classification cases is considered an accepted treatment modality for immediate function and esthetics. The recommendation to delay implant placement for two weeks after early osteotomy and to use a tissue punch emphasize optimal outcomes, ensuring proper bone healing, and minimizing trauma for a more controlled and aesthetically pleasing result.

Keywords: *immediately loaded implants, relaxed tissue beds, long span Kennedy class IV*

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1. Introduction

Partially edentulous cases with long anterior edentulous area represent a challenging problem facing prosthodontists. Restoring such cases requires both esthetic and biomechanical consideration; so many options of replacement are available including removable or fixed prosthesis. Factors that can be considered in the selection of the most appropriate restoration for each patient include: the length of the edentulous span, height and width of the residual ridge, arch from, angle's occlusal classification, esthetic demands, and financial limitations [1].

One of the most important indications for use of overdenture is that of providing support for long anterior denture bases, although RPOD restore most oral function such as mastication, phonation, and esthetics. The use of metal clasps in this design often compromise esthetics, especially when abutment teeth for clasps are anterior teeth [2].

As technology and techniques in implant dentistry continue to advance, the range of options for tooth replacement is likely to expand even further. Individualized treatment plans, considering factors such as bone health, esthetics, and patient preferences, play a crucial role in achieving successful outcomes in dental implant procedures.

The multidimensional nature of dental implant success, involving considerations of patient factors, surgical techniques, and advancements in implant surface modifications. The principles of dental implant rehabilitation has been changed from just concentrating on function to achieve long-term aesthetic outcomes [3,4,5]. The immediately loaded implants success rate is comparable to that of delayed loading, leading to increased clinical interest in immediate loading [6,7]. Several aspects guide success rate of immediate loading, involving selection of patients, quality of bone, design, length and surface treatment of implant, operating expertise, and the use of a traumatic surgical techniques. These considerations emphasize the significance of thorough planning and customization of treatment based on individual patient characteristics. The implant surface modifications are accomplished via sandblasting or acid etching, to foster osseointegration, offering a quicker and adequate secondary stability for successful loading [8,9].

The "restoration-driven implant placement" concept is a valuable attitude in contemporary implant dentistry, highlighting the association of implant placement with the future planned prosthesis. It corresponds to a strategic approach that combines the final prosthesis planning with surgical technique [10].

Although immediate loading improves patient satisfaction by decreasing the overall treatment time, the decision to apply this approach should be centered on careful consideration of individual patient factors, bone quality, and other relevant criteria [8]. Reduced heat generation during implant placement through water coolant, minimizing drilling time, and utilizing low speed cutting, is an important factor for ideal enhanced healing, improve implant placement protocols. Successful healing process is achieved by allowing early granulation tissue formation of, instant bone formation, and the blending of new and old bone [6]. The main objective of exercising an a traumatic technique is to control heat generation that can lead to cell death in bone tissue through the use of gradual drilling with profuse coolant and decrease the drilling speed [11]. Prolonged exposure to high temperatures can lead to thermal bone osteonecrosis. Mechanical trauma is correlated to excessive force or improper drilling techniques during implant placement and may cause microfractures in the bone. Mechanical trauma cause the formation of fibrous or granulation tissue capsule that negatively impact bone healing [12]. The drilling speed and bone strain levels are crucial to optimize biomechanical considerations to improve bone healing and increase the longevity of dental. The levels of bone strain during implant loading affect the bone formation type, i.e. higher strain levels lead to pathological conditions, including fibrous tissue formation [13,14].

Soft tissue managements, particularly in cases with multiple implants, are significant considerations affecting overall treatment success. Improper soft tissue handling may negatively impact both cosmetic and functional outcomes. Procedures that spotlight on soft tissue health preservation, reduce trauma, and promote optimal healing are critical for succeeding the required aesthetic and functional outcomes [15].

A two weeks waiting period after osteotomy optimize tissue healing and enhance osseointegration through neoangiogenesis and development of collagen fibers in the healed surgical sites. Collagen provides structural support and plays a key role in wound healing and tissue remodeling. Neoangiogenesis refers to the establishment of fresh blood vessels that transmit nutrients and oxygen to the healing tissues [16,17,18].

Retention between implants and partial overdenture is obtained from the attachment (retentive mechanisms) between them. Several types, including the ball/O-ring, bar/clip, magnets, or locator attachments are available. There are specific consideration when selecting attachments in implant overdenture, including the condition of supporting ridge, opposing arch, strength of bite and the number and position of implant [19].

The importance of achieving a balance between functionality, aesthetics, and comfort in denture design is well emphasized. Properly positioned and well-designed retentive mechanisms contribute to the overall success of denture treatment, providing patients with a comfortable and natural-looking prosthesis. The retentive mechanism should ideally be placed in such a way that it could not be observed through the denture base. Ensuring that the retentive elements do not disrupt the overall alignment and arrangement of the denture components is crucial for functionality and comfort. Excessive enlargement could impact the overall size and fit of the denture, potentially leading to discomfort and compromised functionality [20].

The Locator system seems to offer a versatile and durable solution for dental implant applications, particularly in cases where space is limited, or implants are not perfectly aligned. The rotational movement capability and self-locating design enhance patient convenience and overall performance. Additionally, its compatibility with various implant systems makes it a flexible choice for clinicians. Its self-locating design allows easy overdenture seating without precise alignment and represents an easy solutions for divergence up to 40^{0}.

Also, it requires only one tool with three functions for all clinical and laboratory sequences.it is Compatible with a high number of implant systems. The transmucosal height of the abutment varies based on the implant system. It represents biomechanically favorable conditions if the height is chosen precisely. Its dual internal and external retention permit long-lasting performance. It has in vitro durability of 60,000 cycles of insertion-disinfection without alteration. Non-rigid connection allows rotational movement, absorbing forces without loss of retention [21,22].

The current research aimed to assess the impact of immediate loading of maxillary implants supporting Kennedy Class IV overdentures, with a particular emphasis on a newer placement modality involving implant placement delayed for two weeks after osteotomy. The study likely seeks to contribute insights into the feasibility and success of this approach for improving patient outcomes in such cases.

2. Materials and Methods

10 maxillary Kennedy Class IV partially edentulous patients with missing four to six anterior teeth opposed by restored or natural dentition were chosen for the current research from the University Dental Hospital, at the dental college of Taif University. Their ages were 40-60 years. Exclusion criteria was any systemic disease that might affect the healing process or complicate surgical procedures. This ensures that the study focuses on a relatively homogeneous group of individuals without additional health complications. Screening tests for homeostasis, blood glucose level, assessing blood pressure and panoramic radiographs were accomplished for all patients preoperatively. All patients received new maxillary metallic removable partial dentures Figure 1 using the conventional methods where primary upper and lower impressions were recorded using alginate impression material[1] which were then poured to produce study casts that were surveyed and used to fabricate special acrylic trays. Peripheral molding using green stick compound[2] and final impression were made using light body additional silicone[3]. Pouring and duplication of master stone casts were done, and metal frameworks were then fabricated and checked for any modifications and functional impressions were recorded using the altered cast techniques. After that record blocks were constructed and jaw relations were recorded, and casts were mounted on semi-adjustable articulator[4] using face bow transfer[5]. Setting of artificial teeth and the trial dentures were tried in for any adjustment. Dentures were then flasked, processed, finished, and inserted in the patient's mouth. Clinical remounting procedures and recall appointments to correct any minor errors were done. Transparent surgical splints were also be constructed. Diagnostic wax-up of the future prosthesis were constructed on the duplicated cast, and tried on patient mouth Figure 2.

Permitting the strategy of splitting mouth, within the same individual, left side is designated as treatment group (I), and the right serves as the control (II). For Group I (Study group). The stent were placed to determine the area to be included in the flap. Mesiodistal incisions were made, in the maxillary left canine or incisors areas, according to missing teeth using blade # 15, through the attached gingiva and the mucoperiosteum. Two vertical incisions were done and extended to the depth of the buccal sulcus. Periosteal elevators were used to dissect the flap as close to bone as possible to avoid damaging the periosteum and reflect the mucoperiosteal flaps. Low speed, high torque and internally and externally irrigated hand pieces were utilized to drill the implant beds. The stents were seated on the alveolar ridge and the locator drills were used to identify drilling position throughout surgical stents. The stents were then removed, and the locator drills were used to penetrate the alveolar crest and establish the proper location and angulation of the implant. The implant sites were enlarged successively to the proper depth marked on the drill (10mm). Profuse irrigation and frequent cleaning of the drills were performed. The drilling motions were always done in an up and down motion to prevent over-sizing of the implant bed and to allow irrigation solution to reach the full hole depth Figure 3. The mucoperiosteal flaps were repositioned and sutured over the empty hole using # 4-0 braided absorbable sutures. The day after the operation, Patients were examined to assess post-operation complications, as well as extent of any edema or hematoma. The operation site was checked for any flap defect or cut sutures. On the seventh day of the operation, the area was cleaned by using 1.5% hydrogen peroxide solution in saline. The operation site was again checked, and all sutures were removed. After two weeks from the osteotomy, tissue punches were utilized to punch the formerly drilled implant bed Figure 4. The stents were seated in place and the area to be punched was marked by bleeding points induced by straight probes through the stent hole. Tissue punches[6] of 4.0 mm diameter were used to dissect the gingival tissue covering the implant bed from the surrounding tissues. Then, tissue forceps were applied to remove this part. Curettage was done in the site and profuse irrigation with saline had taken place. Regular neck tissue level implants[7] mounted on the vial cap was inserted in place by using the vial cap until resistance was felt. Then wrench system was applied to complete seating of the implant in place.

Figure 1. Conventional metallic RPD were inserted in the patient mouth

1 Kromalgin, Vannini Dental Industry, Italy.

2 MAARC Green Tracing Sticks, IndiaMART InterMESH Ltd.Uttar Pradesh, India.

3 Variotime®Light Flow Refill, Kulzer GmbH, Leipziger Straße 263450 Hanau, Germany.

4 A7 Plus C.S.A Articulator, CORIDENT,Chimsan-dong, Buk-gu Daegu, South Korea

5Artex® Facebow, Jensen Dental. North Haven, USA.

6 Tissue punch, IMTEC Co. Ardmore, Oklahoma, USA.

7 Institut Straumann AG. Basel, Switzerland

(a)

(b)

Figure 2. Diagnostic wax-up of the future prosthesis (a) on duplicated cast,(b) tried on patient mouth

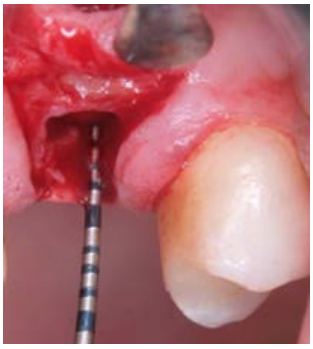

Figure 3. Surgical implant bed in study group

Figure 4. Tissue punch used to expose the implant bed 2 weeks after initial drilling

For group II (control group), Flaps were reflected at the maxillary right side, implant beds were prepared, and implants were inserted immediately Figure 4 using the vial cap then the wrench system. The healing abutments were then located and screwed over the implant. The mucoperiosteal flaps then repositioned and sutured over the implant using # 4-0 braided absorbable sutures and the same postoperative instruction were followed. The day after the operation, patients were examined to assess post-operation complications, as well as extent of any edema or hematoma. The operation site was checked for any flap defect or cut sutures. On the seventh day of the operation, the area was cleaned by using 1.5% hydrogen peroxide solution in saline. The operation site was again checked, and all sutures were removed. The surgical sites were then checked after removal of healing abutments. The implants and the abutments were ready in this stage to be loaded immediately with the denture. 2-mm-high locator abutments [8] Figure 6 were selected, screwed using a universal hexangular driver[9] and torque wrench[10]. White blockout spacer[11]were then positioned on the abutments to create space and prevent material from flowing into the gingival tissues. After that, snap black processing inserts inside the matrices over the locator abutment. Pressure indicating pastes were used to indicate the areas to be relieved in the maxillary removable partial dentures. The dentures were relieved to pick up the metal housing using autopolymerizing polymethylmethacrylate. To avoid resin irritation, Vaseline [12] was smeared on the lips, teeth and edentulous ridge mucosa contiguous to the implants. Acrylic resin[13] were mixed and applied on the attachments and into the relieved Maxillary RPD by a micro brush. The prostheses were placed over the abutments and instruct patients to occlude into centric occlusion till polymerization of acrylic resin. The prostheses were then checked for excess acrylic resin. The black processing inserts were replaced by the gray (zero) retention inserts and finally, overdentures were inserted in place Figure 7 and post insertion instructions and oral hygiene measures were given to the patients.

(a)

(b)

Figure 5. Implants were inserted immediately in control group. (a) Reflected flap (b) sutured flap

8 locators R-Tx abutments, Zest Dental Solutions, Loker Avenue East, Carlsbad, CA, USA.

9 Zest Dental Solutions, CA, USA.

10 Zest Dental Solutions, CA, USA.

11Zest Dental Solutions, CA, USA.

12 Vaseline; Unilever, Unilever House. Victoria Embankment, London, United Kingdom

13 Eco-cryl cold. Protechno, Girona, Spain.

Figure 6. Locator abutments screwed over the implants

Figure 7. Final Implant-supported overdentures inserted in patient's mouth

3. Methods of Evaluation

Clinical assessment of soft tissue: For group I, soft tissue healing was assessed immediately after first stage surgery, after 7 days and after 14 days. For group II, soft tissue healing was assessed immediately after surgery, after 7 days and after 14 days. The assessment was performed based on El-Sharkawy standards [23] that involve dehiscence of incision lines, Shedding of the surgical site, and Irritation. The bench mark of evaluation were classified into: zero = No inflammation or infection, no dehiscence, and no sloughing (i.e. Excellent healing)**,** 1 =Mild inflammation or infection, mild dehiscence and sloughing (Minor redness at only one suture area), 2 =Moderate inflammation or infection, moderate dehiscence and sloughing (reasonable redness, swelling and edema at two to four suture areas), 3 = Severe inflammation or infection, severe dehiscence and sloughing (more inflammation, and edema at above four stitch spots).

Mobility Clinical assessments: According to Smith and Zarb [24], osseointegration of the implants was determined clinically by evaluating implant stability through implant bimanual manipulation in two directions. Clinically implant mobility was divided into two grades: 0 = No mobility and 1 = Mobility noted. The evaluation was carried out closely to implant insertion, and after one, three, six and nine months intervals from implant placement.

Subjective assessment

The modified Cornell Medical Index [25] was used to assess the patient satisfaction with the prosthesis regarding both left and right sides (both groups) for their ability to chew food, Stability, Retention and Comfort. This was scored into:1 = poor, 2 = Fair and 3 = Good.

Radiographic assessment

Digital periapical radiographs were used to assess marginal bone loss in both groups immediately after drilling, implant placement, one, three, six and nine months. Long cone x-ray unit[14] was used. Dental x-ray unit operating at 70 K.V and 6 M.A with a focal film distance of 35 cm was used with standard size films[15] (3.2 x 4.1 cm). Amount of bone loss on the were estimated using special system software[16] described by El Attar et al [16]. Statistical analysis of the results were carried out using Wilcoxin-Signed Rank test.

4. Results

Clinical evaluation: Soft tissue healing results were better in study group rather than for control group. For group I, 85% of patients had excellent healing and 15% of patients had slight redness, while for group II, 65% of patients had excellent healing and 35% of patients had slight redness immediately after implant placement and loading. After 7 days, for group I, 85% of patients had excellent healing and 15% of patients had slight redness, while for group II, 85% of patients had slight redness and 15% of patients had more redness, swelling and oedema. After 14 days, for group I, 100% of patients had excellent healing, while for group II, 65% of patients had excellent healing and 35% of patients had slight redness. Figure 8, Figure 9)

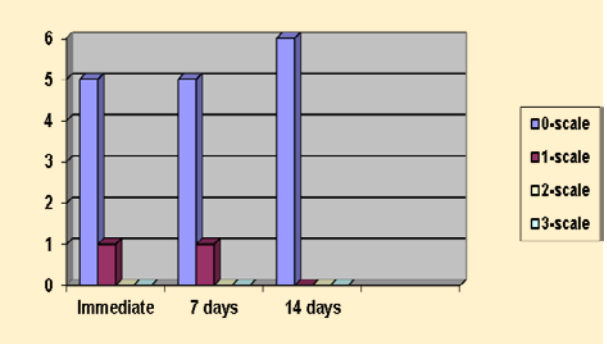

Figure 8. Soft tissue healing scales in study group throughout follow up periods

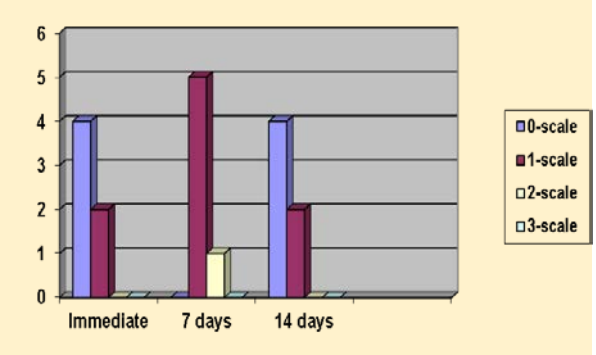

Figure 9. Soft tissue healing scales in control group throughout follow up periods

14 Dentotime, Siemens Co, Munich, Germany.

15Ecta speed Kodak films. kodac compony, Rochester, NY 14650 USA

16 Image J 1.27 April 2002. WWW.rsb.inf.nih.gov US.

Results of implant mobility: No implant showed any sign of mobility with 100% success rate throughout the follow up periods in both study and control groups.

Subjective assessment: Results showed 100% good score regarding retention of the prosthesis, 85% good score regarding stability and comfort, and 75% good score regarding ability to chew food. No poor score was reported Figure 10.

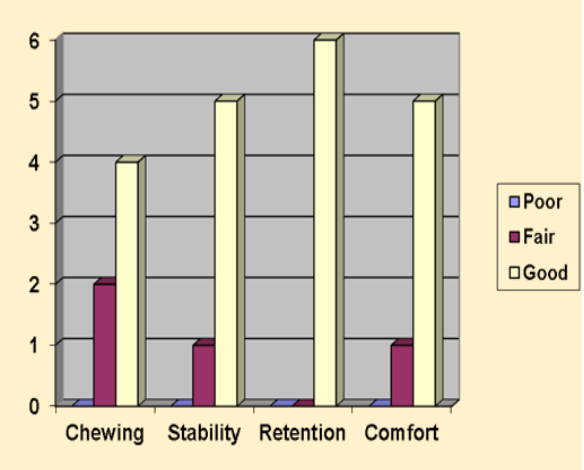

Figure 10. Patient Satisfaction scales

Results of radiographic evaluation: Implants bone heights on the mesial and distal aspects in both groups were measured and statistically analyzed.

Table 1. Shows mean bone level changes and standard deviation around implants of both groups

Group	n		LT	One month	Three months	Six months	Nine months
Study group (I)	5	Mean	10.91	10.87	10.82	10.76	10.70
		SD	0.0121	0.0121	0.0121	0.0163	0.0105
		Mean difference		0.04	0.08	0.13	0.17
		SD		0.0141	0.0155	0.0179	0.0160
Control group (II)	5	Mean	10.91	10.87	10.78	10.72	10.65
		SD	0.0082	0.0082	0.0105	0.0117	0.0105
		Mean difference		0.05	0.13	0.18	0.22
		SD		0.0103	0.0141	0.0151	0.0110
Wilcoxin Signed Rank Test				0.98	3.95	5.4	5.6
P-value				.18652	.00008*	.00032*	.00003*

* Significant at P<0.05, LT: Loading time, n: number of cases.

The mean difference from LT-1 month was 0.04 (SD=0.0141) for group I and 0.05 (SD=0.0103) for group II. Nonsignificant differences disclosed in both control and study groups concerning bone heights around implants. The mean difference from LT-3 months was 0.08 (SD=0.0155) for group I and 0.13 (SD=0.0141) for group II. From LT-6 months, the mean difference was 0.13 (SD=0.0179) for group I and 0.18 (SD=0.0151) for group II. From LT-9 months the mean difference was 0.17 (SD=0.0160) for group I and 0.22 (SD=0.0110) for group II. Statistical analysis using Wilcoxin rank test disclosed that there were significant difference of bone heights after3,6,and 9 months after immediate loading (P<0.05) and bone loss around the control group implants were higher than that of the study group at the specified evaluation intervals.

5. Discussion

The length of the span, esthetics and other biomechanical problems represent serious prosthodontic challenges during the management of Kennedy Class IV. Traditionally, replacing the missing teeth was between fixed or removable partial dentures that may exhibit many problems such as stability and retention of the denture. The implant supported removable partial overdenture is the treatment of choice especially in the patient with maxillary denture esthetic problems in anterior long edentulous saddle.

In this study ten partially edentulous patients were selected, with missing upper four or six anterior teeth that considered as long Kennedy Class IV, their age ranging from 40-60 years to avoid variation in bone density [26]. Patients with systemic diseases that disturb bone metabolism or have any endocrine dysfunction or nutritional disturbances that could complicate the implant treatment were excluded. Patients with bad habits as bruxism, clenching, tongue thrusting or abnormal ridge relationship (Angle's II&III) were excluded to avoid any abnormal excessive force that may lead to ridge resorption or implant bone loss [27]. Co-operation and interest of the selected patients were important in this study to accept and withstand long follow up period. Sufficient inter arch distance was important to provide enough space for attachment placement, and also enough buccolingual width and length of the alveolar ridge to permit sufficient thickness of bone around the implant [28]. The mandibular arches of included individuals were either dentulous or restored with fixed prosthesis to exclude effects of opposing occlusion [29].

The holistic approach needed in oral rehabilitation, taking into account not only the functional aspects of dental interventions but also their impact on a patient's psychological well-being and social interactions, especially when addressing missing teeth in visible areas of the mouth. It emphasizes the importance of timely and effective solutions to minimize the challenges associated with edentulous periods. Early and delayed implant failures can be affected by several factors such as bone quantity and quality, implant length, diameter, location, design and surface treatment, surgical technique and opposing occlusion and biomechanics [30]. After 2 weeks, highest bone loss occurs at the defect margins. This indicates a period of bone loss or remodeling in response to the surgical procedure or trauma. Following the initial resorption, new trabecular arrangement was recorded. Trabecular bone is a spongy type of bone with a lattice-like structure, and its formation is a part of the bone healing process. By the third week, the bone defect is in the process of repair with the rapid formation of new trabecular bone. This suggests that, at this point, the bone may offer a more relaxed and healed environment, ready to receive a dental implant fixture. Having a relaxed and healed environment is preferable for implantation compared to introducing an implant in a wounded and warmed bed. This preference is based on the idea that a more favorable healing environment contributes to the success of dental implant procedures [31,32].

While reflecting flaps is considered the standard attitude for placing implants, esthetic outcomes can be compromised. Flap reflection involves lifting the gum tissue to expose the underlying bone, this may affect cosmetic appearance. The punch technique is highlighted as providing rapid and complete improvement of soft tissue. This means that the gingival tissue around the implant looks and functions more naturally. The use of the punch technique is associated with minimal bleeding providing a cleaner surgical field and potentially reducing the risk of complications such as postoperative pain, edema, and tenderness. Overall, the punch technique is reported to result in improved esthetics and function of the gingival soft tissues surrounding implants. [15,31,32]. Gradual drilling techniques displayed excellent outcomes by increasing the drilling revolutions per minute (rpm) and decrease cutting force and specific energy and heat generation [11,13].

The implant-supported partial overdentures did not have a posterior extension or clasps. This design feature can contribute to a more discreet appearance and improved aesthetics. Implant-supported partial overdentures were well-accepted by patients due to their simple design, ease of use, and hygiene benefits. The features mentioned, such as easy removal, and cleaning absence of clasps, and limited tissue coverage, contributed to the overall positive patient experience with these overdentures.

The results of clinical assessments of soft tissue in the control side showed more inflammation than the study side particularly after 7 days which might be assigned to variations in the condition of gingival tissues surrounding implants at the loading time. The soft tissue at the study side had sufficient healing period before implant placement and loading. On the other hand, for the control side, the implants were placed immediately in the freshly prepared osteotomy site and loaded with the prosthesis while a full thickness mucoperiosteal flap was secured around the implant by sutures. These may be considered the factors that contributed to higher degree of inflammation in the control side. This was in agreement with Zunino, who reported that with the use of punch technique, no sutures were required and that no free gingiva would remain as a consequence of excessive undermining as seen in cases of incisions. He also reported that punch technique allowed achievement of rapid healing and attachment of gingiva around the implant's abutments, in addition, minimal bleeding was obtained [33].

Evaluation of implant mobility was carried out using a two-point scale, namely mobile or non-mobile, by Smith and Zarb who stated that the clinical mobility graded on a non-parametric scale and determined by the usual clinical method used in periodontics was adequate [24]. According to their scale, all implants in both sides did not show any signs of clinical mobility. This indicated that osseointegration was achieved and maintained during the evaluation period. Successful osseointegration of the implants was probably due to conservative surgical protocol, proper patient and implant selection which agreed with Hahn, and his documented factors which may influence the success of immediately loaded implants [34].

All patients showed equal results in both sides regarding chewing ability, retention, and stability of the prostheses. This was in agreement with Salloum who reported that implant-supported prostheses improve function, and ability to eat and speak, therefore, enhance the psychological behavior of the patient. Also, such prostheses do not require extensions that interfere with muscle action [35].

Regarding bone level changes around the implants, the research reported significant variations among the two sides from the 3rd. month and subsequent evaluation intervals. The study side showed less bone resorption around the implants than the control side. This may be attributed to the proper timing of implant placement, two weeks after osteotomy preparation which allowed revascularization, and formation of collagen fibers around implant, and also attributed to the use of conservative approach. This was in agreement with Perrone that suggested the formation of new fresh trabecular bone at the defect margins to enhance repair process [36]. So, implants were inserted in vital bone. This agreed with Misch et al who concluded that reducing the surgical trauma at implant placement time will reduce the danger of occlusion strains and this could be accomplished by procurement of more newly vital bone at the bone implant interface [14]. On the other hand, as for the control side, the increase in bone resorption may be attributed to the presence of a non-vital zone of bone in response to the surgical trauma, despite taking all the possible measures to avoid it. This was in agreement with Roberts who described a 1mm or more non-vital region of bone surrounding around the implant [37] and Eriksson et al who described that surgical trauma either thermal or mechanical can cause microfractures of bone or osteonecrosis [12].

6. Conclusion

The use of implant-retained overdenture in long class IV Kennedy classification cases is considered an accepted treatment modality for immediate function and esthetics. Delaying implant placement by two weeks after early osteotomy results in better outcomes. Allowing for primary healing of the bone before implant placement can contribute to improved results, indicating the significance of proper bone healing in the success of dental implant procedures. Additionally, the use of a tissue punch is highlighted as a positive step for creating a precise opening in the soft tissue, minimizing trauma and facilitating a more controlled and aesthetically pleasing outcome.

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