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A Comparative Evaluation of Soft Tissue Changes Around Two Piece Delayed Loaded Implant in One Stage versus Two Stage Implant Surgery Procedure: A Clinico-Radiographic in Vivo Study

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Abstract

Statement of problem: Various studies have been conducted to compare the soft-tissue changes between one-stage and two-stage implant surgery procedure but the relation of soft tissue and aesthetics with the type of surgical procedure is yet to be studied.

Purpose of study: The purpose of the present study was to evaluate the soft-tissue changes around one-stage versus two-stage implants both radiographically and clinically to assess the success of implants.

Material and methods: Twenty edentulous sites for implant placement were selected from patients in the age range of 18- 51 years. They were randomly assigned to two equally sized groups respectively for one-stage and two-stage implant surgery procedure. After placement of implants, all the sites were evaluated for soft-tissue outcome

using standardized indices. Patient satisfaction was analyzed using visual analog scale (VAS) and aesthetic outcome was observed by 3 blind observers. All the follow ups were done after implant placement (T_0), at 3 months (T_1) and 6 months after loading (T_2). Any changes in soft tissue dimensions were also assessed on CBCT with the help of a prepared stent.

Results: The collected experimental datasets were compared between one-stage and two-stage implant surgical procedures. Inter-group comparisons of One-stage Vs Two-stage implant surgical procedure among the variables showed a non-significant result. Patient Compliance scores and Aesthetic outcome by blind observers also showed non-significant differences.

Conclusions: Within the limitations of the study, it was concluded that there were no significant differences with respect to soft-tissue outcome, patient compliance and aesthetic outcome

Keywords: Co-Morbidities, Implant Placement, Surgical Procedure, Tissues

Clinical Implications

This study will help clinically which surgical protocol to be adopted in which situations and regarding the soft tissue outcome of different surgical protocols of implant placement.

Introduction

Dental implant is one of the best choices for reconstruction of aesthetics and function. Its high success rate is related to case selection, implant system selection and surgical methods opted. One-stage or two-stage surgical approaches are routine surgical methods in dental implant placement. The minimum rate of bone loss around fixtures is the most important criteria for evaluation of implant success that can be affected by the surgical approach opted.[1] Soft and hard tissue maintenance, as well as the ability of the dental team to diagnose and predictably reconstruct these tissues where they are lacking, aids in preventing aesthetic implant failures. Patients today seek a quicker approach for achieving tooth replacement and aesthetic results. Achievement of osseointegration, however, does not always correlate to a successful aesthetic outcome. Comprehensive treatment planning from the outset and understanding the specific values, needs, and expectations of the patient are essential for an overall successful result. To avoid unexpected disappointments, prior to any surgery, clinicians need to share with the patient the case-specific limitations upon treatment based on the patient's clinical presentation and aesthetic concerns. A comprehensive analysis (i.e, periodontal, caries, radiographic, and occlusal) is needed to establish a correct diagnosis and prognosis for each tooth when devising the treatment plan. Necessary caries control, endodontic, periodontal, and orthodontic therapies should be properly sequenced based on the patient's treatment goals.[2] The original Brånemark protocol calls for a two-stage approach where-in, the implant is placed at the first-stage, countersunk to subcrestal position and covered with tissue during the osseous healing period. Reasons for using this approach are to minimize the risk of infection, prevent apical growth of the mucosal epithelium, and minimize the risk of undue early transmucosal loading.[3] Implants may be placed penetrating the oral mucosa (1 stage procedure) or can be completely buried under the oral mucosa (2 stage procedure) during the healing phase of the bone at the implant surface. With 2 stage procedure, the risk of having unwanted loading onto the implants is minimized, but a second minor surgical intervention is needed to connect the healing abutments and more time is needed prior to start the prosthetic phase because of the wound healing period required in relation to the

second surgical intervention.[4] Healthy soft tissue surrounding a dental implant is essential for successful implant restoration. This success includes the establishment of health, function, and aesthetics. Different aspects of soft-tissue healing, implant design, and maintenance of soft tissue around dental implants need to be considered before implant placement. The success of dental implants is dependent on the establishment of a soft-tissue barrier that is able to shelter the underlying osseous structures and the osseointegration surrounding the implant body. The aesthetics of a dental implant prosthesis depends on the health and stability of the peri-implant mucosa. Understanding of soft-tissue healing and maintenance around dental implants is paramount for implant success.[5] The aim of the present study was to evaluate the soft tissue changes around one-stage versus two-stage implants, both radiographically and clinically to assess the success of implants. The present study was done with the objective to determine which procedure is better for soft tissue esthetics. The proposed null hypothesis of this study is that "There is no relation between soft tissue changes and type of surgical procedure for implant placement within a specified period of time."

Materials and Methods

Implant surgical procedure by both one-stage and two-stage surgery are routinely performed nowadays. Which procedure is better for soft tissue esthetics should be checked experimentally. This study was performed on partially edentulous male and female patients of a private dental institute in the age range of 18 to 51 years. Written informed consent in 3 languages (English, Hindi, Bengali) was taken after explaining the need for the study. The study protocol was approved by the Institutional Ethics Committee (IEC). The study was conducted over a period of 18 months. Twenty edentulous sites for implant placement of either sex, who fulfilled the under mentioned inclusion and exclusion criteria, were selected.

Inclusion criteria

Partially edentulous situation irrespective of any specific region of the arch, patient above 18 years of age, two-piece implant system of a specific company, sufficient keratinized gingiva (>2 mm on either side of incision), delayed loading of implants for all selected cases.

Exclusion criteria

Patients with co-morbidities, cases with the necessity of gingival grafts, cases with irradiation in the head and neck region, pregnant or nursing patients, immunocompromised patients, subjects undergoing psychiatric therapy, patients with untreated periodontal diseases, patients with severe bruxism or clenching, patients with poor oral hygiene and motivation, smokers were excluded.

After proper clinical and radiographic assessment, 20 patients were prepared for implant placement, divided into two groups respectively for one-stage and two-stage implant surgery procedure. A standardized implant system was used for all the cases. 10 patients who were selected for two-stage surgical procedure were called after 3 months for the second surgery when the cover screw was replaced with the gingival former and left for 15 days for the healing procedure. All the implants were loaded after 3 month 15 days including the one-stage implant cases. After 6 months of loading, the patients were called for follow up. Clinical and radiographic data was collected during each appointment.

Study variables

Subsequent to implant placement, soft tissue changes were checked and compared.

Soft tissue criteria - bleeding on probing, mobility,

papilla dimensions, Marginal Mucosa Level (MML), measurement of peri-implant attached gingiva (height and width).

Other criteria - patient compliance and esthetic assessment by blind observers.

Case history was recorded and a parameter sheet for data collection was prepared. Cases selected from the Out Patient Department (OPD) of the institute were prepared for implant placement after proper diagnostic impression making and model fabrication followed by proper articulation of the models on a mean value articulator in maximum intercuspal position (MIP). A complete blood picture (Hemoglobin % (Hb%), Total count (TC), Differential count (DC), Erythrocyte Sedimentation Rate (ESR), Prothrombin Time (PT), Activated Partial Thromboplastin Time (APTT), Bleeding Time (BT), Clotting Time (CT), Blood Sugar fasting and Post Prandial (PP)) was taken. The preoperative radiological investigations were also done including Intraoral Periapical Radiograph (IOPAR), Orthopantomogram (OPG) and Cone Beam Computed Tomography image (CBCT). The preoperative extraoral and intraoral clinical photographs were also recorded. A clear heat cured acrylic surgical guide for the implant placement with a hole in the preplanned site was prepared for each case. A separate cold cure resin stent was fabricated for the purpose of measurement of peri-implant attached gingiva (height & width) under CBCT images.

For the purpose of standardization, a single implant system (Implant Genesis, Kerala, India) was used. For implant placement, the following steps were followed -

Subsequent to a crestal incision full thickness mucoperiosteal flap was raised. Osteotomy site was prepared with sequential drilling till the required size. Implant was placed in the position with proper angulation. Gingival former or cover screw was placed according to the study requirements. Sutures were given with 5028 3-0 Mersilk.

The first follow up visit was performed for the suture removal i.e., after 7 days of implant surgical procedure. Each case was studied 3 times respectively at a fixed time interval i.e., at the time of implant placement (T_0), 3 months after implant placement (T_1) and 6 months after loading of implant (T_2). In all the follow up appointments, clinical photographs were taken and the selected soft tissue criteria were measured with the help of specific indices and equipment. The radiographs were also repeated at each follow up i.e., T_0, T_1 & T_2.

Method of data collection

The data collection sheet or Parameter Sheet was formulated and data was collected accordingly.

Soft tissue criteria- Table 1 (Citation 6-10)

Other Criteria

Patient Compliance: Recording dental patient satisfaction should be a priority for clinicians as it is essential to improve clinical outcomes. The factors influencing satisfaction of the patients with implant treatments are still unclear. A questionnaire survey was performed to assess patient satisfaction and data was collected at four times intervals. The questionnaire covered participants' information including name, gender, age and their satisfaction score was based on a visual analog scale of 1–5. The oral implant impact profile questionnaire (OIIP-Q), contained 15 questions (Q1–Q15) related to satisfaction with the dental implant. All participants were asked to disclose the level of impact on visual analog scales where '1' = unsatisfaction to '5' = satisfaction.[11]

Aesthetic outcome: Fürhauser and colleagues[12] developed the Pink Esthetic Score (PES) for evaluating the soft tissue around single-tooth implant crowns. They objectively assessed the aesthetic outcome of the soft

tissues contouring a dental implant restoration, addressing crucial problems that are easily overlooked in a general assessment. The PES criteria are based on 7 variables: mesial papilla, distal papilla, soft-tissue level, soft tissue contour, alveolar process deficiency, soft-tissue color, and texture. Each variable is given a score of 2, 1, or 0 with 2 as the best score and 0 as the worst score, for a maximal possible score of 14.[13]

In this study, assessment of clinical aesthetic criteria was performed by 3 blind observers. The average score was then considered for statistical evaluation.

Study Flowchart- Table 2

Results and Analysis

All the selected soft tissue criteria were evaluated according to the standardized methods. Digital OPGs were performed using Vatech PAX-I OPG machine, CBCT images were acquired with MyRay Skyview 3D CBCT machine and RVGs were performed using Carestream RVG CS 5200 & Carestream Dental Software. Panoramic images were analyzed on EzDent-i software and CBCT images were analyzed on NNT viewer software. Any changes in soft tissue dimensions were assessed on CBCT with the help of the prepared stent. Radiographic data was collected from CBCT and the various soft tissue criteria datasets were collected with help of standardized indices. The collected experimental datasets were compared between one-stage and two-stage implant surgical procedures.

For statistical analysis, data was entered into a Microsoft excel spreadsheet and then analyzed by SPSS (v 27.0; SPSS Inc). For Graphs 'M.S +variables' was used. Inter-group comparisons of Stage 1 Vs Stage 2 were done with the help of Mann-Whitney U test. Mean comparison of Patient Compliance scores and Aesthetic outcome between Stage 1 and Stage 2 was also performed with the help of Mann-Whitney U test. P-value ≤ 0.05 was considered as statistically significant.

Table 3 along with the Figure 1 shows Inter-group comparisons of One-stage Vs Two-stage implant surgical procedure among the variables. All the comparisons showed a non-significant result (P>0.05).

Table 4 along with the Figure 2 shows Mean comparison of Patient Compliance scores between One-stage and Two-stage cases. According to the patient compliance scores, One-stage and Two-stage case showed non-significant differences (P>0.05).

Table 5 along with the Figure 3 shows Mean comparison of Aesthetic outcome between One-stage and Two-stage cases by blind observers. According to the Aesthetic outcome scores given by blind observers, One-stage and Two-stage case showed non-significant differences (P>0.05).

Discussion

During the past few years, replacement of the missing teeth with dental implants has become a crucial part of modern dental practice. Dental implants have transformed the treatment options for replacement of missing teeth. Implants improve quality of life for patients who are unable to keep their natural teeth, fix acute problems, and give patients the benefit of restorative improvements for a modern lifestyle.[14] The success of an implant-supported prosthesis is dependent on several factors and classically defined according to criteria, which mainly focus on osseointegration and the amount of radiographic bone loss. Although these factors are indispensable elements of implant success, they often fail to objectively evaluate all aspects of treatment outcomes, particularly of the implants placed in esthetically demanding areas. Dental implants are commonly used not just to provide patients with function but also form and esthetics. Therefore, an accurate

assessment of success inevitably involves objective and patient-reported esthetic evaluation of the treatment outcomes.

Patient satisfaction, which indicates the success of the implant treatment from the patient's perspective, is another important outcome measure and is commonly performed with questionnaires or a visual analog scale (VAS). A current review of the literature, however, reveals only a limited number of studies reporting on patient-centered outcomes in addition to objective evaluations of implant-supported rehabilitations in the anterior maxilla. Among these, few studies previously reported that objective assessments may fail to reflect subjective patient outcomes. Therefore, this study aims to investigate and report objective and patient-reported esthetic outcomes and how well they correlate for single-tooth implant restorations.[15]

In this study, the inter-group comparisons between different variables of one-stage vs two-stage cases showed non-significant results (Table 1). DeAngelo SJ et al (2007) found that peri-implant soft tissue clinical maturity may be established as early as 4 weeks following implant placement by a one-stage surgical protocol. There was no statistically significant association between flap thickness or papillary height and number of implant bleeding sites at 12 weeks ($P > 0.05$).[16] So according to the study, BOP should be very much obvious in case of one-stage surgical procedure within one month of implant placement. In this study assessment was done at 3 months after implant placement (T_1) and 6 months after loading (T_2) for follow up, when few cases showed positive results for BOP, which supports the findings of their study. Chaushu L et al (2020) revealed that there were no significant demographic differences between the one- and two-stage implant placement groups,[17] a conclusion that was similar to this study outcome. Esposito M et al (2009) showed no statistically significant differences for prosthesis and implant failures between the different procedures.[4] The findings of this study are similar to the above mentioned study. Gülay G et al (2012) evaluated the primary stability of 1-stage (nonsubmerged) and 2-stage (submerged) implants via newest wireless resonance frequency (RF) analyzer and newer wireless mobility measuring (MM) device. Both wireless RF analyzer and wireless MM device were adequate in assessing implant stability. There was no difference between 2-stage and 1-stage implant systems, except lower MM values were noted for non-submerged implants.[18] Their study result was also consistent with this study though they had used advanced RF analyzer for assessment of mobility. Newer wireless mobility measuring (MM) device may not be so reliable which may lead to the lower MM values for non-submerged implants. Chang M et al (1999) stated that the anatomy of implants and teeth is substantially different and has a profound influence on the height of the papilla. Compared to natural teeth, the papillae at implant sites are reported to be significantly shorter.[19] In this study, the mean score was noted to be between 2.10-2.70 i.e. the papilla height filled more than half of the interproximal space but not up-to the contact point (Table 1). van Kesteren et al. (2010) obtained MML by measuring the distance between the apical-coronal position of the mid-buccal marginal mucosa and a reference line crossing the CEJ of adjacent teeth. In the study by van Kesteren et al., MML analysis was carried out before (baseline) and at six months after tooth extraction (follow-up) indicating that most of the recession occurred within the first three months. Nonetheless, no significant differences between groups were found at any time-point ($p = 0.170$).[20] This study

shows a result consistent with the above study though they included immediate loading cases. Torkzaban P et al (2015) evaluated and compared the radiographic bone loss and soft tissue parameters around one stage and two stage implants. Twenty four patients with submerged implants and twenty four patients with non-submerged implants at the time of loading were assessed in this prospective cohort study. The soft tissue assessment included probing depth (PD), papilla index (PI), mucosal thickness (MT) and keratinized tissue (KG); another parameter assessed was the radiographic distance between the shoulder of the implant and alveolar crest evaluated at baseline (loading time) and 3,6 and 12 months after loading in both groups. The changes in the soft tissues including PD, KG, MT and PI had no significant differences in either group. Based on the results of this study there was no difference in hard and soft tissue changes one year after loading of one or two stage implants.[21]

The Mean comparison of Patient Compliance scores between One-stage and Two-stage cases showed non-significant differences (P>0.05) (Table 2). Esposito M et al (2009) found no statistically significant difference between the two procedures, however trends suggested less implant failures with the 2-stage (submerged) approach especially in fully edentulous patients and 1-stage approach that might be preferable in partially edentulous patients since it avoids one surgical intervention and shortens treatment times.[4] Similarly non-significant differences were observed between one-stage and two-stage cases in this study, though in the above mentioned study they had clearly differentiated the preferred choice of surgical procedure according to the partial or complete edentulism of the patients. Dong H et al (2019) stated that bone augmentation and the period of teeth loss are negative factors affecting patient satisfaction, and the success rate and survival time of implants are considerable aspects for patients.[11]

In this study, the Mean comparison of Aesthetic outcome between One-stage and Two-stage cases by blind observers showed non-significant differences (P>0.05) (Table 3). Alfaer AS et al (2023) stated that one-stage surgery provides aesthetics sooner but carries the risk of implant overloading during the healing phase. On the other hand, two-stage surgery, the traditional approach, offers a higher success rate and allows for optimal osseointegration.[22] In contrary, this study shows no preference regarding aesthetic outcome for different stages by the blind observers. This discrepancy of results may be due to the fact that the study was based on a comprehensive literature search conducted on 22 May 2023, in the Medline, PubMed, and Cochrane databases, utilizing the medical topic headings (MeSH) and a combination of all available related terms, according to the database. Cordaro L et al (2009) reported that there were no differences in soft tissue recession around post extractive single implants when using a submerged or non-submerged technique. The authors also evaluated changes in keratinised tissue height and found that at the 1-year follow up, there was statistically significant less keratinised tissue (1.1 mm) around implants placed according to a 2-stage technique,[23] a result consistent with this study.

Conclusion

The present study was conducted with an attempt to assess if there is any difference between one stage versus two stage surgical procedure of implant placement regarding soft tissue assessment and esthetic outcome. The conclusions drawn from the analysis of the results in this study state that –

1. Inter-group comparisons of One-stage Vs Two-stage implant surgical procedure among the variables showed a non-significant result (P>0.05).

2. Mean comparison of Patient Compliance scores between One-stage and Two-stage cases showed non-significant differences (P>0.05).

3. Mean comparison of Aesthetic outcome between One-stage and Two-stage cases by blind observers showed non-significant differences (P>0.05).

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Legend Tables and Figures

Table 1: Soft tissue criteria

Criteria	How assessed:
Bleeding on probing (BOP)	By bleeding index of Mombelli & Lang[6]
Mobility	By clinical implant mobility scale of Misch & Silc[7]
Papilla dimensions	By papilla index of Jemt / Papilla Fill Index (PFI)[8]
Marginal Mucosal Level (MML)	By scoring (score 0 = no difference in gingival level; score 1 = <1 mm difference; score 2 = <2 mm difference; score 3 = <3 mm difference; and 4 = differences >3 mm)[9]
Measurement of peri-implant attached gingiva (height & width)	With the help of a stent/acrylic plate under CBCT images and clinically with periodontal probe and endodontic file.[10]

Table 2: Study flowchart

One-Stage Cases	Two-Stage Cases
Initial diagnostic radiographs (CBCT) and clinical photographs were taken. Placement of implants (T_0) was performed. Gingival former placed over the fixture (non-submerged).	Initial diagnostic radiographs (CBCT) and clinical photographs were taken. Placement of implants (T_0) was performed. Cover screw placed over the fixture and primary closure done.
3 months after implant placement (T_1) - no second surgery was performed. All the sites were re-examined clinically and radiographically. Impression procedures were undertaken.	3 months after implant placement (T_1) - a second surgery was performed to remove the cover screw and for placement of gingival former/ healing abutment. After 2 weeks, (for healing) prosthetic procedures were commenced. All the sites were re-examined clinically and radiographically.
Delayed loading of implants was achieved. 6 months after loading (T_2), all the sites were re-examined clinically	Delayed loading of implants was achieved. 6 months after loading (T_2), all the sites were re-examined clinically

Table 3: Inter-group comparisons of STAGE 1 Vs STAGE 2

Variables/Duration	Stage	N	Mean	SD	Mean difference	P value	Result
BOP T1	Stage 1	10	0.10	0.32	0.00	1.000	Not significant
	Stage 2	10	0.10	0.32			
BOP T2	Stage 1	10	0.00	0.00	0.00	1.000	Not significant
	Stage 2	10	0.00	0.00			
Mobi T1	Stage 1	10	0.00	0.00	0.00	1.000	Not significant
	Stage 2	10	0.00	0.00			
Mobi T2	Stage 1	10	0.00	0.00	0.00	1.000	Not significant
	Stage 2	10	0.00	0.00			
PD T1	Stage 1	10	2.50	0.53	-0.40	0.208	Not significant
	Stage 2	10	2.10	0.74			
PD T2	Stage 1	10	2.70	0.67	0.00	1.000	Not significant
	Stage 2	10	2.70	0.67			
MML T1	Stage 1	10	1.40	0.52	0.00	1.000	Not significant
	Stage 2	10	1.40	0.52			
MML T2	Stage 1	10	0.90	0.32	0.40	0.161	Not significant
	Stage 2	10	1.30	0.95			

AG (H) T0	Stage 1	10	2.55	0.93	-0.40	0.280	Not significant
	Stage 2	10	2.15	0.58			
AG (H) T1	Stage 1	10	2.20	0.98	-0.45	0.337	Not significant
	Stage 2	10	1.75	0.59			
AG (H) T2	Stage 1	10	1.95	0.80	-0.25	0.455	Not significant
	Stage 2	10	1.70	0.59			
AG (W) T0	Stage 1	10	1.20	0.26	-0.15	0.240	Not significant
	Stage 2	10	1.05	0.28			
AG (W) T1	Stage 1	10	0.95	0.28	0.05	0.654	Not significant
	Stage 2	10	1.00	0.24			
AG (W) T2	Stage 1	10	0.95	0.28	0.00	0.957	Not significant
	Stage 2	10	0.95	0.16			

Statistical Analysis: Mann-Whitney U test. Statistically significant if $P \leq 0.05$

Table 4: Mean comparison of Patient Compliance scores between Stage 1 and Stage 2.

Questions	Stages	N	Min	Max	Mean	SD	Mean difference	P value	Result
Q1	Stage 1	10	3	5	4.40	0.70	0.00	1.000	Not significant
	Stage 2	10	3	5	4.40	0.70			
Q2	Stage 1	10	3	5	4.50	0.71	-0.50	0.154	Not significant
	Stage 2	10	3	5	4.00	0.82			
Q3	Stage 1	10	3	5	3.70	0.67	0.40	0.154	Not significant
	Stage 2	10	3	5	4.10	0.57			
Q4	Stage 1	10	3	5	4.20	0.79	-0.20	0.510	Not significant
	Stage 2	10	3	5	4.00	0.67			
Q5	Stage 1	10	3	5	4.00	0.82	0.20	0.573	Not significant
	Stage 2	10	3	5	4.20	0.79			
Q6	Stage 1	10	3	5	4.20	0.92	-0.50	0.186	Not significant
	Stage 2	10	3	5	3.70	0.67			
Q7	Stage 1	10	3	4	3.20	0.42	0.30	0.170	Not significant
	Stage 2	10	3	4	3.50	0.53			
Q8	Stage 1	10	4	5	4.40	0.52	-0.20	0.483	Not significant
	Stage 2	10	3	5	4.20	0.63			

Q9	Stage 1	10	3	5	4.10	0.74	0.30	0.344	Not significant
	Stage 2	10	3	5	4.40	0.70			
Q10	Stage 1	10	3	5	3.90	0.74	0.10	0.737	Not significant
	Stage 2	10	3	5	4.00	0.67			
Q11	Stage 1	10	3	4	3.40	0.52	0.40	0.075	Not significant
	Stage 2	10	3	4	3.80	0.42			
Q12	Stage 1	10	3	5	4.10	0.88	-0.10	0.706	Not significant
	Stage 2	10	3	5	4.00	0.47			
Q13	Stage 1	10	3	5	3.80	0.79	0.60	0.091	Not significant
	Stage 2	10	3	5	4.40	0.70			
Q14	Stage 1	10	3	4	3.80	0.42	0.00	0.925	Not significant
	Stage 2	10	3	5	3.80	0.63			
Q15	Stage 1	10	3	5	4.30	0.82	-0.20	0.516	Not significant
	Stage 2	10	3	5	4.10	0.74			

Statistical Analysis: Mann-Whitney U test. Statistically significant if P≤0.05

Table 5: Mean comparison of Aesthetic outcome between Stage 1 and Stage 2.

Variables	Stages	N	Min	Max	Mean	SD	Mean difference	P value	Result
Mesial Papilla	Stage 1	10	1	2	1.40	0.21	0.03	0.837	Not significant
	Stage 2	10	1	2	1.43	0.32			
Distal Papilla	Stage 1	10	1	2	1.40	0.31	0.03	0.905	Not significant
	Stage 2	10	1	2	1.43	0.32			
Tissue Contour	Stage 1	10	1	2	1.67	0.27	-0.17	0.203	Not significant
	Stage 2	10	1	2	1.50	0.24			
Gingival Level	Stage 1	10	1	2	1.47	0.28	-0.10	0.521	Not significant
	Stage 2	10	1	2	1.37	0.29			
Alveolar Process	Stage 1	10	1	2	1.17	0.24	0.16	0.188	Not significant
	Stage 2	10	1	2	1.33	0.31			
Coloring	Stage 1	10	1	2	1.30	0.37	0.13	0.406	Not significant
	Stage 2	10	1	2	1.43	0.39			
Texture	Stage 1	10	1	2	1.47	0.28	0.06	0.562	Not significant
	Stage 2	10	1	2	1.53	0.24			

Statistical Analysis: Mann-Whitney U test. Statistically significant if P≤0.05

Figure 1: Inter-group comparisons between STAGE 1 & STAGE 2 variables

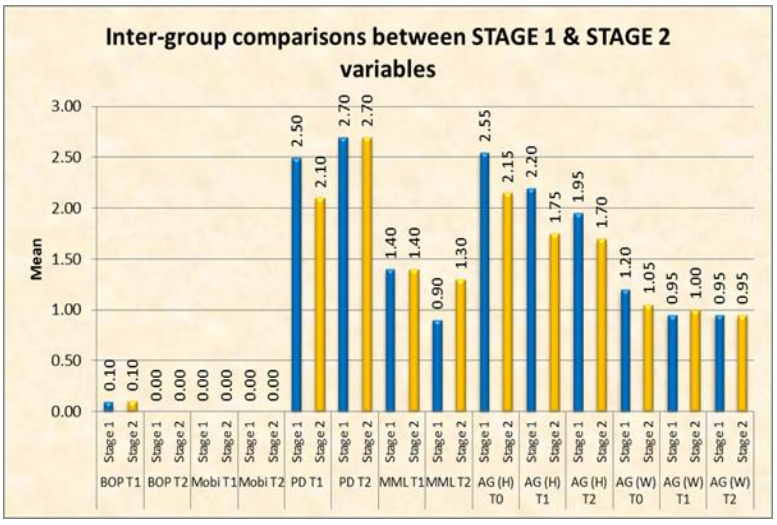

Figure 2: Mean comparison of Patient Compliance scores between Stage 1 and Stage 2

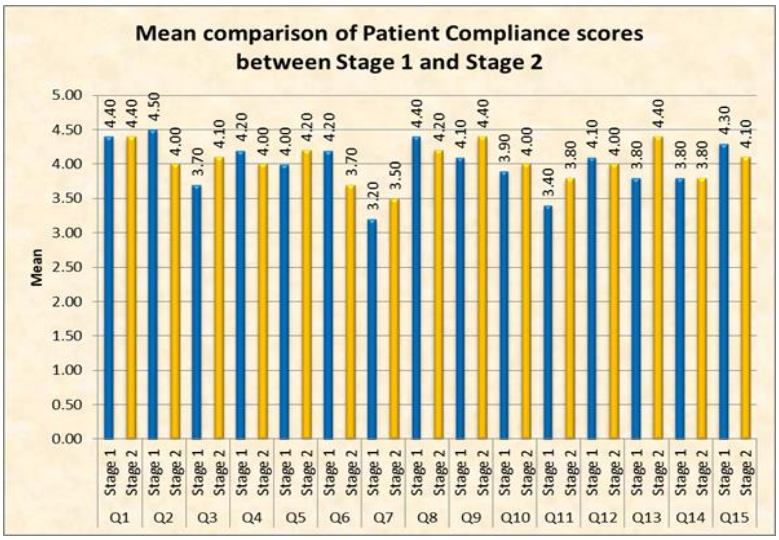

Figure 3: Mean comparison of Aesthetic outcome between Stage 1 and Stage 2

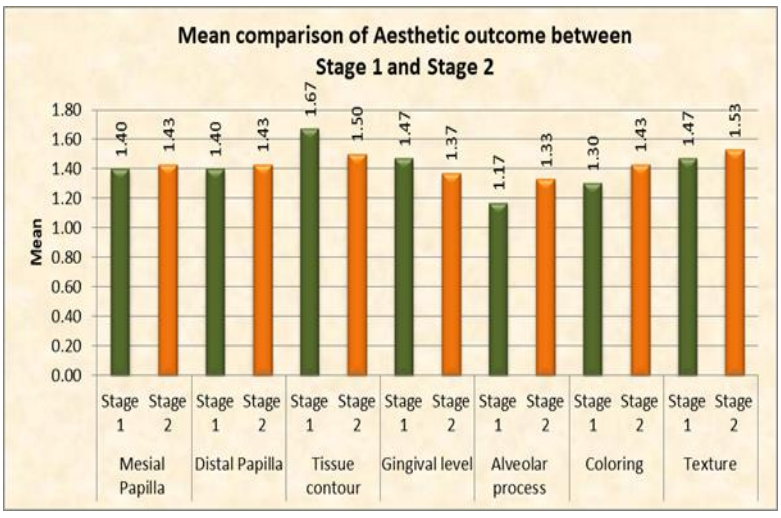

Figure 4: Implant Kit

Figure 5: Surgical Guide

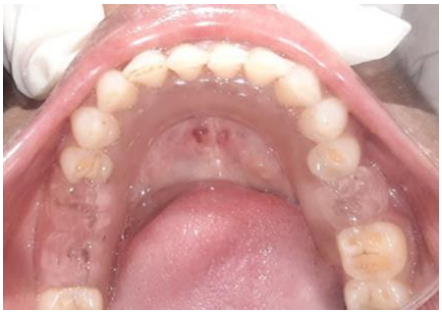

Figure 6: Stent (to be used along with CBCT)

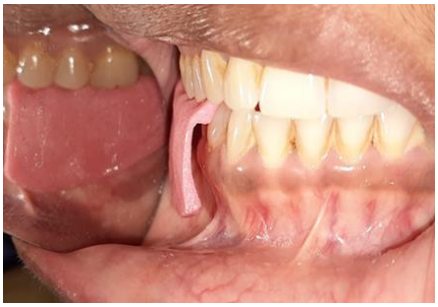

Figure 7: T_0 CBCT

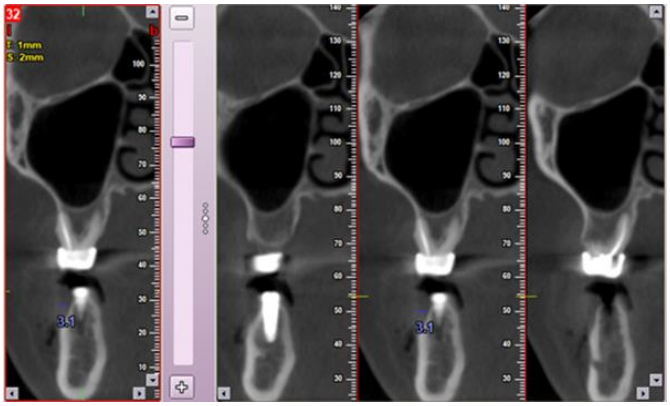

Figure 8: T_1 CBCT

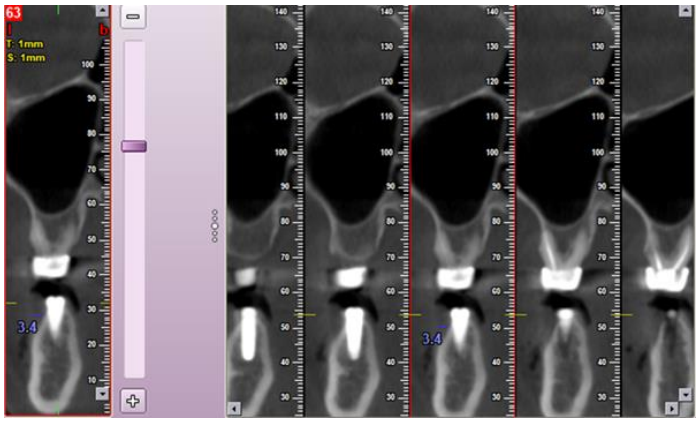

Figure 9: T_2 CBCT

Figure 10: Measurement of Bleeding on Probing

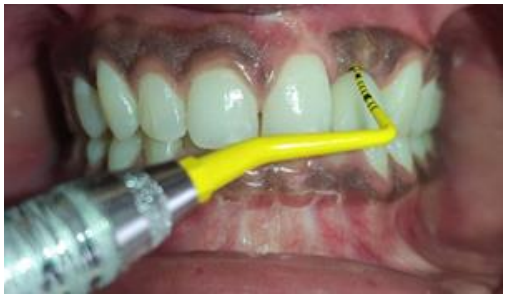

Figure 11: Measurement of Implant Mobility

Figure 12: Jemt Classification

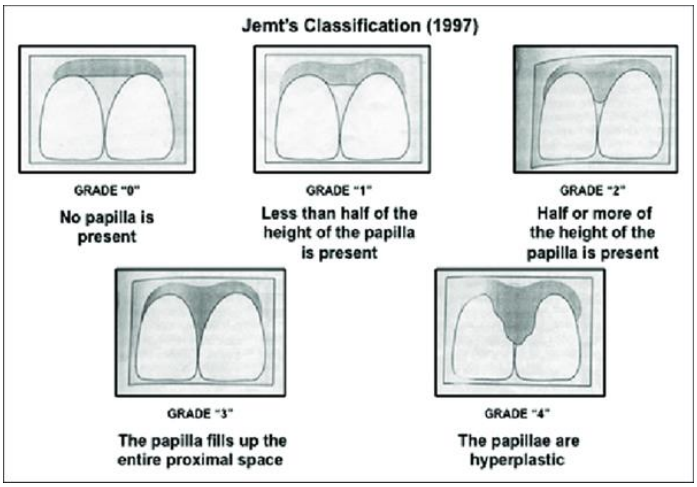

Figure 13: Measurement of Papilla Dimension (Showing Grade 2)

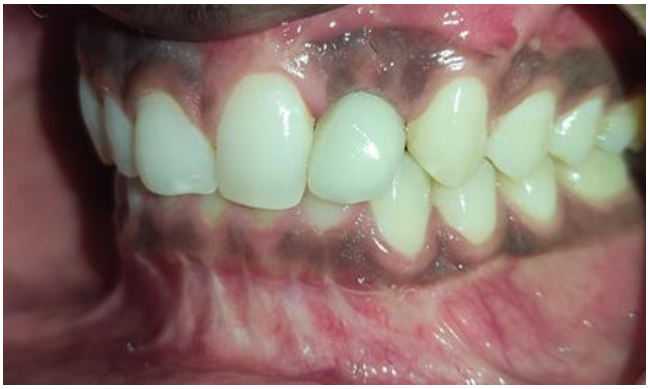

Figure 14: Measurement of Marginal Mucosal Level (MML)

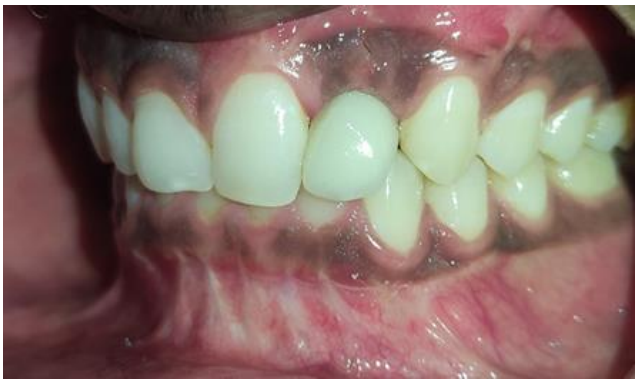

Figure 15: Measurement of Attached Gingiva (Height & Width)

Figure 16: Measurement of Attached Gingiva (Under CBCT)