Original Article

A Clinical Study to Compare the Immediate and Delayed Loading of Implants with Flapless Technique: An Institutional Based Prospective Study

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Abstract

Background: Dental implant therapy is an exceptionally reliable and efficient way to replace missing teeth. Flapless or minimally invasive surgery allows surgeons to install implants more quickly, without the need for big flaps, and with less blood and discomfort for the patient. The research aims to evaluate the flapless technique with both immediate and delayed implant loading. **Material and Methods:** Thirty partially edentulous patients over the age of eighteen who visited the department of oral maxillofacial surgery at Jaipur Dental College in Jaipur, Rajasthan, India, over the course of a year and who wanted to replace missing teeth were chosen for the study after meeting the sampling requirements. Thirty patients were randomly assigned to two groups, each with 15 patients. Test Group I involved loading the implant immediately (within 48 hours) following fixture installation, while Test Group II involved loading the implant conventionally (within 3 months) following fixture placement. Friedman's test was used to compare the mean radiographic bone loss for both Group I and Group II on the mesial and distal sides at various intervals (baseline, 1, 3, and 6 months). **Results:** The mean radiographic bone loss (mesial) among Group I patients varied significantly ($P < 0.05$) from baseline (mean: 0.00) to 1 month (mean: 0.93), 3 months (mean: 1.39), and 6 months (mean: 1.64). Comparing baseline (mean: 0.00) to 1 month (mean: 1.02), 3 months (mean: 1.07), and 6 months (mean: 1.28), Group II patients also showed a significant ($P < 0.05$) difference in mean radiographic bone loss (mesial). When comparing the mean radiographic bone loss (distal side) between Group I (immediate loading) and Group II (delayed loading) at baseline, one month, three months, and six months, Friedman's test revealed a significant ($P < 0.05$) difference. **Conclusion:** Crestal bone loss in the immediate and delayed loading regimens did not differ statistically significantly. Patients may benefit from immediately loaded implants after satisfactory primary stability has been achieved, as they shorten the duration of edentulism.

Keywords: Immediate Implants, Delayed Implants, Mesial Bone Loss, Distal Bone Loss.

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Introduction

To sustain a single prosthetic tooth, dental implants—which are typically composed of alloplastic materials—may be surgically inserted into or put onto the jawbone. They may serve as attractive replacements for lost teeth or as abutments. It has been demonstrated that dental implant therapy is an exceptionally effective and reliable treatment option for replacing lost teeth.

With flapless or minimally invasive surgery, doctors may place implants faster, without large flaps, and with less haemorrhage and pain for the patient afterward. Remedy has used invasive but minimal techniques for orthopedic, abdominal, prostate, and other surgical operations. Minimally invasive surgical methods lessen discomfort and blood loss.[1]

The positive outcomes of on-the-spot loaded (IL) implants enabled physicians to expand the field of implant dentistry, enhancing functional and cosmetic outcomes through osseointegration. By using IL implants and a one-stage surgical procedure, patients can receive treatment more quickly and with less surgical intervention, thereby greatly improving their comfort, satisfaction, and overall well-being. Using IL implants in edentulous mandibles, Francetti et al. verified excessive bone-to-implant connections ranging from 78 to 85%.[2] When Chiapasco et al. evaluated the effects of IL with implant DL, they found no discernible difference between the two groups, indicating that IL is not detrimental to osseointegration.[3] Traditionally, osseointegrated dental implants have been positioned using a two-step procedure.[4] For three to four months in the mandibles and six to eight months in the maxillae, implants were immersed and allowed to recover. Higher failure rates have been linked to early attempts to load the

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implant. This meant that patients frequently had to wear less-than-ideal temporary prostheses and had to wait an exceptionally long period until the prosthetic implantation was delivered. The first study that suggested osseointegrated implants might be inserted early or immediately in the mandibles of some individuals was published in 1990.[5]

The present trend is increasingly focused on improving patient comfort and happiness as well as patient aesthetics due to the development of dental implant therapies. In the two-stage implant placement process, Van der Zee found postsurgical tissue loss after flap reflection. This suggests that flap surgery for implant placement may have a detrimental impact on implant esthetic results, particularly in the maxillary anterior area.[6] According to William et al., implants placed without flap reflection show clinically significant osseointegration and stay stable, much like implants implanted with flapped techniques.[1] The study's objective is to assess the flapless approach with immediate and delayed implant loading.

Materials and Methods

Thirty partially edentulous patients aged 18 or older who sought to replace missing teeth and visited the Jaipur Dental College's Department of Oral Maxillofacial Surgery in Jaipur, Rajasthan, India, within a year were selected for the study after meeting the sampling requirements. Partially edentulous patients with fully healed alveolar sockets, sufficient bone volume (buccolingual and mesiodistal widths of at least 4 and 5 mm), appropriate bone quality for implantation, and ideal periodontal health in the remaining dentition were among the selection criteria. Patients were excluded from the study if they smoked, had insufficient interarch space to accommodate the required restorative component, were on bisphosphonate therapy, had parafunctional habits, had any known systemic diseases or conditions, or were taking medications known to interfere with minor surgical procedures or wound healing.

Thirty patients were randomly split into two groups, each with 15 patients.

Test Group I: Implant loading within 48 hours after fixture insertion

Test Group II involves the implant's delayed/conventional loading (CL) three months after the fixture is placed.

Complete hemograms, casts (study and working model), ridge mapping, pictures, and standardised periapical radiographs with a millimetre grid (X-ray mesh) were all part of the thorough investigation. The diameter and length of the implants were determined using study casts, clinical evaluations, and radiographic (orthopantomogram) assessments of the accessible bone.

For correct implant placement, a surgical stent made of self-cure acrylic resin (DPI RR Cold Cure, DPI, Mumbai) was created in each instance. Every patient was informed about the study's methodology and provided their consent to participate.

Implant Placement Surgically

One day before implant surgery, patients were kept on oral antibiotics. Crestal incisions were made on the edentulous location using a no. 15 blade once sufficient local anaesthetic had been achieved. The crestal incision reached the neighbouring tooth's mid-lingual and mid-buccal fissures. A periosteal elevator was used to raise a full thickness mucoperiosteal flap. After inserting the surgical template, its correct placement was verified. A succession of drills was used to accurately and gradually prepare the implant osteotomy site in accordance with the manufacturer's instructions, site requirements, and extensive irrigation. The revolutions per minute (1000–1500 rpm) that Branemark advised were used for bone drilling. Using a depth gauge, paralleling pins, and intraoperative radiographs, the depth and angulation were continually assessed. The following drills were used for final osteotomy preparation and could accept the fixture dimensions once the osteotomy's depth and angulation were verified. To make sure that no bone fragments or debris remained at the base or affixed to the vertical walls of the osteotomy site, the implant site was carefully rinsed with sterile saline after preparation.

Threaded root-form implants were used in this experiment. A torque-controlled wrench was used to position the implant body or fixture. A 3-0 braided silk suture was used to correct the flap margins and secure them without strain. Intraoral periapical (IOPA) radiographs were acquired to ascertain the first crestal bone level post-implantation. The postoperative regimen was explained to the patient both orally and in writing. To mitigate postoperative pain and oedema, they were directed to provide antibiotics and analgesics for an extra three-day post-surgery and to do rinses with 0.2% chlorhexidine gluconate bi-daily.

Radiographic Evaluation and Follow-Up

Every implant location for the chosen patients had an IOPA radiograph obtained. A lead grid with a 1-mm2 grid pattern was attached to the sensor to account for magnification and picture distortion problems. The typical long-cone paralleling method with a film-positioning mechanism was used to standardise the radiographs. For radiographic examination, follow-up was planned at 1, 3, and 6 months, with the initial restoration on the implants serving as the baseline. On a millimeter scale, the distance between the initial point of bone-to-implant contact and the edges of the implant abutment junction was measured.

Analysis of Statistics

Friedman's test was used to compare the mean radiographic bone loss for both Group I and Group II on the mesial and distal sides at various intervals (baseline, 1, 3, and 6 months).

Results

At baseline, one month, three months, and six months, the Friedman test was used to evaluate the mean radiographic bone loss (mesial side) between Group I (immediate loading) and Group II (delayed loading) participants. Patients in Group I showed a statistically significant ($P < 0.05$) difference in mean mesial radiographic bone loss between baseline (mean: 0.00) and 1 month (mean: 0.93), 3 months (mean: 1.39), and 6 months (mean: 1.64). Group II patients showed a statistically significant ($P < 0.05$) difference in mean radiographic bone loss (mesial) between baseline (mean: 0.00) and assessments at 1 month (mean: 1.02), 3 months (mean: 1.07), and 6 months (mean: 1.28). However, there was no statistically significant difference ($P > 0.05$) between one month and three months, or between three months and six months [Table 1 and 2].

When comparing the mean radiographic bone loss (distal side) at baseline (mean: 0.00) to one month (mean: 1.03), three months (mean: 1.52), and six months (mean: 1.50), Friedman's test revealed a significant difference ($P < 0.05$) between Group I (immediate loading) and Group II (delayed loading). However, when comparing one month, three months, and six months among Group I patients, there was no significant difference ($P > 0.05$). With baseline averages of 0.00, 1.12 at one month, 1.07 at three months, and 1.02 at six months, patients in Group II had comparable results [Table 3 and 4].

Table 1: Comparison of mean radiographic bone loss at different interval in group I in mesial side

Radiographic bone loss mesial	Group I (immediate)				P-value
	Mean	SD	Mean rank	Critical value	
Baseline	0.00	0.00	1.24	21.936	<0.001*
At 1 month	0.93	1.12	2.18		
At 3 months	1.39	0.92	3.03		
At 6 months	1.64	0.70	3.38		

Table 2: Comparison of mean radiographic bone loss at different interval in group II in mesial side

Radiographic bone loss mesial	Group II (delayed)				P-value
	Mean	SD	Mean rank	Critical value	
Baseline	0.00	0.00	1.04	22.807	<0.001*
At 1 month	1.02	0.56	2.89		
At 3 months	1.07	0.59	3.12		
At 6 months	1.28	0.52	2.97		

Table 3: Comparison of mean radiographic bone loss at different interval in group I in distal side

Radiographic bone loss distal	Group I (immediate)				P-value
	Mean	SD	Mean rank	Critical value	
Baseline	0.00	0.00	1.17	22.428	<0.001*
At 1 month	1.03	0.82	2.43		
At 3 months	1.52	0.72	3.17		
At 6 months	1.50	0.82	3.24		

Table 4: Comparison of mean radiographic bone loss at different interval in group II in distal side

Radiographic bone loss distal	Group I (delayed)				P-value
	Mean	SD	Mean rank	Critical value	
Baseline	0.00	0.00	1.97	20.846	<0.001*
At 1 month	1.12	0.85	2.68		
At 3 months	1.07	0.66	2.83		
At 6 months	1.02	0.65	2.75		

Discussion

Implant dentistry has advanced to the point where a high implant survival rate, attained by the CL method alone, is insufficient to satisfy patients and healthcare professionals. Patients are less inclined to accept implant treatment if an extended period of osseointegration is required prior to the placement of the repair. The restoration of phonetics, mastication, and aesthetics with implants requires an extended duration. Consequently, several loading regimens have been established and classified into three distinct groups: immediate (laden at the time of implant placement or within 48 hours thereafter), early (loaded around 6 weeks later), and conventional (loaded at 3–6 months). The CL protocol seeks to preserve the implant within its native environment throughout the repair phase. It was thought that exerting pressure on the implant at this critical phase may induce micromovements at the implant-bone interface, potentially resulting in implant failure.10 There is now less time between implant implantation and functional loading due to advancements in surgical techniques, innovative implant designs, and surface configurations during the last several decades. Strategies like rapid and early loading of dental implants are gaining prevalence.

Patients who may have their treatment period significantly shortened and who can lead normal lives with little discomfort due to edentulism favor such treatments.

The results of the research showed that Group I demonstrated progressive bone resorption on the mesial and distal sides, as evidenced by a significant increase in mean radiographic bone loss from baseline at 1, 3, and 6 months.

The mean radiographic bone loss did not significantly change from one month to three months or from three months to six months, indicating that bone resorption stabilized after the first period. According to a 2013 recommendation by Guruprasada et al,[11] peri-implant bone loss may also have been induced by surgical stress and implant micromovement caused by the functional and nonfunctional pressures of the tongue and cheek when the implant was loaded immediately after insertion.

This might be explained by the fact that during the first month following loading, occlusal pressures to which implants are subjected trigger bone remodeling. A recent study indicates that mechanical strain induces osteoblasts to secrete osteoprotegerin, thereby enhancing bone formation and reducing osteoclastic activity as the duration of loading increases.[12] From baseline to 1, 3, and 6 months, Group II's mean radiographic bone loss on the mesial and distal sides increased significantly. This is consistent with a 2003 study by Cardaropoli et al., which shows that the majority of bone resorption after implant surgery occurs in the first weeks or months following implantation. Bone remodelling, which is highly active after 8 weeks of healing and shows different degrees of bone maturation, may be the cause of the lack of a discernible change in average radiographic bone loss from 1 month to 3 months or from 3 months to 6 months. Bone remodelling in CL reduces the initial bone loss during the surgical healing period. Additionally, by creating a biological barrier around the implant apex, the healing site is now shielded from microbial activity. Resorption and remodelling of the crestal bone occur after implantation and prosthetic attachment.[15]

At the time of second-stage surgery, the bone is thinner and weaker than it is 6 to 12 months after prosthetic loading. Weaved bone is weaker and less structured than lamellar bone, which is extra-mineralized and well-organised. Lamellar bone starts to develop several months after the woven bone repair has replaced the devitalised bone following surgical insertion trauma around the implant.

Conclusion

We concluded that the crestal bone loss from the immediate and delayed loading methods did not differ statistically significantly. Once sufficient primary stability has been achieved, patients may benefit from immediately loaded implants, which reduce the duration of edentulism.

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Conflicts of interest

There are no conflicts of interest.

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