Section A-Research paper

COMPARATIVE EVALUATION OF CRESTAL BONE CHANGES AFTER IMMEDIATE AND DELAYED IMPLANT PLACEMENT:A RADIOGRAPHIC AND CLINICAL STUDY

Dr. Nikhil Hole[1], Dr. Guljot Singh[2], Dr. Neha Jain[3], Dr. Kalyani Goswami[4], Dr. Jyoti Parkash[5], Dr. Jagir Singh[6]

[1,4,5,6] PG student, Department of Periodontics & implantology, Daswani dental college & research center Kota
[2]HOD & professor Department of Periodontics & Implantology Daswani dental college & research center Kota
[3]PROFESSOR, Department of Prosthodontics crown and bridge & implantology Daswani dental college & research center kota

Corresponding author
Dr. Nikhil Hole, PG student 3rd Year, Department of Periodontics & implantology DASWANI dental college and research Center, Kota

ABSTRACT

Oral implants constitute one of the most successful treatment modalities in dentistry. The aim of the present study is to clinically evaluate the periodontal parameters of osseointegrated immediate and delayed dental implants and to radiographically evaluate the difference in the crestal bone height after immediate and delayed placement of dental implants.

Methodology

The purpose of the comparative study was to evaluate the crestal bone loss in immediate and delayed implant placement. In the present study, total 20 patients were selected, in which (Group I) 10 samples of immediate implant and (Group II) 10 samples of delayed implants were recorded with fulfilling the inclusion and exclusion criteria were recruited within the age group of 18 to 60 years comprising both male and female visiting the Department of Periodontology and implantology Daswani dental college & research center, Kota. Sequentially recorded radiograph to evaluate crestal bone height by taking radiovisiography (RVG) with the help of inbuilt software grids using long cone paralleling technique and to measure the Bucco-lingual width of bone clinically with the help of varnier caliper and the periodontal parameters the Oral Hygiene Index - Simplified and Gingival index recorded at baseline, 3 months and 6 months.

RESULT

The crestal bone height, buccolingually it shows difference in between in Group A and Group B according to study the crestal bone height and buccolingual bone in Group B more crestal bone loss occurs compared to Group A. The clinical parameters OHI-S index shows significant result and higher values on Group B compared to Group A. The gingival index shows no changes in between both the groups.

CONCLUSION

Taking the results of the present study into account, it could be concluded that conventional implant placement Group B is associated with more marginal bone loss when compared with immediate implant placement Group A. Further long-term studies

with larger sample sizes are necessary to evaluate crestal bone loss in order to substantiate the basis of selection of the best implant placement protocol and it will enhance the success rates in long term.

INTRODUCTION

Tooth loss reflects the ultimate outcome of the oral disease over the course of life. The revolutionary breakthrough was first evolved from the research efforts of the Swedish orthopaedic surgeon P. L. Branemark in late 1960s by pioneering of insertion of machined screw‐type commercially pure titanium implants with minimal surgical trauma. Brånemark *et al*. termed the bone bonding ability of implant as "Osseo‐integration" and defined it as "a direct structural and functional connection between ordered living bone and the surface of a load carrying implant."[1] The most natural method to replace a missing tooth is with an implant rather than preparing adjacent teeth. The first single tooth-crown restoration using a Branemark implant (Nobel BioCare) was placed in December 1982.[2] The criteria for success in implants should involve the establishment of a soft tissue contour with intact interproximal papilla and a predictable gingival contour.[3]

There are various factors which affect the success rate of implant. Occlusal overload is one such key biomechanical factor which influences implant success as it is the primary factor for generation of peri‐implant strain and peri‐implant bone loss. Since many patients complained of the discomfort of edentulous spaces during the long healing period of the conventional implant protocol the concept of immediate loading was proposed by some authors in the early 1990s.[4] A small degree of radiographically determined peri-implant alveolar bone loss which has been clinically accepted by several authors is commonly observed in patients treated with dental implants. Albrektsson et al. (1986)[5] The etiological factors underlying crestal bone loss remain unclear and there is a great deal of controversy. Infection and occlusal overload have been the main theories explaining marginal bone loss.[6]

MATERIAL & METHODS

Selection of Patients

A total of 20 implant sites in need of single tooth replacement were included in study amongst those patients visiting the Department of Periodontics and Implantology, Daswani Dental College and Research center, Kota.

Criteria for Inclusion

1. Age:18 - 60 years.
2. Subjects with missing teeth/teeth for extraction in mandibular arch without any localized or generalized pathology in the implant region as determined by clinical history and radiographic evaluation.
3. Medically healthy subject.
4. For delayed implant placement, patients tooth extraction must have been done ≥ 3 months.
5. Radiologically adequate (10-12mm) mesio-distal, bucco-palatal/bucco-lingual span for implant placement.
6. Radiologically adequate bone height (08-15mm) for implant placement.
7. Cessation of all deleterious oral habits before, during and after the implant placement procedure and in the course of the follow up.
8. Fair oral hygiene maintained OHI -S and Gingival index.

Criteria for Exclusion

1. Medical history should reveal no chronic medical illness or debilitating systemic disorders such as diabetes mellitus, hypercoagulative or clotting disorders, liver or kidney disorders, etc. that may interfere with either the implant placement procedure or subsequent healing and osseointegration.
2. Pregnancy.
3. Periodontal diseases.
4. Mentally challenged subjects.
5. Immunocompromised subjects.
6. Allergies or hypersensitivity to drugs, antibiotics, anti-inflammatory and cortisone medications.
7. Dental history of bruxism, parafunctional habit and/or lack of stable posterior occlusion.
8. Insufficient bone quantity and quality as determined by clinical inspection and pre- operative radiographs and/or CBCT scan before implant placement.
9. Insufficient vertical inter-arch space to accommodate the prosthetic component. Patients with adverse oral habits such as smoking, tobacco and tobacco products chewing or alcohol consumption.

Presurgical Technique

After assessing the pre-treatment records, the presurgical procedure was start with the patient and scheduled for implant surgery after Phase I therapy. Facial skin all around the oral cavity was scrubbed with povidone iodine solution (5%), and the patient was made to rinse with 0.2% chlorhexidine digluconate mouthrinse for 1 min before surgery. The area of surgery was anesthetized using 2% lignocaine with adrenaline concentration of 1:80000.

Surgical procedure

The patient was prepared, draped and anesthetized under routine aseptic conditions with local Anaesthesia preferably infiltration using 2% lignocaine with adrenaline concentration of 1:80000 given buccally and lingually/ palatally to achieve anesthesia. A crestal incision with sulcular releasing incisions at adjacent teeth was given. In case of immediate implants (Group-A) mucoperiosteal flaps were raised to facilitate tooth removal and every effort was made to minimize trauma to crestal bone during extraction and implants were placed. Similarly, mucoperiosteal flaps were raised in healed sockets and implants were placed in (Group-B) patients. All implants were placed within alveoli confines and were ensured to be clinically stable at the time of insertion without the use of grafts and barrier membranes. Next, the gingival tissue was closed with interrupted sutures using 3-0 merksilk suture. Immediately after implant placement in each patient in both Groups the following parameters were measured which were used as baseline measurements - The distance from buccal bone to lingual bone using vernier caliper. Crestal height of bone - by radiovisiography with long cone paralleling technique using grid to measure the distance between apical end of first step of implant and most coronal point of interproximal crestal bone height. The baseline value to determine the amount of bone loss was interproximal crestal bone height measured immediately after implant placement. The following clinical parameter were recorded at baseline, 3 months and 6 months for both immediate and delayed dental placement procedure. The Oral Hygiene Index -Simplified and Gingival Index measured for the evaluation of oral hygiene status.

Statistical Analysis

The results were obtained after statistical analysis and the data of all clinical and radiographical parameters were as follow. Statistical analysis was done by using descriptive and inferential statistics using Student's paired and unpaired t test and software used in the analysis was SPSS 27.0 version and $p<0.05$ is considered as level of significance. Stastically result based on the analysis of available data.

Result

A total of 20 implants were placed in which (Immediate) Group A consists of 10 implants placed in fresh extraction sockets and (Delayed) Group B consists of 10 implant placed sites in healed socket. It was observed that mean differences in crestal bone height, buccolingual bone width, OHI S index, Gingival index at different periods of observations for both Group A and Group B recorded.

The mean difference in crestal bone height measurement at baseline,3 months, 6 months was statistically significant between Group A and Group B. The mean difference in crestal bone height measurement from baseline to 3 months, baseline to 6 months and between 3 to 6 months was not statistically significant between Group A and Group B given in table no 1 (Graph 1). The mean difference in buccolingual bone measurement at baseline,3 months, 6 months was statistically non-significant between Group A and Group B. The mean difference in buccolingual bone measurement from baseline to 3 months, 3 to 6 months significant change was found and baseline to 6 months was not statistically significant between Group A and Group B given in table no 2 (Graph 2). The mean difference in OHI-S index measurement there was significant change at baseline,3 months and at 6 months was statistically non-significant between Group A and Group B. The mean difference in OHI-S index from baseline to 3 months non-significant change was found and baseline to 6 months, 3 months to 6 months was statistically significant between Group A and Group B given in table no 3 (Graph 3).

The mean difference in Gingival index measurement there was significant change at baseline, 6 months and at 3 months was statistically non-significant between Group A and Group B. The mean difference in Gingival index from baseline to 3 months baseline to 6 months, 3 months to 6 months was non-significant change was found between Group A and Group B given in table no 4 (Graph 4).

Time Interval	Group A		Group B		t-value	p-value
	Mean	SD	Mean	SD		
Baseline-3 months	1.01	0.33	0.93	0.40	0.47	0.63, NS
Baseline-6 months	0.89	0.32	1.14	0.50	1.30	0.20, NS
3-6 months	0.12	0.24	0.21	0.48	1.90	0.07, NS

Table no 1 Comparison of mean difference in crestal bone height measurement in two groups Group A and Group B at baseline- 3 months, 3 months - 6 months and baseline – 6 months.

Time Interval	Group A		Group B		t-value	p-value
	Mean	SD	Mean	SD		
Baseline-3 months	0.63	0.40	0.01	0.65	2.62	0.017, S
Baseline-6 months	0.89	1.35	1.32	1.04	0.79	0.43, NS
3-6 months	0.26	1	1.33	1.23	2.12	0.047, S

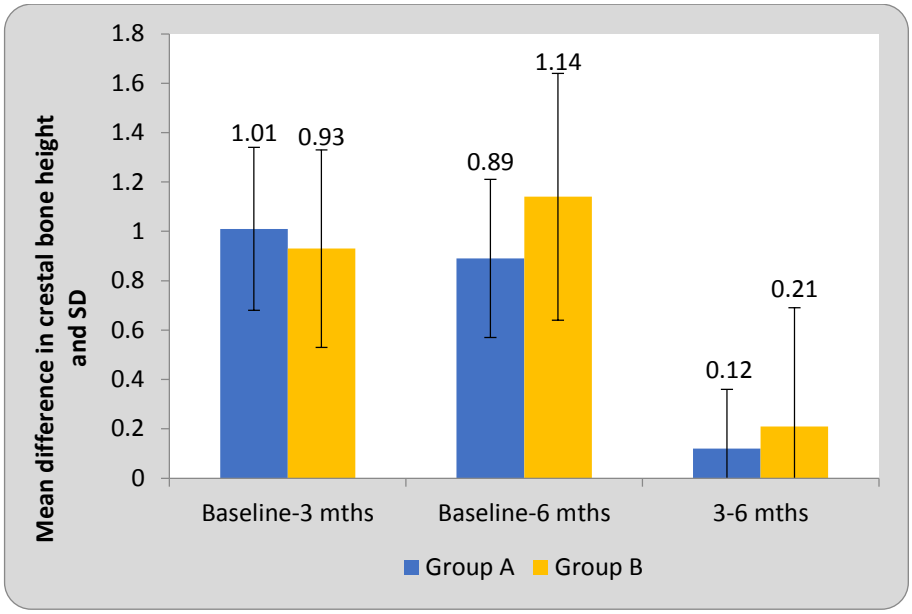
Table no 2 Comparison of mean difference in Buccolingual bone measurement in two group Group A and Group B at baseline - 3 months, 3 months - 6months and baseline - 6 months.

Time Interval	Group A		Group B		t-value	p-value
	Mean	SD	Mean	SD		
Baseline-3 months	0.08	0.75	0.27	0.63	0.60	0.55, NS
Baseline-6 months	0.12	0.66	0.63	0.57	2.70	0.015, S
3-6 months	0.04	1.02	0.90	0.81	2.26	0.036, S

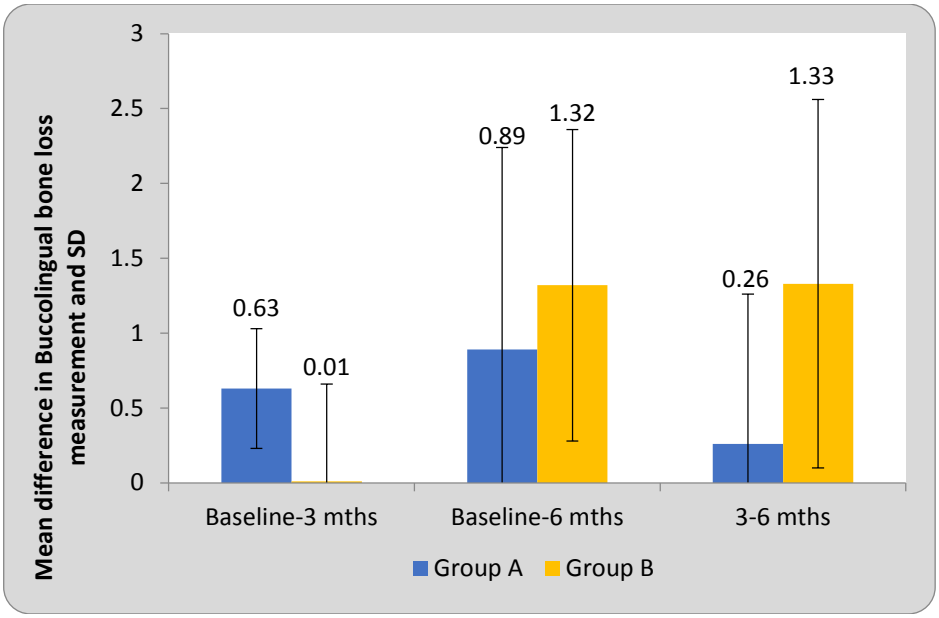
Table no 3 Comparison of mean difference in OHI Index Score in two groups Group A and Group B at baseline-3 months, baseline-6 months and 3 months – 6 months.

Time Interval	Group A		Group B		t-value	p-value
	Mean	SD	Mean	SD		
Baseline-3 months	0.29	0.50	0.19	0.26	0.55	0.58, NS
Baseline-6 months	0.23	0.51	0.33	0.39	0.48	0.63, NS
3-6 months	0.06	0.29	0.14	0.26	1.58	0.13, NS

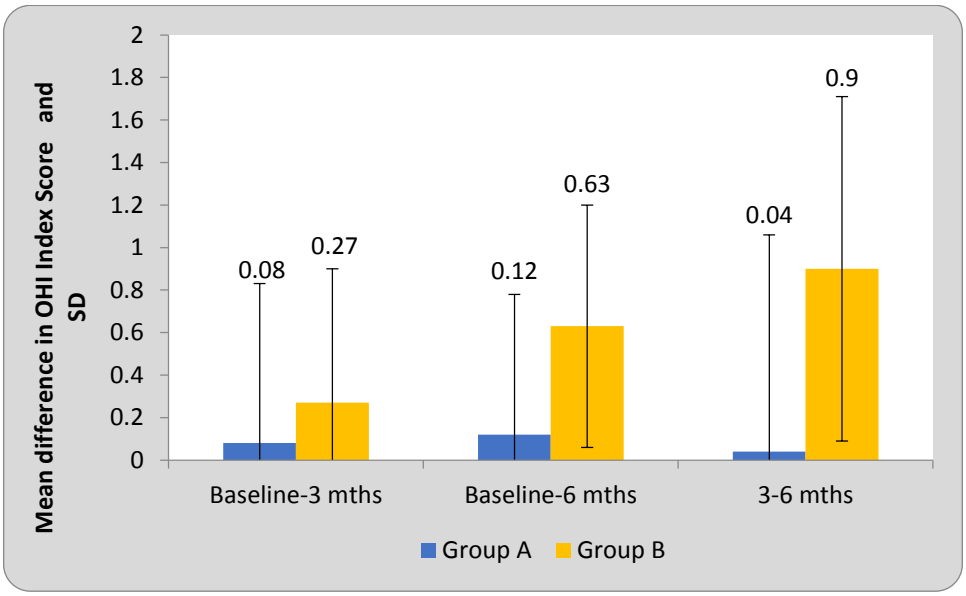
Table no 4 Comparison of mean difference in Gingival Index Score in two groups at baseline-3 months, baseline- 6 months. and 3 months-6 months.



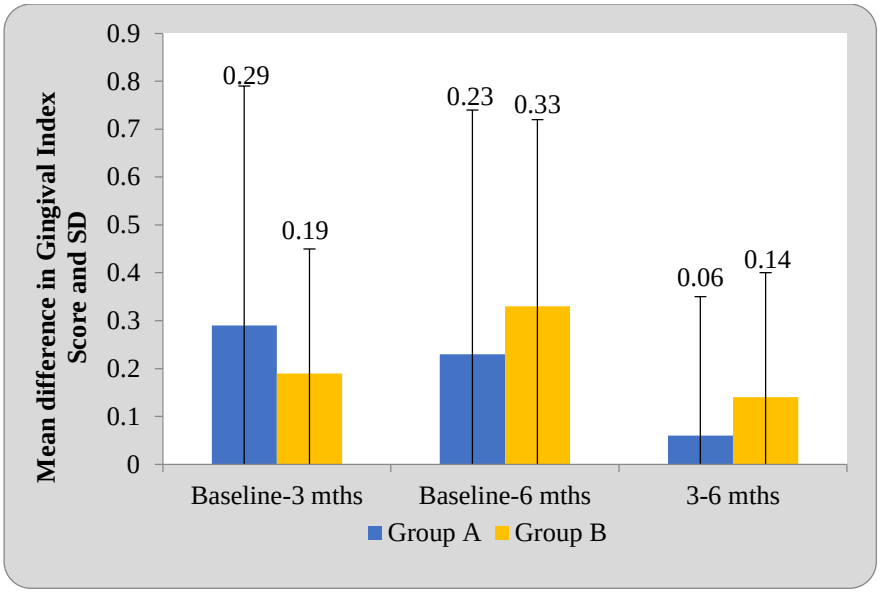
Graph 1 : Comparison of mean difference in crestal bone height measurement in Group A and Group B at baseline, 3 months and 6 months.



Graph 2: Comparison of mean difference in Buccolingual bone measurement in Group A and Group B at baseline- 3 months, 3 months- 6 months and baseline-6 months



Graph 3 : Comparison of mean difference in OHI Index Score in group A and groups B at baseline-3 months, 3 months – 6 months and baseline - 6 months



Graph 4: **Comparison of mean difference in Gingival Index Score in Groups A and Group B at baseline-3 months, baseline-6 months and 3 months- 6 months.**

DISCUSSION

The present study included patients reporting to the Department of Periodontics and Implantology, Daswani Dental College and Research Centre, Kota, Rajasthan for extraction or with a complaint of missing teeth. Medically healthy patients between 18-60 years of age group, with fair oral hygiene, Medically healthy subject, Radiographically adequate bone height, cessation of all habits were included in the study. Whereas, patients with Periodontal diseases, Immunocompromised subjects, Allergies or hypersensitivity to drugs were excluded from the study.

In the present study the evaluation of crestal bone height was measured with the help of Grid using software (Nanopix) in radiovisiographs, using long cone paralleling technique and XCP holder to measure the crestal bone loss around an implant. Buccolingual width was measured with the help of vernier caliper and clinical parameters, Gingival index and OHI – S index were recorded at baseline, 3 months and 6 months. All the patients were treated successfully without any complications and all of them completed the follow up. The 20 implant sites were found to be asymptomatic and without any evidence of mobility, pain and absence of radiolucency around the implant after 3 and 6 months. No implants were lost and the survival rate of dental implants in the present study was 100%. According to this study, there was greater reduction in crestal bone height in Group B due to bone loss as compared to Group A, The results for crestal bone height measurement are in accordance with the study done by **Akshara M Shitole, Dr Pradeep Shukla, Dr. Prerna Kataria (2022)**[7] **& Chuang SK (2005)**[8] In contrast, according to study done by **Guruprasada *et al*. in (2013)23 S.** according to the results of the present study was no significant difference in crestal bone loss around implants placed with immediate and delayed techniques**.**

Buccolingually, Group B exhibited more bone loss as compared to Group A, The results for buccolingual width are in accordance with the study done by **Covani, Cornelini and Barone (2004)**[11] in which delayed group exhibited more marked osseous recontouring. It can be speculated that early remodeling may start immediately after tooth extraction and continue, non-uniformly, even after delayed implant placement. In contrast, according to **Covani et al (1993)**[11] the buccolingual ridge alterations occurring in delayed implants were found to be similar when compared to the bone loss found in immediate implants.

The OHI-S index in this study, showed significant result and higher values in Group B compared to Group A. The results are in accordance with the study done by **Hilario Pellicer-Chover, David Peñarrocha-Oltra et al (2013)[12]** in which higher values seen for delayed implant placement than immediate implant. While, **Santhosh Sekar, Thangakumaran Suthanthiran et al (2019)[13]** demonstrated no statistically significant difference in both the group A and group B.

The Gingival index in this study exhibited no changes in both the group A and group B. **Santhosh Sekar, Thangakumaran Suthanthiran (2019)[13]** also reported no statistically significant difference in both the groups, but **Hilario Pellicer-Chover, David Peñarrocha-Oltra et al (2013)[12]** was slightly higher among immediate implant placement than delayed implant placement.

CONCLUSION

This study concluded that immediate implant placement is significantly better than delayed implant placement. Preservation of crestal bone with prevention of collapse of the architecture of gingiva is achieved through immediate implant placement. The therapy time, preservation of esthetically acceptable gingiva as well as enhanced patient comfort is among the other advantages. Although the cases dealt in this study are not numerous the data suggest that the healing in both groups are equally good. Hence, we should opt for the immediate placement of the implants. It will preserve the bone and prevent the collapse of the gingival architecture. It also reduces the treatment cost, time, preserves the gingival esthetics, and increases the comfort of the patient.

Bibliography

1. Ashish Bali, Mrinal Jindal, Amit Goel et al Comparative Evaluation of Clinical and Radiographical Outcomes of Immediate Versus Delayed Dental Implant Placement: A Prospective Study Indian Journal of Dental Sciences 2019 Volume 11 Issue 3 July-September.

2. CONTEMPORARY IMPLANT DENTISTRY ISBN: 978-0-323-04373-1 Third Edition Copyright © 2008, 1999, 1993.

3. P.K. Sasi Kumar, Abinaya Ravikumar Clinical and Radiographic Evaluation of Immediate and Delayed Single-tooth Implant Placement: An 18-month Follow-up Study J Periodontol Implant Dent 2013;5(2):41–54.

4. Kanika Mohindra Comparative Evaluation of Crestal Bone Changes after Delayed and Immediate Implant Placement Dent Implants Dentures 2: 120 Volume 2 • Issue 2.

5.T. Albrektsson, P.-I. BR.&NEMA OSSEOINTEGRATED TITANIUM IMPLANTS Acta orthop. scand. 52, 155-170, 1981.

6. Ron Doornewaard, Veronique Christiaens et al Long-Term Effect of Surface Roughness and Patients' Factors on Crestal Bone Loss at Dental Implants. A Systematic Review and Meta- Analysis Clinical Implant Dentistry and Related Research, 2016, Volume 00, Number 00.

7.Akshara M Shitole, Dr Pradeep Shukla Comparative evaluation of crestal bone changes in immediate and delayed placement of dental implant: A clinic radiographical study International Journal of Medical and Biomedical Studies Volume 6, Issue 01; January: 2022; Page No. 87-97.

8.Pirker W, Kocher A. Immediate, non-submerged, root analogue zirconia implants placed into single-rooted extraction sockets: 2-year follow-up of a clinical study. International journal of oral and maxillofacial surgery. 2009 Nov 1;38(11):1127-32.

9. Schultes G, Gaggl A. Histologic evaluation of immediate versus delayed placement of implants after tooth extraction. Oral Surgery, Oral Medicine, Oral Pathology, Oral Radiology, and Endodontology. 2001 Jul 1;92(1):17-22.

10. Maj Guruprasada, Maj Gen G.K. Thapliyal, Brig V.R. Pawar et al A comparative analysis of periimplant bone levels of immediate and conventionally loaded implants medical journal of armed medical force India 69 (2013) 41 e47.

11.Ugo Covani, Roberto Crespi, Roberto Cornelini Immediate implant loading supporting single crown restoration, A 4-year prospective study J Periodontol 2004 Volume 75 number 7.

12. Wilson GT, Weber HP. Classification of and therapy for areas of insufficient bony housing prior lo dental implant placement. Journal of Periodontology and Restorative Dentistry. 1993:13:451-459. Page | 86

13. Hilario Pellicer-Chover, David Peñarrocha-Oltra et al Single-blind randomized clinical trial to evaluate clinical and radiological outcomes after one year of immediate versus delayed implant placement supporting full-arch prostheses J Pharm Bioallied Sci. 2019 May; 11(Suppl 2): S278–S284.