

# Clinical & Radiographic Evaluation in Crestal & Subcrestal Implant Placement- A Prospective Original Study

<sup>1</sup>Dr. Priyanka Singh, <sup>2</sup>Dr. Archana Jalheria, <sup>3</sup>Dr. Akshay Bhandari, <sup>4</sup>Dr. Suraj Reddy Loka, <sup>5</sup>Dr. Jadhav Sachin Kumar, <sup>6</sup>Dr. Lahari Muppalla

<sup>1</sup>Junior Resident-3, Department of Prosthodontics, H.P Government Dental College & Hospital, Shimla, Himachal Pradesh, India

<sup>2</sup>MDS, Consultant Prosthodontist, Smile Dental Care, Ahmedabad, Gujarat, India

<sup>3</sup>Senior Lecturer, Department of Prosthodontics, MGV's KBH Dental College & Hospital, Nashik, Maharashtra, India

<sup>4</sup>Senior Resident, Department of Public Health Dentistry, Government Dental College & Hospital, Hyderabad, Telangana, India

<sup>5</sup>Post Graduate Student, Department of Public Health Dentistry, Post Graduate Institute of Dental Sciences, Rohtak, Haryana, India

<sup>6</sup>Practicing Dentist, AP Super Specialty Clinic, Hyderabad, Telangana, India

Corresponding Author: Dr. Priyanka Singh (E-mail Id: [privankasingh2792@gmail.com](mailto:privankasingh2792@gmail.com))

## ABSTRACT

**Background-**The long-term survival of dental implants is evaluated by the amount of crestal bone loss around the implants. Many possible etiologies of early crestal bone loss around implants including surgical trauma, occlusal overload, periimplantitis, the presence of microgap, reformation of biologic width, implant crest module, and others have been proposed. However, the location of dental implants, whether subcrestal or equicrestal, is still becoming increasing importance for researchers.

**Materials & Method-** A total of 20 implants were placed (10 dental implants per group, Group I-Equicrestal and Group II- 1mm Subcrestal) in subjects requiring placement of mandibular teeth. Patient was then recalled for follow up for radiographic evaluation which was made at 1 month and 3 months of implant loading for evaluation of crestal bone changes with the help of radiographs.

**Result-** The results says that crestal bone loss around implants which are placed equicrestal led to lesser bone loss when compared to implants which are placed subcrestal after loading and patient's perception of pain was lesser in the equicrestal implants as compared to subcrestal implants.

## INTRODUCTION

"Dental implants have emerged as a panacea for the treatment of edentulism, both partial and complete".

Dental implants have become a standardized and predictable treatment modality for the rehabilitation of partially and totally edentulous patients, resulting in high survival and success rates.<sup>[2]</sup> Several factors may contribute to the success or failure of a dental implant, including bone support and the stability of the bone crest adjacent to the implant.

A zone of epithelium and connective tissue integration forms a "biologic width" that surrounds and protects an abutment and implant from pathologic insults. It has been observed that if the biologic width is altered in an apical direction, a corresponding marginal bone loss will also occur. This area of bone loss usually starts at the implant-abutment interface.<sup>[1]</sup>

The long-term survival of dental implants is evaluated by the amount of crestal bone loss around the implants. This peri implant crestal bone level and peri implant bone remodelling depends upon location of Implant Abutment Junction (IAJ) in relation to bone crest and the amount of soft tissue coverage <sup>[3]</sup>.

Many possible etiologies of early crestal bone loss around implants (from implant placement to 1-year post-loading) including surgical trauma, occlusal overload, periimplantitis, the presence of microgap, reformation of biologic width, implant crest module, and others have been proposed. However, the location of dental implants, whether subcrestal or equicrestal, is still becoming increasing importance for researchers.<sup>[6]</sup>

Hence, the aim of this in -vivo study is to evaluate the impact of crestal and subcrestal implant placement in clinico-radiological parameters such as crestal bone loss, clinical attachment level and patients perception of pain.

## MATERIALS AND METHODS

The study was conducted on subjects visiting the Department of Prosthodontics and Crown & Bridge, Himachal

Pradesh Government Dental College and Hospital, Shimla. The ethical approval by the Institute Ethical Committee was obtained. The subjects were evaluated based on clinical and radiographic parameters for implant placement by two techniques (crestal and subcrestal).

### **Study population:**

The study included statistically significant patients in which minimum of two implants were placed in edentulous region having adequate amount of bone and keratinized tissue.

### **The selection criteria was as follows:**

#### **Inclusion criteria**

- All patients requiring minimum two dental implants.
- Adequate amount of bone and keratinized tissue.
- All subjects should be 18 or greater than 18 years of age.
- All patients should be periodontally healthy.

#### **Exclusion criteria**

- Irradiation in the head and neck area less than 1 year
- Poor oral hygiene and motivation
- Untreated periodontal disease
- Systemic contraindications such as Uncontrolled Diabetes etc.
- Active infection or severe inflammation in the area.

### **Study Groups**

A total of 20 implants were placed (10 dental implants per group) in subjects requiring placement of mandibular teeth. Selected subjects were grouped on the basis of type of surgery during implant placement as:

**Group I:** implant placed equicrestal

**Group II:** implants placed 1 mm subcrestal

**Randomization:** Randomization of study subjects was done by lottery method. Each subject was told to randomly choose from identical slips for different groups.

## **METHODOLOGY**

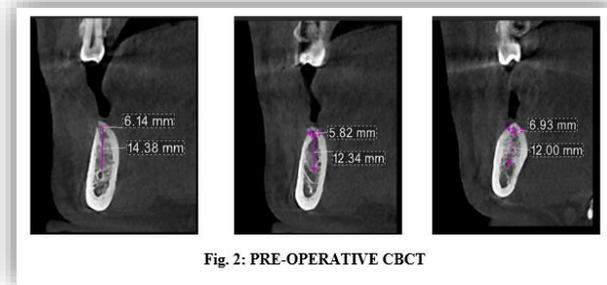
### **1. Pre surgical Assessment:**

- A detailed medical and dental history of each subject was obtained along with preoperative photographs and radiographs. (Fig.1)



**Fig.1: Pre-Operative Intra-Oral View**

- Pre- operative IOPA and Orthopantomogram (OPG) provided the necessary information regarding the available bone and distance of vital structures, i.e., mandibular canal from the implant site, maxillary sinus, and floor of nasal cavity. A pre-measured 3mm diameter ball bearing was used to calculate the magnification of OPG.
- CBCT was used to accurately evaluate the amount of bone and proximity from vital structures for each patient. (Fig.2)



**Fig.2: Pre-Operative CBCT**

- All subjects were motivated to maintain oral hygiene.

### 2. Fabrication of Study Models and Surgical Stent:

- Preliminary alginate impressions were made and study models fabricated prior to surgery. A diagnostic wax-up of the involved tooth was made and a surgical stent was fabricated based on the wax-up to facilitate implant placement. (Fig.3)



**Fig. 3: Marking with Surgical Stent**

### 3. Surgical Preparation:

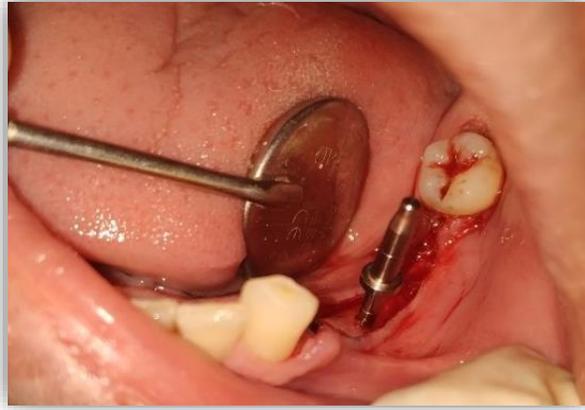
The patients were pre-medicated with antibiotics (Amoxicillin 2g) 1 hour prior to surgery and were asked to rinse the mouth with Chlorhexidine 0.2%.

Local anaesthesia was administered using Lignocaine with adrenaline in the ratio of 1:100000 at the involved site.

### 4. Surgical Procedure:

#### Implant Placement Procedure:

- Crestal incision was given for full thickness flap reflection, mucoperiosteal flap was elevated both buccally and lingually to expose the bone.
- Surgical stent was then placed over the crest to mark the implant site. The implant diameter was kept the same while placing implants equicrestal and subcrestal.
- The implant site was penetrated with the help of a pilot drill which was used to create a bleeding point at site of initial osteotomy when the surgical stent was still in place.
- After marking the implant site by surgical stent, the surgical stent was removed and pilot drill was used to complete depth, followed by subsequent drills of increasing diameter to create an osteotomy site of required dimensions for each patient.
- A paralleling pin was used during osteotomy preparation to assess the drilling orientation.(Fig.4,5)



**Fig.4: Paralleling Pin Placed For 1<sup>st</sup> (Subcrestal) Implant**



**Fig. 5: Subcrestal Placement of 1<sup>st</sup> Implant and Paralling Pin Placed For 2<sup>nd</sup> (Equicrestal) Implant**

- Implant was placed equicrestal into this osteotomy site with the help of a torque wrench.
- Healing abutments (Gingival formers) / cover screw was then screwed to the implants immediately after implant placement to close the opened implant site.
- Once the healing abutments were placed the surgical site was thoroughly irrigated and flap was sutured using non- resorbable 3-0 silk sutures to achieve water-tight closure. (Fig.6)



**Fig.6: Placement of Sutures**

- Similarly, Group II Implants were placed 1 mm subcrestally. (Fig.7)



**Fig. 7: Placement of All Implants**

- Patients were prescribed with antibiotics and analgesics for 1 week, post-operatively.

**5. Medication and Follow up:**

- Post-operative instructions were given to the patients regarding diet, oral hygiene maintenance and following medications were prescribed and IOPA is taken.(Fig.8)



**Fig.8: Post-Operative IOPA of Subcrestal and Equicrestal Implant Placement**

Patients were instructed to have a soft diet and to avoid chewing the treated area for first few days. Oral hygiene at the surgical site was limited to soft brushing for the first 2 weeks and regular brushing in the rest of the mouth.

After implant placement by both the techniques implants were left for osseointegration for a period of 3 months following conventional loading protocols and abutments were placed thereafter. (Fig.9)



**Fig. 9: Final Prosthesis Placed**

**RESULTS**

**TABLE 1: Mean Crestal Bone Loss (Mesial) in two groups at different time intervals**

Variable	Group 1		Group 11		't' value	p value
	Mean	± SD	Mean	± SD		
At 0th Month	-0.309	0.054	-0.422	0.120	2.71	0.01444
At 1st Month	-0.385	0.062	-0.576	0.101	5.07	0.00008
At 3rd month	-0.487	0.062	-0.703	0.078	6.80	0.00001

**TABLE 2: Mean Crestal Bone Loss (Distal) in two groups at different time intervals**

Variable	Group 1		Group 11		't' value	p value
	Mean	± SD	Mean	± SD		
At 0th Month	-0.262	0.077	-0.402	0.082	3.93	0.00098
At 1st Month	-0.310	0.085	-0.565	0.071	7.23	0.00001
At 3rd month	-0.581	0.047	-0.681	0.062	4.02	0.00081

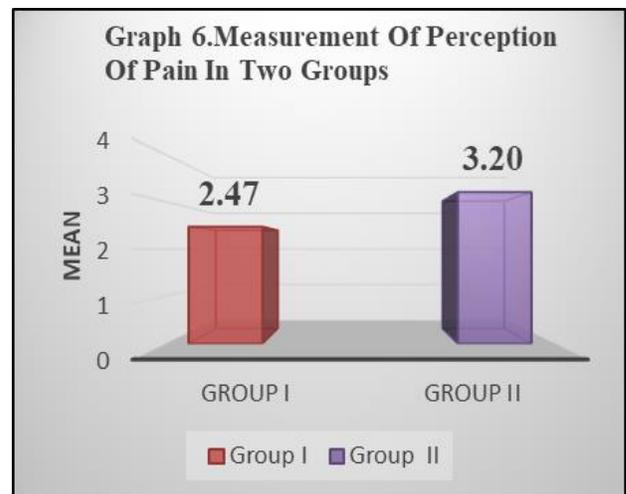
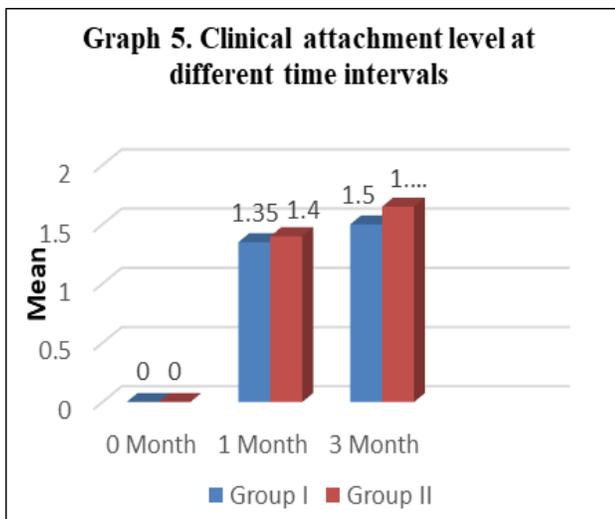
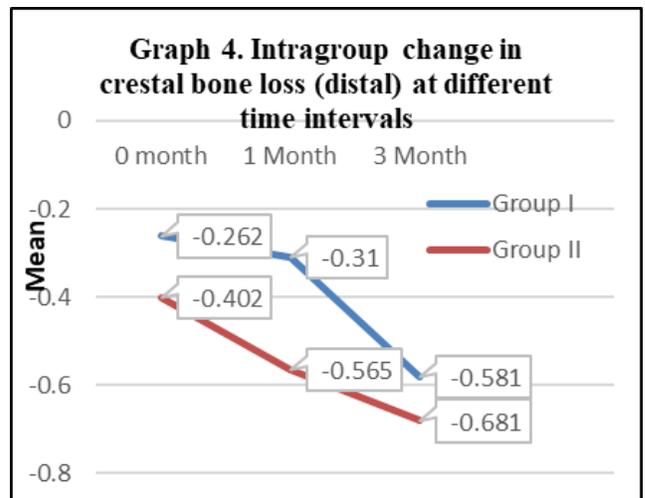
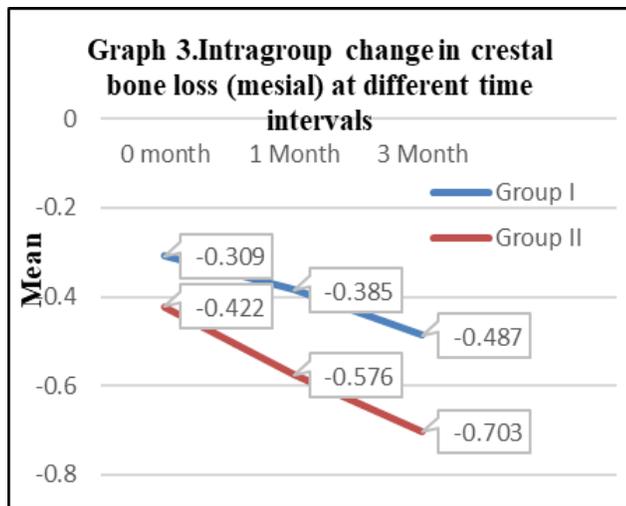
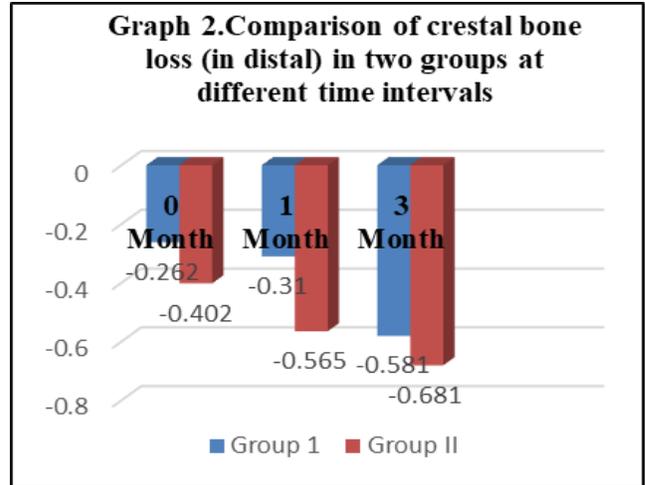
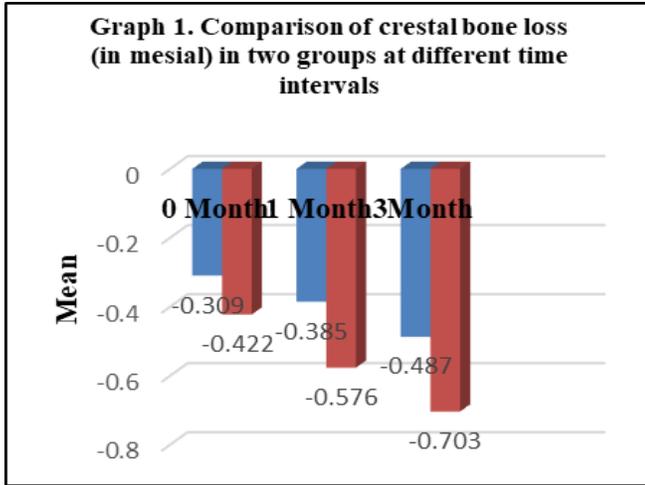
**TABLE 3: Mean of clinical attachment loss at different time intervals of Group I and II implants**

Variable	Group 1		Group 11		't' value	p value
	Mean	± SD	Mean	± SD		
At 0th Month	-	-	-	-	-	-
At 1st Month	1.35	0.47	1.40	0.45	0.239	0.813
At 3rd month	1.50	0.40	1.65	0.41	0.818	0.423

**TABLE 4: Mean Perception of Pain in Two Groups**

Variable	Group 1		Group 2		't' value	p value
	Mean	± SD	Mean	± SD		
Perception of Pain	2.47	0.84	3.20	0.91	2.028	0.059

**GRAPHS**



**DISCUSSION**

In successfully osseo-integrated implants the process of initial breakdown begins at the crestal region. Individual effect of placement depths in relation to crestal bone is crucial to decide on the choice of placement depth (equi or subcrestal) during the surgical phase of treatment. Many procedural and biomechanical factors like implant design, micro movement, second stage surgery may lead to disruption of junctional epithelium leading to more crestal bone resorption after loading<sup>[21]</sup>

The present study evaluated and compared the marginal bone loss, clinical attachment and success of implants rehabilitated with crowns implants placed equicrestal and subcrestal in a partially or fully edentulous patients over a follow-up period of 3 months. Marginal bone measurements revealed that marginal bone loss using digimizer software version 4.5.0 predominantly occurred in 3 months after loading.

The intra-group comparison of the changes in the crestal bone measured from the implant shoulder to the first visible bone to implant contact on the mesial side of dental implant at different time intervals. The **mean of crestal bone loss on mesial side** in equicrestal and subcrestal implant at 0 month was **-0.309** and **-0.422** respectively with a **p-value of 0.0144**, which is **considered significant**. (Table 1). The mean for mesial crestal bone loss at 1 month for equicrestal implant was **-0.385** and **-0.576** for subcrestal implants. **The p-value was 0.00008, which is considered significant**. (Table 1). The mean for mesial crestal bone loss at 3 month for equicrestal implant was **-0.487** and **-0.703** for subcrestal implants. **The p-value was 0.00001, which is considered significant**. (Table 1).

Similarly, intra-group comparison of the changes in the crestal bone measured from the implant shoulder to the first visible bone to implant contact on the distal side of dental implant at different time intervals. The **mean of crestal bone loss on distal side** in equicrestal and subcrestal implant at 0 month was **-0.262** and **-0.402** respectively with a **p-value of 0.0009**, which is **considered significant**. (Table 2)

The mean for distal crestal bone loss at 1 month for equicrestal implant was **-0.310** and **-0.565** for subcrestal implants with a **p-value of 0.00001, which is considered significant** and mean for mesial crestal bone loss at 3 month for equicrestal implant was **-0.581** and **-0.681** for subcrestal implants with a **p-value of 0.00081, which is considered significant**. (Table 2).

Thus, the present study shows that crestal bone loss was significantly lower in implants placed equicrestally than with implants subcrestally

It was observed that increasing the depth of implant insertion, the first point of contact between bone and implant was located more apical to the interproximal bone peaks. Result of micro movements at the implant–abutment interface or may be due to bacterial migration and colonization of the microgap on a screw retained abutment thus, implant placement at subcrestal level may be deleterious for the maintenance of periimplant bone, since it implies that the microgap must lie below the peri-implant bone crest, which induces localized chronic inflammation.

This study is in accordance with the study conducted which accepted 1 mm of peri-implant bone loss during the first year offunction, followed by an annual loss of under 0.2 mm after the first year in service as criteria for implantsuccess.<sup>5</sup> Previous study found that the subcrestal placement of external-hex connection implants leads to more pronounced radiographic bone loss. Equicrestal tapered implants showed less bone remodeling compared to 1 mm and 2 mm subcrestal implants. The authors suggested that the greater buccal bone remodeling in subcrestal implants could be explained by a greater wound surface area coronal to the implant platform thus leading to greater buccal bone remodeling, Some investigations demonstrated that subcrestal placement of implants had a negative influence on peri-implant tissue remodeling.<sup>[3]</sup>

Other aim of present study was to compare clinical attachment loss at different intervals of the implants loaded equicrestal and subcrestal implant after loading. The **mean of clinical attachment level** in equicrestal and subcrestal implant after 1 month of loading was **1.35** and **1.40** respectively with a **p-value of 0.813**, which is **considered non significant** and **mean of clinical attachment level** in equicrestal and subcrestal implant after 3 month of loading was **1.50** and **1.65** respectively with a **p-value of 0.423**, which is **considered non significant** (Table 3). Thus, the present study shows that clinical attachment loss was statistically insignificant among equicrestal and subcrestal implant level at different interval after loading of implant.

In a histological study conducted by placing implants at different depths in relation to the bone crest, reported higher vertical expansion of the junction epithelium and the connective tissue in relation to the greater depth of insertion. However, the Authors observed that if the implants were placed below the bone crest, the first bone-to-implant contact was located more coronally, near to the implant/abutment interface.<sup>[16]</sup>

Pain perception by the patient at equicrestal and subcrestal implant level and showed that the mean of the **patient's perception of pain for the equicrestal implant placement** was **2.47** while the mean of the patient's perception of pain for **subcrestal implant placement** was **3.20**. **The p-value was 0.059** which is considered to be not significant (Table 4). Although insignificant, the present study shows that patient's perception of pain was lesser in the equicrestal implants as compared to subcrestal implants.

The drawbacks of this study included the fact that in this study, intra-oral radiography was used to evaluate the radiologic changes in peri implant bone level, which is quite a sensitive method. However, it should be noted that this technique could only record bone level in two dimensions (mesial and distal). Therefore, it is highly likely that some information (bone loss in the buccal and lingual dimensions) might be missing, although enough data can be recorded for clinical follow up and diagnostic procedures. Currently, new diagnostic radiographic methods such as

cone beam computed tomography (CBCT) are more reliable for scientific studies and evaluations, but due to lack of patient co-operation and absence of relevant infrastructure we had to use intraoral radiography.

Other limitations of the study were the small sample size, the fact that a split mouth study could not be conducted as well as the fact that temporization in the healing phase was not conducted.

## CONCLUSION

It was observed that among the parameters considered to compare both the loading protocol the crestal bone loss around the implant after 3 months follow up shows significant difference. The result says that crestal bone loss around implants which are placed equicrestal led to lesser bone loss when compared to implants which are placed subcrestal after loading, considering all the other factors remains unchanged. It was also observed that patient's perception of pain was lesser in the equicrestal implants as compared to subcrestal implants. Within the limitations of this study, it can be concluded that equicrestal implant placement might be preferable over subcrestal implant placement restoring dental implants.

Further observational and randomized controlled studies with a longer follow-up could provide deeper evidence-based conclusions concerning the use of narrow diameter implants.

## REFERENCES

1. Fetner M, Fetner A, Koutouzis T, Clozza E, Tovar N, Sarendranath A, Coelho PG, Neiva K, Janal MN, Neiva R. The Effects of Subcrestal Implant Placement on Crestal Bone Levels and Bone-to-Abutment Contact: A Microcomputed Tomographic and Histologic Study in Dogs. *Int J Oral Maxillofac Implants*. 2015 Sep-Oct;30(5):1068-75
2. CristinaValles, XavierRodríguez-Ciurana, Marco Clementini, Mariana Baglivo, Blanca Paniagua, JoseNart-Influence of subcrestal implant placement compared with equicrestal position on the peri-implant hard and soft tissues around platform-switched implants: a systematic review and meta-analysis. *Clin Oral Invest*22, 555–570 (2018).
3. Koutouzis T, Fether M, Fetcher A, Lundgren T. Retrospective evaluation of crestal bone changes around implants with reduced abutment diameter placed non-submerged and at subcrestal positions: the effect of bone grafting at implant placement. *J Periodontol*. 2011 Feb;82(2):234-42
4. Arthur B. Novaes, Raquel R. M. Barros, Valdir A. Muglia, Germana J. Borges-Influence of inter implant distances and Placement depth on papilla formation and Crestal resorption: A clinical and Radiographic study in dogs. *Journal of Oral Implantology*. Vol. XXXV/No. One/2009.
5. Hilario Pellicer-Chover, María Peñarrocha-Diago, David Peñarrocha-Oltra, Sonia Gomar- Vercher, Rubén Agustín-Panadero, and Miguel Peñarrocha-Diago. Impact of crestal and subcrestal implant placement in peri-implant bone. *Med Oral Patol Oral Cir Bucal*.2016 Jan 1;21(1):e103-10.
6. Aous Dannan. Crestal Bone Loss Around Dental Implants; A Short Communication. *The Internet Journal of Dental Science*. 2012 Volume 10 Number 2
7. Hermann, J. S., Buser, D., Schenk, R. K., & Cochran, D. L. (2000). Crestal Bone Changes Around Titanium Implants. A Histometric Evaluation of Unloaded Non-Submerged and Submerged Implants in the Canine Mandible. *Journal of Periodontology*, 71(9), 1412–1424.
8. Hämmerle CH, Brägger U, Bürgin, Lang NP.- The effect of subcrestal placement of the polished surface of ITI implants on marginal soft and hard tissues. *Clin Oral Implants Res*. 1996 Jun;7(2):111-9.
9. Leonhardt Å, Gröndahl K, Bergström C, Lekholm U. Long-term follow-up of osseointegrated titanium implants using clinical, radiographic and microbiological parameters. *Clin. Oral Impl. Res*, 13, 2002; 127–132.
10. Tomas Linkevicius, Dr Habil, Simonas Grybauskas. The Influence of Soft Tissue Thickness on Crestal Bone Changes Around Implants: A 1-Year Prospective Controlled Clinical Trial. *Int J Oral Maxillofac Implants* 2009;24:712–719.
11. Welander M, Abrahamsson I, Berglundh T. Subcrestal placement of two-part implants. *Clin. Oral Impl. Res*. 20, 2009; 226–231.
12. Donovan R, Fetner A, Koutouzis T, Lundgren T. Crestal bone changes around implants with reduced abutment diameter placed non-submerged and at subcrestal positions: a 1-year radiographic evaluation. *J Periodontol*. 2010 Mar;81(3):428-34
13. Koh RU, Oh TJ, Rudek I, Neiva GF, Misch CE, Rothman ED, Wang HL. Hard and soft tissue changes after crestal and subcrestal immediate implant placement. *J Periodontol*. 2011 Aug;82(8):1112-20
14. Marco Degidi, Vittoria Perrotti, Jamil A. Shibli, Arthur B. Novaes, Adriano Piattelli, and Giovanna Iezzi.

Equicrestal and Subcrestal Dental Implants: A Histologic and Histomorphometric Evaluation of Nine Retrieved Human Implants. *J Periodontol* 2011;82:708-715.

15. Romanos, G. E., Aydin, E., Gaertner, K., & Nentwig, G.-H. (2013). Long-Term Results after Subcrestal or Crestal Placement of Delayed Loaded Implants. *Clinical Implant Dentistry and Related Research*, 17(1), 133–141.
16. Lombardo G, Corrocher G, Pighi J, Faccioni F, Rovera A, Marincola M, Nocini PF. The impact of subcrestal placement on short locking-taper implants placed in posterior maxilla and mandible: a retrospective evaluation on hard and soft tissues stability after 2 years of loading. *Minerva Stomatol.* 2014 Nov-Dec;63(11-12):391-402.
17. Calvo-Guirado JL, Lopez-Lopez PJ, Mate Sanchez JE, Gargallo Albiol J, Velasco Ortega E, Delgado Ruiz R. Crestal bone loss related to immediate implants in crestal and subcrestal position: a pilot study in dogs. *Clin. Oral Impl. Res.* 25, 2014, 1286–1294.
18. Lee, J., Fiorini, T., Gamborena, I., Wenzel, B. A., Schüpbach, P., Wikesjö, U. M. E., & Susin, C. Effect of Platform Shift/Switch on Crestal Bone Levels and Mucosal Profile Following Flapless Surgery and Crestal/Subcrestal Implant Placement. *Clinical Implant Dentistry and Related Research*, 18(1), 73–81
19. Kütan, E., Bolukbasi, N., Yildirim-Ondur, E., & Ozdemir, T. Clinical and Radiographic Evaluation of Marginal Bone Changes around Platform-Switching Implants Placed in Crestal or Subcrestal Positions: A Randomized Controlled Clinical Trial. *Clinical Implant Dentistry and Related Research*, 17, e364–e375.
20. Palaska I, Tsaousoglou P, Vouros I, Konstantinidis A, Menexes G. Influence of placement depth and abutment connection pattern on bone remodeling around 1-stage implants: a prospective randomized controlled clinical trial. *Clin. Oral Impl. Res.* 00, 2014, 1–10.
21. Balaji Nagarajan, Varsha Murthy, David Livingstone, Manohar Paul Surendra, and Srinivasan Jayaraman. Evaluation of Crestal Bone Loss Around Implants Placed at Equicrestal and Subcrestal Levels Before Loading: A Prospective Clinical Study. *J Clin Diagn Res.* 2015 Dec; 9(12): ZC47–ZC50.
22. Aimetti M, Ferrarotti F, Mariani GM, Ghelardoni C, Romano F. -Soft tissue and crestal bone changes around implants with platform-switched abutments placed nonsubmerged at subcrestal position: a 2-year clinical and radiographic evaluation. *Clin Oral Implants Res.* 2017 Nov;28(11):1342-134
23. Van Eekeren, P., Tahmaseb, A., & Wismeijer, D. Crestal Bone Changes Around Implants with Implant-Abutment Connections at Epicrestal Level or Above: Systematic Review and Meta-Analysis. *The International Journal of Oral & Maxillofacial Implants*, 31(1), 119–124.
24. Al Amri, M. D. Crestal bone loss around submerged and nonsubmerged dental implants: A systematic review. *The Journal of Prosthetic Dentistry*, 115(5), 564–570.e1.
25. De Siqueira RAC, Fontão FNGK, Sartori IAM, Santos PGF, Bernardes SR, Tioffi R. Effect of different implant placement depths on crestal bone levels and soft tissue behavior: a randomized clinical trial. *Clin Oral Implants Res.* 2017 Oct;28(10):1227-1233
26. Gatti, C., Gatti, F., Silvestri, M., Mintrone, F., Rossi, R., Tridondani, G., Borrelli, P. A Prospective Multicenter Study on Radiographic Crestal Bone Changes Around Dental Implants Placed at Crestal or Subcrestal Level: One-Year Findings. *The International Journal of Oral & Maxillofacial Implants*, 33(4), 913–918.
27. Natalia Palacios-Garzón, Eugenio Velasco-Ortega, José López-López- Bone Loss in Implants Placed at Subcrestal and Crestal Level: A Systematic Review and Meta-Analysis. *Publisher of Open Access Journals. Materials* 2019, 12, 154.
28. Al Amri, M.D.; Alfadda, S.A.; Labban, N.Y.; Alasqah, M.N.; Alshehri, F.A.; Al-Rasheed, A.S. Comparison of Clinical, Radiographic, and Immunologic Inflammatory Parameters around Crestally and Subcrestally Placed Dental Implants: 5-Year Retrospective Results. *J. Prosthodont.* 2017.
29. Calvo-Guirado, J. L., Pérez-Albacete, C., Aguilar-Salvatierra, A., de Val Maté-Sánchez, J. E., Delgado-Ruiz, R. A., Abboud, M, Romanos, G. E. Narrow- versus mini-implants at crestal and subcrestal bone levels. Experimental study in beagle dogs at three months. *Clinical Oral Investigations*, 19(6), 1363–1369.
30. Degidi, M., Perrotti, V., Shibli, J. A., Novaes, A. B., Piattelli, A., & Iezzi, G. Equicrestal and Subcrestal Dental Implants: A Histologic and Histomorphometric Evaluation of Nine Retrieved Human Implants. *Journal of Periodontology*, 82(5), 708–715.