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Original Research Article

Evaluation of crestal bone levels around rough surface basal implants after prosthetic loading in atrophied ridges - A clinico radiographic study

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Abstract

Background: Dental implant placement is a standard practice in implant dentistry. However, there are situations where traditional implant placement may not be feasible. Basal implantology—also referred to as bicortical, cortical, or strategic implantology—focuses on anchoring dental implants in the cortical regions of the jawbone. These areas are more resistant to bone loss and infections, making the technique a stable and reliable alternative

Aim: The aim of the study was to evaluate crestal bone levels around KOS rough surface basal implants after prosthetic loading in atrophied ridges.

Materials and Methods: The Study was conducted in the Department of Periodontology and Oral Implantology, I.T.S. Centre for Dental Studies and Research, Muradnagar, Ghaziabad. The patients visiting the OPD who met the inclusion criteria and willing to give the informed consent were included in the study. A total of 20 rough KOS rough surface basal implants were evaluated in this study. The mean crestal bone levels were assessed at baseline and 6 months using IOPA with grid. Gingival index was measured at baseline and 6 months. VAS score for pain was assessed at baseline, 3rd and 7th day and patient satisfaction was evaluated using Likert scale.

Results: There were insignificant changes in crestal bone levels at 6 months after prosthetic loading as compared to baseline. Gingival index assessed showed no statistically significant difference at 6 months compared to baseline. VAS score for pain showed significant improvement at 3rd day and 7th day compared to baseline. Likert Scale used to assess the patient's satisfaction level showed no statistical difference between baseline and 6 months.

Conclusion: The current study suggests that basal implants are a good alternative to conventional implants, where bone levels are compromised.

Keywords: Basal Implant, Cortico-basal, Atrophied ridge, KOS, Rough Surface, Likert scale.

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1. Introduction

Basal implantology, also known as bicortical, cortical, or strategic implantology, represents a modern and advanced approach to dental implant placement that targets the basal cortical sections of the jawbone. This technique takes advantage of bone areas that are naturally more resistant to infection and resorption. The basal bone—distinct from the alveolar processes—comprises the deeper structural bone of the maxilla and mandible. It forms the primary load-bearing framework of the jaws and typically remains stable and robust throughout a person's lifetime. By utilizing this strong cortical foundation, clinicians can successfully place implants in regions where conventional implant methods may not be viable. These implants are uniquely engineered and available in different forms. For example, crestal basal implants are inserted without surgical flaps or incisions and are designed to engage deeper cortical layers, such as the second or third cortex. Unlike traditional implants that depend on osseointegration, basal systems rely on osseoadaptation, a concept that emphasizes the bone's natural ability to remodel and adjust to mechanical stresses applied through the implant surface.[1]

According to the theory of Cortico-basal implantology, the crestal bone is less dense, making it more vulnerable to infections, damage, and resorption. In contrast, the basal bone is densely corticated, is rarely affected by infections or resorption, and provides strong, reliable support for implants. This rationale is derived from orthopedic surgery, where

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cortical areas are known to be resistant to resorption, leading to designation of basal implants as “Orthopedic Implants’’.[2]

Unlike traditional implants, basal implants involve a more straightforward surgical procedure. There is no need for extensive bone drilling, which lowers the risk of thermal damage. During the surgery, a single pilot osteotomy with a pathfinder drill is typically adequate for KOS, KOS Plus, and BCS implants.

The first single-piece implant was created and utilized by Dr. Jean Marc Julliet in 1972. However, its use was quite challenging due to the lack of compatible cutting tools. In the mid-1980s, Dr. Gerard Scortecci developed an implant system complete with specially designed cutting tools. Along with a team of dental surgeons, he introduced disk implants. In the mid-1990s, a group of dentists in Germany further advanced the design by developing new implant types and more suitable tools, building upon the disk implant system. These innovations eventually led to the creation of the modern basal osseointegrated implant, also known as lateral basal implants.[3]

The morphology of basal implants varies. The BOI and BCS have polished and smooth surfaces to reduce inflammation, while KOS and KOS Plus implants have surface treatments and highly polished necks. The BOI implant can be single piece or two-piece, with an exposed conical abutment portion. The BCS implant is a single piece with wide diameter cutting screws. The KOS and KOS plus implants are compression screw designs with different abutment options and highly polished necks. The one which was used in this study is KOS (rough surface) manufactured under the brand “MONO IMPLANT”.[4]

Basal implants are based on the principle of anchoring to the basal bone, bypassing the need for healthy gums or bone grafting. They provide stability in areas with insufficient bone volume, offering a secure foundation for dental prosthesis. This technique ensures faster healing and is suitable for patients with bone loss.

Basal implants were introduced to address the challenges associated with conventional implantology, especially in cases involving severely resorbed ridges or insufficient bone volume. This technique follows an immediate loading protocol, significantly reducing the overall treatment time, cost, and surgical trauma. Patients often favor basal implants due to the rapid delivery of the final prosthesis—typically within 72 hours after surgery—and the minimally invasive approach, which involves less drilling compared to traditional implant procedures.

2. Materials and Methods

The Study was conducted in the Department of Periodontology and Oral Implantology, I.T.S. Centre for Dental Studies and Research, Muradnagar, Ghaziabad. The patients visiting the OPD who met the inclusion criteria and willing to give the informed consent were included in the study. A total of 20 KOS (Rough Surface) Basal implants were placed and evaluated in this study.

2.1. Inclusion criteria

1. Adults with partially edentulous atrophic jaws.
2. Meeting specific bone quality criteria for cortico-basal implant placement.
3. Willing to undergo follow-up assessments for the designated study duration.

2.2. Exclusion criteria

1. History of uncontrolled systemic diseases (e.g., diabetes, autoimmune conditions).
2. Active periodontal disease or ongoing oral infections.
3. Smokers and heavy alcohol drinkers

2.3. Interventions

A total of 20 KOS (Rough Surface) Basal implants, designed for immediate loading in atrophic jaws, were placed following the manufacturer’s recommended protocols.(**Figure 1-3**) The procedure used a single drill protocol, where drilling was done with a drill smaller than the implant's core diameter. The implantation bed was prepared using either a 2mm (yellow) or 2.5mm (black) drill, depending on the implant size. The oral cavity was cleaned with a chlorhexidine mouth rinse for 30 seconds, and local anesthesia (2% lidocaine with 1:100,000 epinephrine) was administered at the surgical site. The drill was advanced until the desired depth was reached, based on the implant size, and bone tapping was performed to compact the cancellous bone. The implant was attached to the handle or ratchet driver and inserted into the fresh osteotomy site, turning it clockwise until high resistance was felt.(**Figure 4**) After implant placement, the alignment was checked for proper prosthetic rehabilitation.(**Figure 6**) Impression caps were then placed, and an impression was made. A cast was created and sent for prosthetic lab work.(**Figure 7,8**)

Post-surgery, patients were advised to apply cold compresses immediately and for the next 24 hours. Instructions on oral hygiene were given, and antibiotics were prescribed to be taken every 8 hours for five days. Chlorhexidine mouth rinse was also prescribed for seven days. Anti-inflammatory medications were given to reduce pain, swelling, and inflammation, aiding in faster recovery.

On the second day, a metal try-in was performed, and the patient’s occlusal records and jaw relations were recorded. On the third day, the completed prosthesis was fixed using GIC luting cement, and any necessary occlusal adjustments were made.

Gingival index and Likert scale assessment was done at baseline and 6 months VAS score for pain was assessed at baseline, 3rd day and 7th day. IOPA with grid (**Figure 5**) was taken to measure crestal bone levels post-surgery (**Figure 10**) and 6 months after prosthetic rehabilitation.(**Figure 11**) The patients received prostheses attached to the implants (**Figure 9**) within 3 days of surgery. In case of any problem regarding the surgery undertaken, patient was advised to report to the clinic as soon as possible.

3. Results

A total 20 rough surface (KOS) basal implants were evaluated in this study for bone in the alveolar crest around implants at baseline and 6 months after prosthetic rehabilitation. Gingival index was assessed at baseline and 6 months. VAS scores for pain were assessed at baseline, 3rd day and 7th day and Likert scale was used for assessing patient satisfaction at baseline and at 6 months. All the patients visited for the recall period. The data obtained was statistically analysed and following results were obtained.

3.1. Crestal bone levels

Table 1 compares the baseline and 6-month crestal bone levels. Crestal bone levels were measured from the neck abutment junction of the implant to the bone level contact mesially and distally and the two sides were averaged out. On assessing crestal bone levels the mean values for baseline were 2.40±1.22mm and 6 months at 2.54±0.97mm respectively. The p-value was 0.154 and there was no statistically significant difference at 6 months compared to baseline.

Table 1: Comparison of baseline and 6 months crestal bone levels vomparison of baseline and 6 months crestal bone levels

Interval	Mean CBL	SD	Difference	p-value
Baseline	2.40	1.22	0.14	0.154
6 months	2.54	0.57		

Paired t test

3.2. Gingival index

Table 2 compares the baseline and 6-month gingival index scores. Gingival index by Loe and Silness was used to measure the gingival status at the mentioned intervals. On comparison the mean GI at baseline and at 6 months was 0.57 and 0.93 respectively. The p-value was 0.059 which was non-significant.

Table 2: Comparison of baseline and 6 months gingival index scores

Interval	Mean GI	SD	Difference	p-value
Baseline	0.57	0.54	-0.36	0.059
6 months	0.93	0.67		

Wilcoxon signed rank test

3.3. Vas score (Pain)

VAS score given by Hayes and Patterson was used to assess pain at baseline, 3rd day and 7th day.

Figure 1: Monoimplant® kit

Figure 2: Monoimplant®

Figure 3: Rough surface Kos monoimplant®

Figure 4: Armamenterium

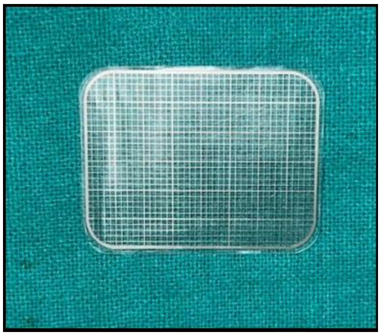

Figure 5: IOPA Grid

Figure 6: After implant placement

Figure 7: Light body putty impression

Figure 8: Mock up for prosthesis

Figure 9: Delivery of final prosthesis.

Figure 10: Crestal bone evaluation at baseline

Figure 11: Crestal bone evaluation at 6 months.

Table 3: Comparison of VAS score at different time intervals

Interval	Mean VAS	SD	p-value	Pairwise comparison
Baseline	5.57	2.07	<0.05*	Baseline vs 3rd day: 0.025*
3rd day	4.14	1.57		Baseline vs 7th day: 0.002*
7th day	0.86	1.57		3rd day vs 7th day: 0.005*

Repeated measures ANOVA test; Bonferroni test; * indicates a significant difference at $p \leq 0.05$

Table 4: Comparison of baseline and 6 months Likert scale responses

Interval	Score 1	Score 2	Score 3	Score 4	Score 5	p-value
Baseline	0	0	0	3 (42.9%)	4 (57.1%)	0.564
6 months	0	0	1 (14.3%)	2 (28.6%)	4 (57.1%)	

Wilcoxon signed rank test

Table 3 compares the VAS score at different time intervals. The mean VAS score at baseline was 5.57 which decreased to 4.14 on 3rd day and 0.86 on 7th day respectively. Mean p-value was of significance which was 0.001. On pairwise comparison p-value between baseline and 3rd day was 0.025, baseline and 7th day was 0.002 and 3rd day and 7th day were 0.005 which were all statistically significant.

3.4. Patient satisfaction using Likert scale

Likert Scale given by Rensis Likert was used to assess patient satisfaction at the mentioned time intervals. It can be seen that 42.9% had a score of 4 at baseline while 57.1% had a score of 5 at baseline. At 6 months 14.3% had a score of 3 while 28.6% had a score of 4 while 57.1% had a score of 5 respectively?. The p-value came out to be 0.564 and there was no statistically significant difference between the baseline and 6-month in terms of Likert scale responses for patient satisfaction. **Table 4**

4. Discussion

Dental implant though a common practice in dentistry sometimes becomes difficult when there isn't enough available bone for conventional implants. While procedures like grafting and direct or indirect sinus lifts can address this issue, they are technique-sensitive, time taking and not always feasible. To address these limitations, new treatment options such as short and cortico-basal implants have been developed.[1]

In this study, a total of 20 rough surface (KOS) basal implants were evaluated for crestal bone levels following prosthetic loading. The clinical parameters assessed included the Gingival Index (GI), the Visual Analogue Scale (VAS) for pain, and the Likert Scale for patient satisfaction. Radiographically, crestal bone levels were measured using IOPA with a grid. Compared to conventional implants, basal implants offer a simpler surgical approach. Typically, a single pilot osteotomy with a pathfinder drill is adequate for KOS, KOS Plus, and BCS implants during surgery.[3]

Basal implantology is an advanced implant system that utilizes the basal cortical bone of the jaws to secure the implant. This approach leverages the stable, unchangeable framework of the maxillary and mandibular bone, offering superior bicortical anchorage, which is why it is also known as bicortical implantology. Basal implants are particularly suited for multiple-unit restorations. They offer several advantages over conventional implants, including the ability to complete the procedure in a single appointment using a flapless technique. This method is straightforward, cost-effective, and requires minimal equipment. Additionally, prefer basal implants because they allow for the final prosthesis to be delivered within 72 hours of surgery and involve fewer drilling steps compared to conventional implant methods.[4] However, there is limited research available on the hard tissue changes around rough surface basal implants after loading. Our study is first to evaluate & compare hard tissue changes around rough surface basal implants after prosthetic loading.

Assessment of crestal bone levels was done in our study using IOPA with grid at baseline and 6 months. The Mean values came out to be 2.40±1.22mm for baseline and 2.54±0.97mm for 6 months respectively and were non-significant ($p>0.05$). This could be owing to the design of KOS implants, featuring a compression screw design and versatile abutment choice which are distinguished by their polished necks, enhancing both functionality and aesthetic outcomes. Similar results to our present study were observed in a study by Anuradha et al,[5] 2020 where periimplant bone levels were assessed using IOPA with grid at baseline, 1 month and 3 months showing no significant changes. They also used CBCT to assess the same at baseline and 6 months showing no significant changes. They concluded that basal implants play a vital role in rehabilitation of patients where compromised or poor quality of bone is present. Contrary results were observed by Saad et al,[6] 2020 in which marginal bone loss and implant stability was assessed at baseline and 6 months. There was excellent implant stability but the marginal bone loss was significantly higher at 6 months.

Assessment of Gingival index (GI) was done to assess the relative status of either health, disease, or both in the gingival tissues. In our study the assessment was done at baseline and 6 months where mean value came out to be 0.57±0.54 and 0.93 ±0.67 respectively and was non-significant ($p>0.05$), showing that the patients maintained good oral hygiene after prosthesis delivery and no gingival inflammation was seen. Awadalkreem et al,[7] 2022 assessed gingival index at 1 week, At 3, 6, 12, and 18 months postoperatively, a significant reduction in the gingival Index (GI) scores was observed, suggesting progressive healing of the peri-implant mucosa. This improvement reflects enhanced soft tissue health around the implant surfaces and a corresponding reduction in the risk of peri-implantitis throughout the study period.

Contrary results were observed in a study by Mitra et al,[8] 2023 where gingival index was assessed at third day, 3 months and 6 months post operatively stating there was significant changes between third day and third month and the third day and sixth month while having no significant changes at third month and sixth month. The presence of fixed prostheses if given with proper finish lines cannot cause periimplant mucositis if patients comply with self-plaque control and periodic maintenance.

Assessment of Visual Analogue score (VAS) was used to assess postoperative pain at baseline, 3rd day and 7th day in our study. The mean VAS score at baseline was 5.57±2.07 which decreased to 4.14±1.57 on 3rd day and 0.86±1.57 on 7th day respectively. This difference in the VAS score at different time points was significant (p-<0.05). Pairwise test was done by Bonferroni test which showed that VAS score on 3rd day and 7th day was significantly lower as compared to the VAS score at baseline. Also, the VAS score on 7th day was significantly lower as compared to the VAS score in 3rd day and also while comparing between baseline and 3rd day (p-0.025), baseline and 7th day (p-0.002) and 3rd day and 7th day (p-0.005) all showed statistically significance. Similar results were observed in a study by Mitra et al,[8] 2023 in which pairwise comparison of mean pain scores between different time periods was done by using the post hoc Bonferroni test, which showed a significant reduction of pain between the third day and third month and the third day and six months. This can be attributed to minimum drilling protocol leading to less patient discomfort.

The evaluation of patient satisfaction was done by using likert Scale at baseline and 6 months where 42.9% had a score of 4 at baseline while 57.1% had a score of 5 at baseline. At 6 months 14.3% had a score of 3 while 28.6% had a score of 4 while 57.1% had a score of 5. There was no statistically significant difference between the baseline and 6-month Likert scale responses (p>0.05). Similar results were observed in a study by Awadalkreem et al,[9] 2020 where patients satisfaction was assessed via a questionnaire. The results showed general satisfaction of comfort, mastication and speech and concluded that basal implant-supported prostheses have a positive impact on oral health and patient's satisfaction. Similar results were observed in a study by Mitra et al. (2023),[8] patient satisfaction was assessed using a structured questionnaire incorporating a Likert scale, where responses were rated from 1 to 5 (1 = strongly disagree, 5 = strongly agree). To analyze satisfaction over time, pairwise comparisons between different follow-up periods were conducted using the post hoc Bonferroni test. The results indicated a statistically significant increase in satisfaction between the third day and third month, as well as between the third day and sixth month. However, no significant difference was found when comparing patient satisfaction between the third and sixth months.

In the present study, minimal crestal bone loss was observed six months following prosthetic loading, supporting the effectiveness of basal implants as a suitable alternative to conventional implants in cases with limited bone volume.[10,11] The stability of the gingival index throughout the follow-up period highlights the patients' adherence to good oral hygiene and supports previous findings of consistent peri-implant soft tissue health with basal systems.[12] Postoperative discomfort, assessed using the Visual Analogue Scale (VAS), was notably low, reinforcing the minimally invasive nature of basal implantology and the benefits associated with fewer surgical interventions.[13] Patient satisfaction, as evaluated using a Likert scale, showed no significant changes over six months, in agreement with studies reporting favorable outcomes for immediately loaded basal implants.[14] Although implant stability quotient (ISQ) measurements are important in evaluating osseointegration, such data could not be recorded in this study, representing a limitation. Additionally, the inclusion of cone beam computed tomography (CBCT) would have provided a more detailed assessment of bone changes. Despite these limitations, basal implants demonstrate strong potential in scenarios with restricted bone height or width, especially due to their capacity for immediate loading, which significantly reduces treatment time and enhances efficiency.[15] However, it is crucial to acknowledge that basal implant placement is a technique-sensitive procedure, and the current lack of comprehensive long-term clinical data warrants caution before widespread implementation in everyday practice.

5. Conclusion

There are very limited studies evaluating hard tissue changes around rough surface basal implants after prosthetic loading. The results of the current study suggests that basal implants are a good alternative to conventional implants, where bone levels are compromised. In our study a total of 20 rough surface basal implants were placed and following conclusions were drawn from the results obtained.

1. There was insignificant changes in crestal bone levels at 6 months after prosthetic loading as compared to baseline.
2. Gingival index assessed in our study showed no statistically significant difference at 6 months.
3. VAS score for pain showed significant improvement at 3rd day and 7th day compared to baseline.
4. Likert Scale used to assess the patient's satisfaction level showed no statistical difference between baseline and 6 months

The current study indicate that basal implants represent a promising alternative to conventional implants in scenarios where bone levels are insufficient. However, the study has notable limitations. For instance the initial stability of the implants was not evaluated, and the procedure's technique sensitivity was not fully explored. To validate and expand upon these results, additional research is required, including studies with larger sample sizes and extended follow-up periods. Such investigations will help to provide a more comprehensive understanding of the efficacy and reliability of basal implants compared to traditional methods.

6. Source of Funding

None.

7. Conflict of Interest

None.

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