

Original Research

EVALUATION OF SOFT TISSUES AROUND SINGLE TOOTH IMPLANTS CROWNS WITH EARLY LOADING: THE PINK ESTHETIC SCORE- AN IN VIVO STUDY

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ABSTRACT:

Single tooth implants have become a standard in dentistry and are considered state of an art and standard care. The purpose of this study was to assess soft tissue changes around single tooth implant crown restoration using pink aesthetic score and also to make a comparative evaluation of crown and soft tissue dimensions between implant supported single tooth replacement and the contralateral natural tooth. The overall results of our study demonstrate a success rate of 100% in maxillary anterior region with all implants successfully osseointegrating. The Data obtained directs us to the conclusion that The Pink Esthetic Score is a reliable score for evaluating the soft tissue esthetics around single tooth implant crowns with early loading protocol. However the need for proper patient selection is emphasized.

Key words: Implant, Crown, Pink Esthetic

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INTRODUCTION

Single tooth implants have become a standard in dentistry and are considered state of an art and standard care.¹ The concept of osseointegration i.e., the direct anchorage of endosseous implants made of commercially pure titanium alloy to the bone, was a breakthrough in oral cavity rehabilitation.² Historically, implants have been used and documented mainly with diameters between 3.75mm and 4.1 mm. These types of implants are widely regarded as standard diameter implants.³ A selective assessment of peri implant soft tissues with an objective score would help to evaluate implant supported restorations and to objectify the soft tissue aesthetic outcome of different surgical or prosthodontic treatment protocols. Some researchers have studied the clinical response of the tissues surrounding implants to determine whether tissues change in any regular pattern.⁴ The aim of this in vivo study was to clinically and radiographically evaluate the soft tissues around single tooth implant crowns with early loading and

record the findings using the pink aesthetic score. The replacement of a tooth with an implant supported crown is the most frequent indication for implant therapy. Consequently, the timing of implant placement is critical for successful treatment. This is especially the case for single tooth replacements in the aesthetic zone where patients high aesthetic expectations represent a challenge for clinicians. Thus, clinicians needed a treatment concept that offers an aesthetic outcome with a high degree of predictability and low risk of complications.⁵ The Pink Esthetic Score is a tool used to measure 7 variables as compared to natural tooth- mesial papilla, distal papilla, soft tissue level, soft tissue contour, alveolar process deficiency, soft tissue color and texture, using a 0-1-2 scoring system, 0 being the lowest and 2 being the highest value, the maximum achievable PES is 14. The PES is a tool for reproducibly evaluating the esthetic appearance of the soft tissues around single tooth implant crowns. The

replacement of a tooth with an implant supported crown is the most frequent indication for implant therapy. Consequently, the timing of implant placement is critical for successful treatment. This is especially the case for single tooth replacements in esthetic zone where patient's high esthetic expectations represent a challenge for clinicians. Thus, clinicians need a treatment concept that offers an esthetic outcome with a high degree of predictability and low risk of complications.+

The purpose of this study was to assess soft tissue changes around single tooth implant crown restoration using pink aesthetic score and also to make a comparative evaluation of crown and soft tissue dimensions between implant supported single tooth replacement and the contralateral natural tooth.⁶ Successful implant dentistry should include an assessment of the long term outcome of the entire implant- prosthetic and soft tissue complex. Fürhauser *et al.* recommended The Pink Esthetic Score as a suitable technique for evaluating soft tissue around single-tooth implant crowns that might change over time and as a useful tool for monitoring long-term soft tissue alterations.⁷

AIMS AND OBJECTIVES

- To evaluate the Pink Esthetic Score.
- To evaluate the soft tissues with respect to the adjacent tooth.
- To evaluate the surrounding and the adjacent bone radiographically.
- To evaluate the width of attached gingiva with respect to the adjacent bone.
- To evaluate post-operative complications, if any.

MATERIALS AND METHODS

The study was conducted as an in vivo study on subjects visiting the Department of Prosthodontics and Crown & Bridge and Oral implantology, Himachal Pradesh Government Dental College and Hospital, Shimla. A total of 10 implants were placed in the 10 subjects. The subjects were evaluated for the Soft Tissues Around Single Tooth Implant Crowns with early loading using the Pink Esthetic Score. All the patients were informed about the purpose and nature of study and informed consent form was signed by the patient. A total of 20 Patients were evaluated and out of those 20 patients, 10 were selected for implant placement after evaluating all the parameters. The study was conducted on a total of 10 patients (7 Males and 3 Females) in which implants were placed in partially dentulous regions of the subjects requiring placement of maxillary and mandibular implants using The Pink Esthetic Score.

Inclusion criteria

- All partially dentate patients requiring dental implants.

- All subjects should be less than 45 years of age.
- All patients should be periodontally healthy.

Exclusion criteria

- Irradiation in the head and neck area less than 1 year.
- Unsatisfactory oral hygiene and motivation.
- Untreated periodontal disease.
- Severe systemic disease that would not allow a short surgical intervention.
- Active infection or severe inflammation in the area.
- Drug abuse.
- Psychologic disorder.

Evaluation of The Pink Esthetic Score- The Pink Esthetic Score is based on seven variables: Mesial Papilla, Distal Papilla, Soft Tissue Level and contour, Alveolar Process Deficiency and Soft Tissue Colour and Texture.

Each variable is assessed with the help of a periodontal probe and score is calculated and recorded. Each variable was assessed with a 2-1-0 score, with 2 being the best and 0 being the poorest score. The mesial and distal papilla were evaluated for completeness, incompleteness or absence. All other variables were assessed by comparison with a reference tooth, i.e. the corresponding tooth (anterior region) or a neighbouring tooth (premolar region). The highest possible score reflecting a perfect match of the peri- implant soft tissue with that of the reference tooth was 14.¹

Surgical preparation: The patients were pre-medicated with antibiotics (Amoxy-Clav-625 mg) before anaesthetizing the patient, the patients were asked to rinse the mouth with 0.2 % chlorhexidine mouth wash. Local anesthesia was then administered using lignocaine with adrenaline in the ratio of 1:100000 at the involved site.

- To insert the implant in the esthetic zone, a full thickness flap was raised using a mid crestal incision in the edentulous area.
- The incision was extended through the sulcus of both adjacent teeth to the respective facial aspects, where divergent distal line-angle releasing incisions were applied
- Bone width was measured to following the manufacturer's protocol for implant placement, an osteotomy was drilled with the help of the surgical stent.
- After marking the site by custom made surgical stent, pilot drill was used, followed by subsequent drills of increasing diameter, and final drill up to the decided depth.
- The implant was inserted first by using hex driver, followed by torque ratchet key.
- The implants were placed slightly below or at the level of alveolar crest.

- Healing screws were screwed to the implants immediately after implant placement to close the opened implant site.
- Then the flap was closed with tight non-resorbable 3-0 black silk sutures to achieve water-tight closure. The patients were prescribed with antibiotics and analgesics for 1 week, post-operatively. Sutures were removed 7–10 days after surgery.
- Patients were not allowed to use any removable prostheses during the healing period. Patients were recalled after 24 hours for review and then after one week for assessment of post-operative recovery and suture removal surgeries. Patients were instructed to have a soft diet and to avoid chewing the treated area for first few days. After implant placement, implants were left for osseointegration for a period of 3 months following conventional loading protocols and abutments were placed thereafter.

Follow up: The patients were recalled for follow up for clinical and radiographic evaluation which was made at 1 week, 3 months and 6 months of implant loading for evaluation of crestal bone changes with help of radiographs as well as for the assessment of The Pink Esthetics Score for evaluation of the soft tissue alterations that occurred over time. The measurements were recorded at:

1. 1 week following dental implant loading.
2. 3 months following dental implant loading.
3. 6 months following dental implant loading

DISCUSSION

In the present study alginate was used for making the preliminary impressions of the arches for diagnostic cast fabrication owing to its hydrophilic nature that allows the material to capture accurate impression in presence of some saliva or blood and good elastic properties.¹³ Followed by primary impression pre-operative OPG and CBCT was obtained to evaluate detailed visualization and measurement of vital structures from the surgical site.

The standardized periapical radiographs are particularly well-suited and preferred for longitudinal assessment of implant bone loss. The periapical radiographs have minimal distortion when they are well angulated applying the standardized projection geometry. In addition, exposure dose of periapical radiography is extremely low compared to that of other modalities. The measurement value on periapical radiographs is the most reliable due to the sharpness and resolution of images obtained with the

standardized periapical radiographs obtained by the long cone paralleling technique with the help of zig fabrication.

Restoration is accomplished using one of these basic loading protocols:

1. **Conventional loading:** Restoration occurs after the initial bone and soft tissue healing process, usually in 3 to 6 months, depending on bone density.

2. **Immediate loading:** Prosthesis is connected at the time of implant placement. This is usually a provisional restoration that is replaced with a definitive restoration after implant and soft tissue healing.

3. **Early loading:** The prosthesis connection occurs from 2 to 3 weeks after implant placement.

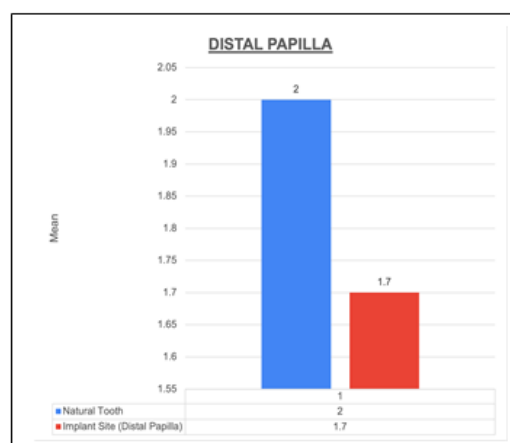
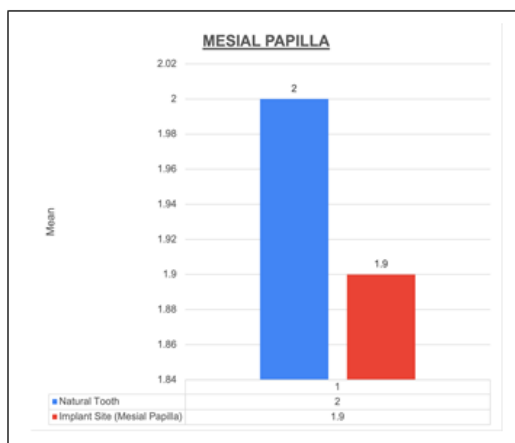
4. **Delayed loading:** The prosthesis is connected 6 to 12 months after implant placement. This method is often chosen in poor quality bone and in situations in which primary stability cannot be achieved during surgical placement.⁸

The Pink Esthetics Score is based on seven variables—the Mesial papilla, distal papilla, soft tissue level, soft tissue contour, Alveolar process deficiency, soft tissue colour and texture. Each variable was assessed with a 2-1-0 score, with 2 being the best and 0 being the poorest score. The mesial and distal papilla was evaluated for completeness, incompleteness or absence. All other variables were assessed by comparison with a reference tooth that is the corresponding tooth (anterior region) or a neighbouring tooth (premolar region).¹

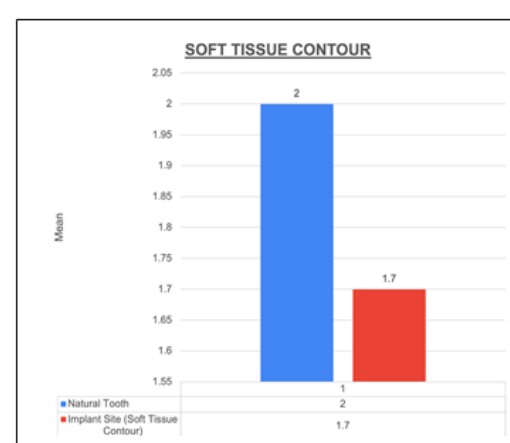
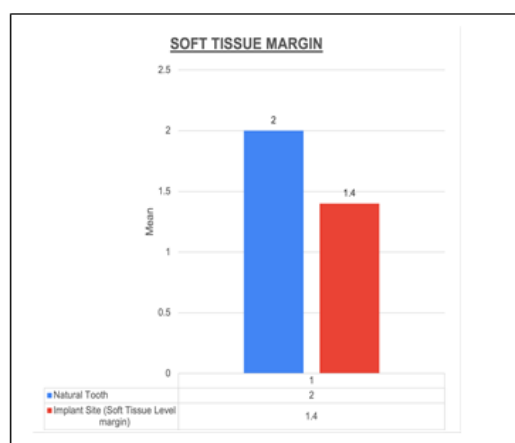
The present study analysed the Soft Tissues around single tooth implant crowns loaded early in a partially dentate patient over a period of 0, 3, 6 months. The aim of the present study was to compare and evaluate the soft tissue parameters based on the Pink Esthetics Score (PES), along with the radiologic changes in peri-implant bone levels in the implants loaded with early loading protocol.

The present study aimed to compare the mean **Mesial Papilla levels** as compared to the contralateral natural tooth with early loading protocol. The result shows a mean of 1.2 ± 0.42 mm over a period of 3 months after loading, while it was 1.9 ± 0.31 mm. for implants loaded after 6 months. The P-value was 0.33 which is considered to be non-significant.

The mean **Distal Papilla Levels** of implants loaded with early loading protocol showed a result of 1.2 ± 0.42 mm over a period of 3 months after loading while it was 1.7 ± 0.31 mm for implants loaded after 6 months. The P-value was 0.065, which is considered to be significant.



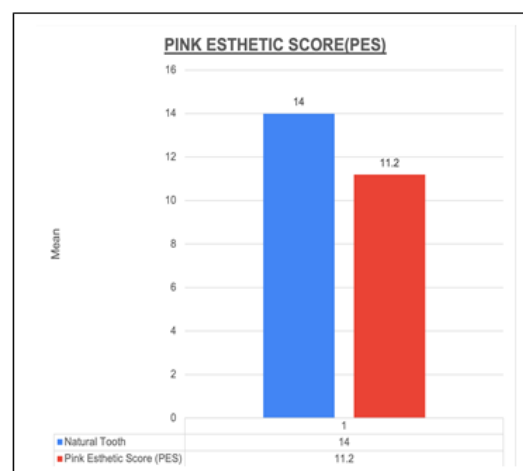
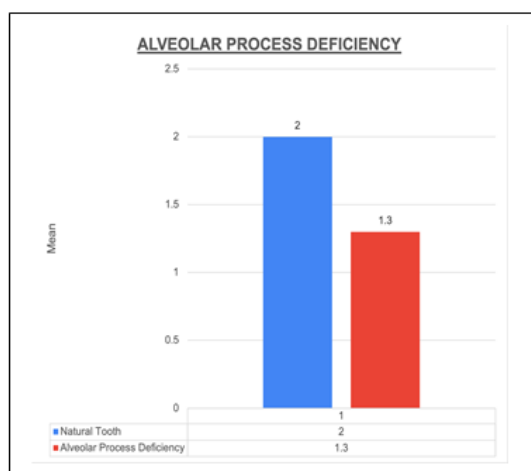
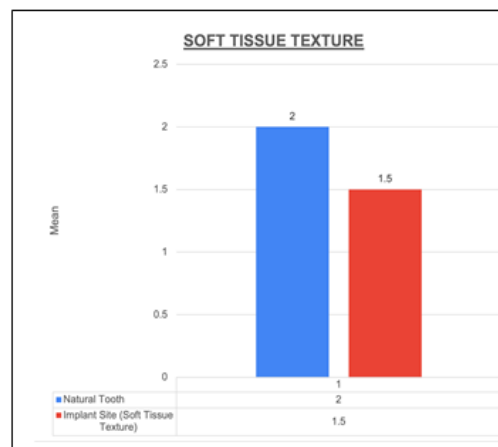
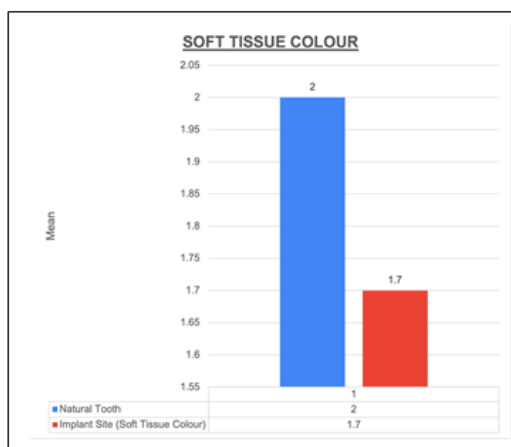
The present study also aimed to compare the **Soft Tissue Margin Level** as compared to the contralateral natural tooth. The result shows a mean of 1.2 ± 0.42 mm over a period of 3 months after loading, while it was 1.4 ± 0.51 mm for implants loaded after 6 months. The P- value was 0.0017 which is considered to be statistically significant.



The present study aimed to compare the mean **Soft Tissue Contour Levels** as compared to the contralateral natural tooth. The result shows a mean of 1.4 ± 0.51 mm over a period of 3 months after loading, while a mean of 1.7 ± 0.48 mm was recorded 6 months post loading. The P- value was 0.06 which is considered to be statistically significant. The present study aimed to compare the mean **Soft Tissue Colour** as compared to the contralateral natural tooth. The result shows a mean of 1.2 ± 0.42 mm over a period of 3 months of loading, followed by a mean of 1.7 ± 0.48 mm after 6 months of loading. The P-value was 0.06 which is considered to be statistically significant. The present study aimed to compare the mean **Soft Tissue Texture** as compared to the contralateral natural tooth. The result shows a mean of 1.1 ± 0.31 mm over a period of 3 months of loading, followed by a mean of 1.5 ± 0.52 mm after 6 months of loading. The P-value was 0.007, which is considered to be statistically significant.

The present study aimed to compare the mean **Alveolar Process Deficiency** as compared to the contralateral natural tooth. The result shows a mean of 1.0 ± 0 mm over a period of 3 months of loading, followed by a mean of 1.3 ± 0.48 mm after 6 months of loading. The P-value was 0.0002, which is considered to be statistically significant. The present study aimed to compare the mean **Pink Esthetic Score (PES)** as compared to the contralateral natural tooth. The result shows a mean of 8.3 ± 1.63 mm over a period of 3 months of loading, followed by a mean of 11.2 ± 1.39 mm after 6 months of loading. The P-value was 0.0001, which is considered to be statistically significant.

The present study aimed to compare the mean **Mean Crestal Bone Loss (MESIAL)** as compared to the contralateral natural tooth. The result shows a mean of 0.30 ± 0.07 mm over a period of 3 months of loading, followed by a mean of 0.41 ± 0.07 mm after 6 months of loading. The P-value was 0.0001, which is considered to be statistically significant.



The present study aimed to compare the mean **Mean Crestal Bone Loss (DISTAL)** as compared to the contralateral natural tooth. The result shows a mean of 0.35 ± 0.07 mm over a period of 3 months of loading, followed by a mean of 0.46 ± 0.06 mm after 6 months of loading. The P-value was 0.0001, which is considered to be statistically significant. Bone resorption is known to take place mainly during the first year after prosthesis placement, decreasing considerably after the prosthesis is stabilized.⁹ There is no precise known cause for initial bone resorption around the implant, but some studies suggested that it could be caused by the interruption of blood

circulation due to the external injury made during surgery.^{10, 11} It is well known that vascularization of the underlying bone is determined by three essential sources: major supra-periosteum vessels, vascular plexus of the periodontal ligament, and the vessels of the alveolar bone. This will imply a certain level of bone resorption during healing in cases in which a mucoperiosteal flap is raised especially in cases where a mucoperiosteal flap is raised twice such as when implants are placed using a two-stage approach.¹² Since the patients were carefully selected, and the surgery was performed by the same operator under standard conditions, the higher bone loss around

implants installed through two-stage approach can be attributed to the histological process of bone repair after trauma and the surgical procedure done for submerge fixtures in which the tissue had to be manipulated twice. 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 cooperation 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. The main disadvantage with Pink Esthetic Score is that it is a subjective score and it varies from person to person. The Pink Esthetic Score (PES) is a tool for reproducibly evaluating the esthetic appearance of the soft tissue around single-tooth implant crowns. Very good and very poor outcomes were associated with low standard deviations, suggesting better reproducibility. Restoring the papilla, which ranks prominently in the literature, fared best in the assessments, while the level of the soft-tissue margin and the colour of the peri- implant soft-tissue fared worst. The latter two variables should, therefore, be given more attention.¹

TABLE 1: Mean Pink Esthetic Score Values as compared to the Contralateral Natural Tooth

| VARIABLE | NATURAL TOOTH | | IMPLANT SITE | | 't value' | 'p value' |
|--------------------------|---------------|------|--------------|------|-----------|-----------|
| | MEAN | ± SD | MEAN | ± SD | | |
| At 0 th Month | 14 | 0 | 7.2 | 0.42 | - | - |
| At 3 rd Month | 14 | 0 | 8.3 | 1.63 | - | - |
| At 6 th Month | 14 | 0 | 11.2 | 1.39 | 6.33 | 0.0001* |

TABLE 2: Mean Crestal Bone Loss (MESIAL) at different time intervals

| VARIABLE | IMPLANT SITE | | 't value' | 'p value' |
|--------------------------|--------------|------|-----------|-----------|
| | MEAN | ± SD | | |
| At 0 th Month | 0.24 | 0.07 | - | - |
| At 3 rd Month | 0.30 | 0.07 | - | - |
| At 6 th Month | 0.41 | 0.07 | 4.91 | 0.0001* |

TABLE 3: Mean Crestal Bone Loss (DISTAL) at different time intervals

| VARIABLE | IMPLANT SITE | | 't value' | 'p value' |
|--------------------------|--------------|------|-----------|-----------|
| | MEAN | ± SD | | |
| At 0 th Month | 0.29 | 0.06 | - | - |
| At 3 rd Month | 0.35 | 0.07 | - | - |
| At 6 th Month | 0.46 | 0.06 | 5.74 | 0.0001* |

SUMMARY AND CONCLUSION

A few conclusions drawn from this study were: - Implants with early loading must gain sufficient primary (mechanical) stability for successful outcome. Soft Tissue esthetics showed comparable survival and success rates both clinically and radiographically. Effective bone-to-implant surface which satisfies the functional needs of the prosthesis is the key to ensure the long-term esthetic outcomes of soft tissues around implants supporting single crowns. Implants placed in good bone quality have a high survival rate. A good maintenance of oral hygiene is advised for healthy peri-implant tissue condition. Based on clinical and radiographic finding, we conclude that the early loading of dental implants has a favorable outcome and better patient acceptance. Overall, we recommend the use of early loading protocol as a viable therapeutic option in improving success and reducing the treatment duration in implants placed in atrophic ridges. However, further trials involving a larger sample size, longer follow-up periods and other sites of maxilla and mandible are necessary before declaring The Pink Esthetic Score for implant placement with early loading protocol as reliable procedure.

Dental implants today have become a highly predictable mode of replacement of missing teeth. The ultimate goal is to achieve function, aesthetics and comfort. Traditional implant loading protocols have involved a 3- 6 months stress free healing period, which was always a source of inconvenience, both to patient and practitioner. Early loading of oral implants has been defined as loading between two weeks and 2 months of implant placement. We have conducted a 6 month prospective clinical study to evaluate the success rates of using The Pink Esthetic Score for soft tissue evaluation around single tooth implant crowns with early loading protocol. The overall results of our study demonstrate a success rate of 100% in maxillary anterior region with all implants successfully osseointegrating. The Data obtained directs us to the conclusion that The Pink Esthetic Score is a reliable score for evaluating the soft tissue esthetics around single tooth implant crowns with early loading protocol. However the need for proper patient selection is emphasized.

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