Original Article

# Evaluation of Soft Tissue Preservation using Hydroxyethyl Cellulose Adhesive Strips over Immediately-placed Dental Implants in Mandibular Molar Areacase report

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## ABSTRACT

**Aim:** This study aimed to evaluate the effect of hydroxyethyl cellulose adhesive strip in soft tissue preservation over immediately-placed dental implants in the mandibular molar area. **Materials and Methods:** Sixteen patients with non-restorable mandibular molars were equally randomized into two groups (n = 8). Following atraumatic extraction and immediate implant placement, group I received only figure-eight sutures, while group II received hydroxyethyl cellulose (HEC) adhesive strips covering the socket before suturing. Clinical evaluations included Landry soft tissue healing index and implant stability. Radiographic evaluation using CBCT was used to assess relative bone density and marginal bone loss. **Results:** All implants exhibited a 100% survival rate with no complications during the observation period. Both groups showed significant improvement in soft tissue healing over time ($p < 0.001$) with no intergroup differences. Implant stability, bone density, and marginal bone loss revealed comparable outcomes between groups ($p > 0.05$). **Conclusion:** HEC adhesive strips demonstrated no significant superiority over conventional suturing in preserving soft tissue health or increasing bone density around immediately-placed implants in mandibular molar area.

**Key Words** :Hydroxyethyl cellulose, Immediate dental implants, Ora-aid, Socket seal surgery, Soft tissue preservation.

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## INTRODUCTION

Placing implants into freshly extracted tooth sockets has become a common practice. Protocols for implant placement, particularly for single-tooth replacement, have evolved to minimize surgical interventions and shorten treatment time, aligning with both patient expectations and clinical goals.[1] The healing process and implant integration may also benefit from the bone regeneration naturally initiated by the extraction itself.[2] Successful outcomes depend on several factors such as atraumatic tooth extraction to preserve the socket anatomy and appropriate site preparation to ensure the initial stability of the implant.[3]Achieving primary socket closure remains a key challenge in immediate implant placement. The critical “jumping distance” (implant-socket gap near the platform) risks implant surface exposure when closure is incomplete, potentially leading to peri-implantitis and osseointegration failure.[4] Additionally, inadequate closure compromises attached mucosal width (AMW) formation essential for long-term stability, while a thin mucosal phenotype further increases peri-implant disease risks.[5]A thick mucosal phenotype around implants enhances keratinized tissue width, which helps reduce plaque buildup and lowers the risk of peri-implantitis and peri-mucositis. Thus, soft tissue thickness plays a essential role in osseointegration and implant stability.[6] A thin gingival phenotype is defined as less than 1.5 mm in thickness, whereas a thick phenotype exceeds 2.0 mm.[7] Enhancing socket healing in immediate implant cases can be achieved through various techniques.

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These methods involve combining bone grafts with collagen-based scaffolds, subepithelial connective tissue grafts or platelet-rich fibrin (PRF) membranes. Although they come with certain drawbacks, such as high morbidity associated with harvesting connective tissue from a second surgical site and the potential for collagen scaffolds to become avascular, increasing the risk of infection at the implant site.[4-8] One particular type of adhesive wound covering; hydroxyethyl cellulose strip (HEC), shows promise in wound management. When applied directly to the oral mucosa, the strip encourages the formation of a protective layer in the oral cavity.[9] HEC adhesive strips have emerged as a promising alternative for wound management. These biocompatible, mucoadhesive barriers create a protective layer that maintains optimal moisture and protects against mechanical irritation. Their composition includes vitamin E, which promotes tissue repair through antioxidant activity. Clinically, HEC strips have demonstrated efficacy in palatal wound healing, with studies reporting reduced pain and accelerated epithelialization compared to conventional dressings. The material's handling characteristics including easy adaptation to wound contours and transparent appearance - offer practical advantages in clinical practice.[9]Based on the above mentioned data, it was of interest to evaluate the soft tissue preservation using hydroxyethyl cellulose over immediately-placed dental implants in mandibular molar area.

## MATERIALS AND METHODS

### Ethical approval and patient consent

This study received approval from the Ethical Committee of the Faculty of Dentistry, Mansoura University (Approval No. A05030240S). The Helsinki Declaration and The Guidelines Set by The Institutional Ethics Committee were adhered to in all aspects of this study. All participants provided written informed consent following a detailed explanation of the study's aims, methods, potential benefits, and possible risks. Patient anonymity was maintained throughout the study.

**Study design**

A randomized controlled clinical trial.

**Sample size calculation**

Sample size was determined usin g G*Power software (v3.1.9.7). With an effect size of 1.40, α = 0.05, and power = 90.59%, a minimum of 8 implants per group (total of 16 implants) were required for statistical significance using the Mann-Whitney U-test.

**Patient selection**

**Inclusion criteria:**

- Individuals aged between 18 and 45 years were included.
- Maintenance of good oral hygiene
- Willingness of patients to cooperate and their full capacity to adhere to the study protocol.
- Sufficient inter-arch space to accommodate the future prosthesis.[10]

**Exclusion criteria:**

- Any local or systemic condition that contraindicates dental implant placement.
- Evidence of acute infection or discharge of pus.
- The patient received radiation therapy to the head and neck region within the past 2 years.[11]
- Parafunctional habits, including bruxism and clenching.
- Pregnancy.

**Randomization and group allocation:**

In this trial, which included both control and study groups involving 16 dental implants (8 per each group), A block randomization approach was utilized in the following manner:[12]

- A block size of 4 was selected.
- Possible balanced combinations with 2 C (control) and 2 S (Study) subjects were calculated as 6 (SSCC, SCSC, SCCS, CSSC, CSCS, CCSS).
- Blocks were randomly selected to allocate all 16 dental implants. One random sequence would be SSCC, SCCS, CSSC, and CSCS. This method ensured an equal distribution, resulting in 8 participants in both the control and study groups.

**Patient grouping:**

Group I included 8 implants placed immediately after extraction, covered only with figure-8 sutures (4/0 vicryl suture, Ghatwary Medical GMS., Egypt.). Group II included 8 implants covered with hydroxyethyl cellulose (HEC) adhesive strips (OraAid, TBM, Korea) and figure-8 sutures.

**Surgical protocol:**

**Preoperative phase:**

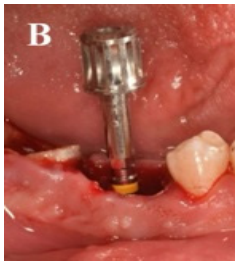
Medical and dental histories were obtained for each patient, followed by a clinical examination, including inspection and palpation, to ensure proper case selection (figs 1A and 3A).



Cone-beam computed tomography (CBCT) was used to assess bone dimensions and proximity to the inferior alveolar canal. Prophylactic antibiotics (augmentin, GSk pharmaceuticals, Egypt.) were administered 1 hour pre-surgery, and chlorhexidine mouthwash 0.12% (Orovex-H, Manufactured by MARCO Group pharmaceuticals, Egypt.) was used for 30 seconds.

**Surgical procedures:**

Patients were anesthetized using local anesthesia was delivered through inferior alveolar nerve block, lingual nerve block, and long buccal nerve infiltration techniques utilizing 4% articaine hydrochloride (Artinibsa 40mg/ml with 1:100000 adrenaline, Inibsa Dental S.L.U, Spain) with a concentration of 1:100,000 epinephrine. The non-restorable mandibular molar was atraumatically extracted by separating the roots with a surgical bur and luxating each individually to preserve the socket walls. Bone curettage was performed, along with socket debridement through irrigation with a normal saline solution. The osteotomy site was prepared using a pilot drill at 800–850 rpm with continuous saline irrigation, followed by sequential drilling according to the manufacturer's protocol to reach the final size and ensure proper angulation and site preparation. The sterile implant (MEDIMECCA Co., CHAORUM Implant System, Seoul, South Korea) was carefully positioned into the osteotomy site using controlled, stable pressure, and final placement was achieved with a ratchet wrench to ensure proper implant stability (figs 1B and 3B).

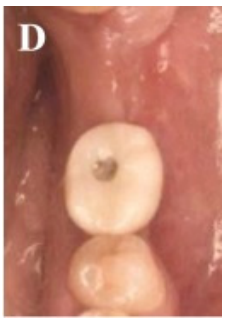




Implant Stability Quotient (ISQ) was measured using Osstell ISQ RF Analyzer (Integrate Diagnostic AB, Gothenburg, Sweden) in mesiodistal/buccolingual directions then cover screw was inserted. Group I received figure-eight suture alone for socket closure (fig 1C), while Group II had implants covered with a hydroxyethyl cellulose (HEC) adhesive strip, trimmed to fit the socket and pressed for 10 seconds to ensure adhesion, followed by figure-eight suture (fig 3C).



**Postoperative care:**

They were instructed not to disturb the surgical site with their fingers or tongue, and to maintain good oral hygiene. Sutures were removed two weeks post-surgery.[13] Antibiotic was continued twice daily for 5 days. Diclofenac potassium 50mg (Cataflam, Alexandria pharmaceuticals and chemical industries, Egypt.) was prescribed to be taken every eight hours for a period of 2 days. All patients had been advised to rinse their mouths with chlorhexidine antiseptic mouthwash twice daily for two weeks starting from the second day of dental surgery. At second surgery four months later, the exposed surgical cover screw was replaced by a healing abutment after 15 days; the abutment remained in place for two weeks before removal. An open tray impression technique was taken. Final restoration was achieved using a screw-retained zirconia crown (figs 1D and 3D).

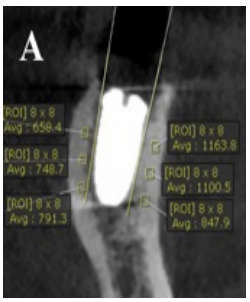

**Clinical evaluation :**

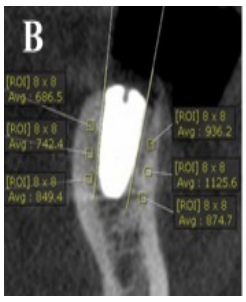
A.Landry soft tissue healing index:
The soft tissue healing was evaluated based on the Landry index[14] at 7th day (T0), 14th day (T1) and 21st day (T2) after implant insertion.

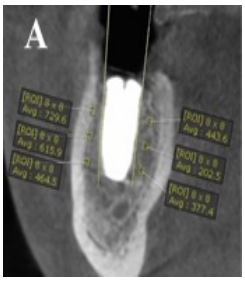
B.Implant stability:
The stability of the implant was measured using the Osstell device during insertion and again at the 4-month postoperative

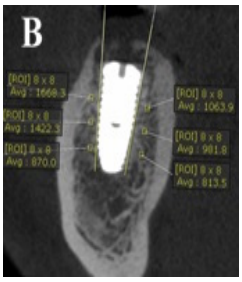
**Radiographic evaluation:**

A.Relative bone density:
Relative bone density values were collected from cross-sectional views using a grayscale bone measuring tool at six points per implant site—three on the buccal side and three on the lingual side. Measurements were taken 1 mm away from the implant fixture at 3mm, 5mm, and 7mm distances on both sides, immediately after implant placement and again after 4 months (figs 2A, 2B, 4A and 4B). The mean grayscale values were calculated for each section, and bone densities from both CBCT scans were compared.[15]

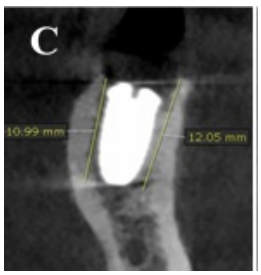


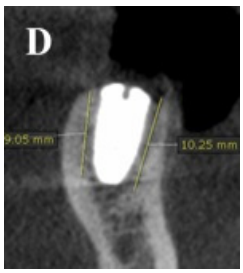



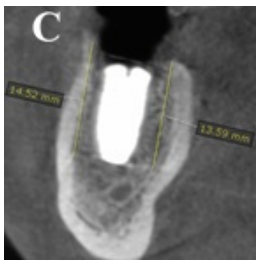



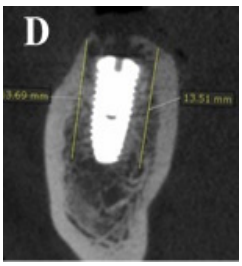




B.Marginal bone loss (MBL)
Cone beam computed tomography (CBCT) from the immediate post-surgical phase were aligned with those after 4 months post-implant insertion (figs 2C, 2D, 4C and 4D). The marginal bone level was measured by referencing the implant's apical end, with bone height recorded at the buccal and lingual sides. Vertical bone loss was calculated by subtracting the bone level after 4 months from the immediate post-surgical values.[16]




**Statistical analysis:**
Data were analyzed using IBM SPSS advanced statistics (Statistical Package for Social Sciences), version 27 (Armonk, NY: IBM Corp). Numerical data were described as mean and standard deviation or median and range. Categorical data were described as numbers and percentages. Data were explored for normality using Kolmogrov-Smirnov test and Shapiro-Wilk test. For normally distrusted variables regarding intergroup comparisons at each time point & analysis done by one way independent t test and changes overtime were done by paired t test.For non-normally distrusted variables regarding intergroup comparisons at each time point & analysis done by Mann Whitney test, for intragroup comparison; changes overtime analysis done by Wilcoxon signed rank test or Friedman test followed by post hoc rank test as appropriate. Comparisons between categorical variables were performed using the chi square test or fisher exact test as appropriate. A p-value less than 0.05 were considered statistically significant. All tests were two tailed.

**RESULTS:**
Out of 29 patients assessed for eligibility 13 did not meet inclusion criteria and were excluded. Sixteen participants were randomized into two equal groups (n=8 in group I [Control] and n=8 in group II [study]). All allocated participants received the intended interventions, completed follow-up, and were included in the final analysis.Demographic data revealed comparable distributions between the studied groups. The mean age was 31.9 ± 9.3 years

in group I and 29.4 ± 8.1 years in group II (p=0.575). Gender distribution showed 62.5% females (n=5) in group I and 50% females (n=4) in group II (p=1.000). Implant sites were predominantly first molars (87.5%, n=7 per group), with no significant differences in anatomical site distribution (p=1.000). (Table 1)

**Table (1):** Comparative analysis of demographic characteristics among the studied groups

| | | Group I | | Group II | | |
|---|---|---|---|---|---|---|
| | | | | | | P value |
| Age (yrs.) | Mean ±SD | 31.9±9.3 | | 29.4±8.1 | | 0.575 |
| | Range | 20-44 | | 20-41 | | |
| | | N | % | N | % | |
| Gender | Male | 3 | 37.5 | 4 | 50.0 | 1.000* |
| | Female | 5 | 62.5 | 4 | 50.0 | |
| Site | First Molar | 7 | 87.5 | 7 | 87.5 | 1.000* |
| | Second Molar | 1 | 12.5 | 1 | 12.5 | |

SD : Standard deviation, p<0.05 is statistically significant, *: Analysis done by Fisher exact

All implants exhibited successful signs of osseointegration without failure. The patients were evaluated as follows:

I. Clinical evaluation:

1.Landry soft tissue healing

As shown in table (2), Landry's soft tissue healing index improved significantly over time within each group (p = 0.001). However, the intergroup comparisons at all time intervals (T0, T1, and T2) revealed no statistically significant differences (p > 0.05).

**Table (2):** Landry Soft tissue healing comparison among the studied groups

| Soft tissue healing | Group I | | | Group II | | | |
|---|---|---|---|---|---|---|---|
| | Median | Min. | Max. | Median | Min. | Max. | P1 value |
| T0 (7th day) | 3 | 2 | 3 | 3 | 2 | 3 | 1.000 |
| T1 (14th day) | 3 | 3 | 4 | 4 | 3 | 4 | 0.721 |
| T2 (21st day) | 4 | 3 | 5 | 5 | 4 | 5 | 0.547 |
| P2 value | 0.001* | | | 0.001* | | | |

Min.: Minimum, Max.: Maximum, p<0.05 is statistically significant, P1 value: Analysis done by Mann Whiteny test. P2 value: Analysis done by Friedman test followed by Wilcoxon signed rank test, *: statistically significant from the other two times an other comparison not significant

2.Dental implant stability:

As shown in table (3), implant stability significantly improved in both groups from placement (T0) to four months post-placement (T1) (p < 0.001). However, no statistically significant differences were observed between the groups at either time points (p = 0.566 at T0; p = 0.828 at T1).

**Table (3):** Comparison of implant stability at different time intervals among the studied groups

| | Group I | | Group II | | |
|---|---|---|---|---|---|
| Implant Stability | Mean | SD | Mean | SD | P1 value |
| At implant placement(T0) | 67.6 | 6.5 | 66.0 | 4.3 | 0.566 |
| At 4 months after implant placement(T1) | 77.3 | 7.0 | 76.6 | 3.9 | 0.828 |
| P2 value | <0.001 | | <0.001 | | |

SD: standard deviation, p<0.05 is statistically significant, P1 value: comparing between groups by independent t test, P2 value: comparing overtime in each group by paired t test.

II. Radiographic evaluation

1.Relative bone density

As shown in table (4), both groups demonstrated increased bone density over time at buccal, lingual, and overall measurements with no statistically significant difference (p > 0.05). Within-group comparisons also showed no statistically significant changes over time (p > 0.05).

**Table (4)**: Relative bone density comparison among the studied groups

| | Group I | | Group II | | |
|---|---|---|---|---|---|
| CBCT bone density | Mean | SD | Mean | SD | P1 value |
| Buccal | | | | | |
| At implant placement(T0) | 929.6 | 250.6 | 965.9 | 199.1 | 0.753 |
| At loading(T1) | 1134.4 | 260.2 | 1242.8 | 350.9 | 0.494 |
| P2 value | 0.274 | | 0.154 | | |
| Lingual | | | | | |
| At implant placement(T0) | 641.6 | 199.8 | 533.9 | 93.3 | 0.189 |
| At loading(T1) | 905.5 | 246.3 | 740.3 | 204.3 | 0.166 |
| P3 value | 0.697 | | 0.246 | | |
| Overall | | | | | |
| At implant placement(T0) | 785.6 | 175 | 749.9 | 115.6 | 0.637 |
| At loading(T1) | 1019.9 | 192.8 | 991.5 | 268.3 | 0.811 |
| P4 value | 0.694 | | 0.095 | | |

SD: standard deviation, p<0.05 is statistically significant, P1 value: comparing between groups by independent t test. P2 value: overtime comparison in buccal side in each group by paired t test. P3 value: overtime comparison in lingual side in each group by paired t test. P4 value: overtime comparison in overall in each group by paired t test.

2.Marginal bone loss (MBL):

As shown in table (5), radiographic evaluation revealed no statistically significant differences in marginal bone loss between the two groups. On the buccal aspect, group I demonstrated a higher mean bone loss (0.60 ± 1.1 mm) compared to group II (0.10 ± 1.0 mm; p = 0.428). Conversely, at the lingual aspect, group II exhibited greater loss (0.70 ± 1.0 mm) than group I (0.02 ± 0.9 mm; p = 0.152). Also, the overall mean MBL was more in group II than group I with no statistical differences (group I: 0.30 ± 0.9 mm; group II: 0.40 ± 0.8 mm; p = 0.739).

**Table(5):** MBL comparison among the studied groups

| | Group I | Group II | | | |
|---|---|---|---|---|---|
| | Mean | SD | Mean | SD | P Value |
| MBL_Buccal | 0.60 | 1.1 | 0.1 | 1.0 | 0.428 |
| MBL_Lingual | 0.02 | 0.9 | 0.7 | 1.0 | 0.152 |
| Overall | 0.30 | 0.9 | 0.4 | 0.8 | 0.739 |

SD: standard deviation, p<0.05 is statistically significant, P value: comparing between groups by independent t test. MBL: marginal bone loss.

## DISCUSSION:

Ensuring consistent soft tissue healing and maintaining peri-implant health in the posterior mandibular region remains a clinical challenge, owing to its complex anatomical and functional characteristics.[17] All implants demonstrated a 100% survival rate over the short-term follow-up, with no biological, mechanical, or prosthetic complications observed, indicating the overall reliability of the protocol utilized.Soft tissue healing plays a critical role in the early stages of implant integration. In this study, healing was assessed at days 7, 14, and 21 post-operatively using the Landry wound healing index. Both group I and group II exhibited progressive and statistically significant improvement in healing scores over time. However, no significant intergroup differences were detected. These results are in line with previous reports by Rodrigues[9] and Belal[18], who documented favorable outcomes with the use of Ora-Aid as a palatal wound dressing.According to the present study, implant stability was evaluated using RFA, with results expressed in ISQ values. No statistically significant differences in ISQ values were observed between the groups at implant placement or at the four-month follow-up. However, both groups demonstrated a statistically significant increase in ISQ values over time, consistent with studies by Victoria et al.[19], Vollmer et al.[20], and Bavetta et al.[21], all of whom reported increased implant stability following a standard healing period, reflecting successful osseointegration. Radiographic evaluation using cone-beam computed tomography (CBCT) provided objective insights into relative bone density and marginal bone level changes. CBCT remains a valuable tool for implant assessment due to its low radiation exposure and high-resolution imaging.[22] In this study, no statistically significant differences were detected between the groups in terms of buccal, lingual, or overall bone density at baseline or at the time of prosthetic loading. These outcomes suggest that the application of HEC strips did not result in enhanced hard tissue healing compared to the control group. This aligns with the understanding that bone density and osseointegration are more strongly influenced by surgical technique, implant design, and patient-specific bone quality.[15]Mustakim et al.[23] stated that maintaining marginal bone levels is crucial for long-term dental implant success, as bone loss can be influenced by factors like bone quality, systemic health, and patient-specific variables. The current study revealed no significant differences in MBL between the two groups across all measured aspects. Although, radiographic analysis revealed a higher mean bone loss (MBL) in group II for both lingual and overall measurements, this difference did not reach statistical significance but may have a clinical importance. While the differences were not statistically significant, the study group exhibited poor adaptability to wound contours, which poses limitations in clinical application. These findings are in contrast with Rodrigues[9], who stated that Ora-Aid's handling characteristics, including easy adaptation to wound contours and transparent appearance, offer practical advantages in clinical practice. Additionally, it showed slightly inferior radiographic outcomes that might be due to inadequate strip adherence and possible debris stagnation around the implant site. These was in agreement with Salih[24], who reported 3–5 hours of adhesion of ora-aid with no notable complications or morbidity. Belal[18] reported that Ora-aid retained from 6 to 9 days when

used as palatal dressing, these was in contrast with the results of the present study that showed limited adhesion time which was considerate as a main issue. These might be due to the difference in wound configuration.

## CONCLUSION

Hydroxyethyl cellulose (HEC) adhesive strips offered no significant advantage over conventional suturing in enhancing soft tissue healing, implant stability, relative bone density and marginal bone loss following immediate implant placement in mandibular molars.

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