EVALUATION OF SOFT TISSUE HEALING AFTER TOOTH EXTRACTION USING MANUKA HONEY GEL IN DIABETIC PATIENTS – A PROSPECTIVE STUDY

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Abstract

Background: Delayed wound healing after tooth extraction is a common concern in diabetic patients due to impaired collagen synthesis, reduced angiogenesis, and compromised immune response. Natural agents such as Manuka honey have demonstrated antimicrobial and tissue-regenerative properties that may accelerate healing. **Aim:** To evaluate the efficacy of Manuka honey gel on soft tissue healing following tooth extraction in diabetic patients compared with conventional saline care. **Materials and Methods:** A prospective clinical study was conducted on 24 controlled type 2 diabetic patients requiring single-tooth extractions. Patients were randomly allocated into two groups: Group A (n = 12) received Manuka honey gel applied directly to the socket after extraction, while Group B (n = 12) received standard saline irrigation and routine care. Healing was assessed on postoperative days 1, 3, 7, and 14 using the Landry, Turnbull, and Howley healing index, Visual Analogue Scale (VAS) for pain, and evaluation for inflammation or infection. Statistical analysis was performed using Student's t-test and Chi-square tests with $p < 0.05$ considered significant. **Results:** Group A showed faster wound epithelialization and significantly higher mean healing scores at all follow-up intervals ($p < 0.05$). Pain reduction was notably greater in the Manuka group by day 3 (mean VAS 2.1 ± 0.6) compared with control (3.6 ± 0.8). No postoperative infections were reported in the Manuka group, while two cases occurred in the control group. **Conclusion:** The application of Manuka honey gel after tooth extraction in diabetic patients significantly enhances soft tissue healing, reduces inflammation, and promotes patient comfort. It can serve as a safe and cost-effective adjunct for wound management in medically compromised individuals.

Keywords: Manuka honey, diabetic patients, wound healing, tooth extraction, soft tissue repair

Introduction

Tooth extraction remains one of the most common minor oral surgical procedures performed in dental practice. In patients with diabetes mellitus, postoperative wound healing is often delayed due to vascular changes, neuropathy, and impaired immune function that hinder tissue repair. Hyperglycaemia reduces fibroblast activity, collagen production, and angiogenesis, resulting in prolonged inflammation and increased susceptibility to infection. Consequently, diabetic patients are at higher risk of developing dry socket, delayed epithelialization, and postoperative discomfort compared to healthy individuals. Natural biomaterials have attracted attention in recent years for their ability to enhance soft tissue healing[1]. Among these, Manuka honey—derived from the nectar of Leptospermum scoparium, a plant native to New Zealand has emerged as a potent therapeutic agent. Its bioactive components, including methylglyoxal (MGO) and hydrogen peroxide, confer antimicrobial and anti-inflammatory effects. Furthermore, Manuka honey promotes fibroblast proliferation, stimulates keratinocyte migration, and enhances angiogenesis, all of which contribute to accelerated wound closure[2].

Previous studies have demonstrated the benefits of honey dressings in chronic ulcers, burns, and surgical wounds. However, limited data exist regarding its application in oral surgical wounds, particularly among diabetic patients. The oral cavity presents unique challenges to wound healing due to constant saliva flow, mechanical stress, and bacterial contamination. Therefore, exploring natural agents like Manuka honey for intraoral wound care could significantly improve postoperative outcomes and patient quality of life. This study aimed to evaluate and compare the soft tissue healing response following tooth extraction in diabetic patients using Manuka honey gel versus conventional saline care. The hypothesis was that Manuka honey gel would enhance soft tissue healing and reduce postoperative pain and inflammation compared to the control.

Materials and Methodology

The present investigation was designed as a prospective, randomized, and controlled clinical study carried out in the Department of Oral and Maxillofacial Surgery at Sibar Institute Of Dental Sciences. Ethical clearance for the research was obtained from the Institutional Review Board (Ref. No: IEC/2025/OMFS/017), and written informed consent was secured from every participant before inclusion in the study. All procedures were conducted in accordance with the ethical standards outlined in the Declaration of Helsinki. The study

comprised 24 patients, including 14 males and 10 females, between 40 and 65 years of age. Each participant had a confirmed diagnosis of controlled type 2 diabetes mellitus with glycated haemoglobin (HbA1c) levels below 7.5% and required a simple tooth extraction. Patients were excluded if they presented with uncontrolled diabetes (HbA1c ≥ 8%), other systemic or immunocompromised conditions, active oral infections such as periapical abscess or cellulitis, a history of allergy to honey or bee-related products, or reported habits of smoking and alcohol consumption. After meeting the inclusion criteria, the subjects were randomly assigned to two equal groups of twelve patients each. In the experimental group (Group A), following atraumatic tooth extraction under local anesthesia, the extraction socket was thoroughly irrigated with sterile saline and filled with 5 mL of medical-grade Manuka honey gel (UMF 15+). These patients were instructed not to rinse the oral cavity for 24 hours postoperatively. The control group (Group B) underwent a similar extraction procedure, after which the sockets were irrigated with saline only, followed by routine postoperative care without the use of any additional agent. All participants were prescribed a standard postoperative regimen comprising Amoxicillin 500 mg three times daily for five days, Paracetamol 500 mg as required for pain control, and 0.12% chlorhexidine mouthwash twice daily starting 24 hours after surgery. Postoperative evaluation was conducted on the first, third, seventh, and fourteenth days following extraction. Healing of the soft tissues was assessed according to the criteria proposed by Landry, Turnbull, and Howley (1988), which grades wound healing on a five-point scale ranging from very poor to excellent based on tissue coloration, presence of bleeding, granulation tissue formation, and degree of epithelization. Pain intensity was measured using a Visual Analogue Scale (VAS) ranging from 0 (no pain) to 10 (severe pain). The presence of inflammation or infection was assessed clinically through the observation of erythema, swelling, or suppuration. The collected data were statistically analyzed using SPSS software version 25.0. Descriptive statistics were expressed as mean values with standard deviation, and differences between the two groups were compared using the independent Student's t-test for continuous variables and the Chi-square test for categorical variables. A p-value of less than 0.05 was considered to indicate statistical significance.

Results

Demographic Data

Both groups were comparable in terms of age, gender, and glycaemic control ($p > 0.05$). The mean age was 54.2 ± 6.3 years in the Manuka group and 52.8 ± 5.9 years in the control group. No postoperative complications related to allergic response or adverse effects were observed Table.1.

Parameter	Group A (Manuka Honey Gel)	Group B (Control – Saline)	*p*-value
Number of patients	12	12	
Mean age (years)	54.2 ± 6.3	52.8 ± 5.9	> 0.05
Gender (Male/Female)	7 / 5	7 / 5	> 0.05
Mean HbA1c (%)	7.2 ± 0.3	7.3 ± 0.4	> 0.05

Table 1. Demographic Data of Study Participants

Soft Tissue Healing

The data in Table 2. on the 3rd postoperative day, Group A demonstrated a mean healing score of 3.6 ± 0.5, significantly higher than Group B (2.8 ± 0.6) ($p = 0.002$). By day 7, most sockets in the Manuka group exhibited complete epithelial coverage (score 4.6 ± 0.4), whereas the control group showed incomplete healing (3.9 ± 0.5). By day 14, healing was excellent in 91.6% of the Manuka-treated sites compared to 66.6% in controls ($p = 0.021$).

Postoperative Day	Group A (Mean ± SD)	Group B (Mean ± SD)	*p*-value
Day 3	3.6 ± 0.5	2.8 ± 0.6	0.002
Day 7	4.6 ± 0.4	3.9 ± 0.5	0.008
Day 14	Excellent healing in 91.6%	Excellent healing in 66.6%	0.021

Table 2. Comparison of Soft Tissue Healing Scores (Landry, Turnbull & Howley Index)

Pain Assessment

The data in Table 3 demonstrates VAS scores declined more rapidly in the Manuka group. On day 1, mean VAS was 4.2 ± 0.8 (Manuka) versus 4.5 ± 0.7 (control). By day 3, the Manuka group showed a mean VAS of 2.1 ± 0.6 compared to 3.6 ± 0.8 in the control ($p < 0.001$). By day 7, pain had nearly resolved in the Manuka group (0.8 ± 0.3).

Postoperative Day	Group A (Mean ± SD)	Group B (Mean ± SD)	*p*-value
Day 1	4.2 ± 0.8	4.5 ± 0.7	0.317
Day 3	2.1 ± 0.6	3.6 ± 0.8	< 0.001
Day 7	0.8 ± 0.3	1.4 ± 0.5	0.015

Table 3. Comparison of Postoperative Pain (VAS Scores)

Inflammation and Infection

The data in Table 4 demonstrates Mild swelling was observed in 3 patients from the control group on day 3, while none were reported in the Manuka group. Two control group patients exhibited delayed healing with mild purulent discharge by day 7, both managed with additional irrigation and antibiotics. No infection was reported in the Manuka group.

Postoperative Day	Group A (Mean ± SD)	Group B (Mean ± SD)
Inflammation (Day 3)	0 / 12 (0%)	3 / 12 (25%
Infection (Day 7)	0 / 12 (0%)	2 / 12 (16.6%)
Overall infection rate	0%	16.6%

Table 4. Incidence of Inflammation and Infection

Discussion

The findings of the present study indicate that the application of Manuka honey gel markedly enhances soft tissue healing following tooth extraction in diabetic individuals when compared with conventional saline management. This observation supports previous evidence highlighting the therapeutic potential of honey in wound repair and its suitability as a safe, biocompatible, and economical adjunct in oral surgical practice[3]. In diabetic patients, delayed postoperative healing results from multiple physiological impairments, including reduced neutrophil efficiency, diminished release of growth factors, compromised microcirculation, and oxidative stress caused by persistent hyperglycaemia. These alterations collectively slow tissue regeneration and increase the risk of infection[4]. Manuka honey, owing to its rich concentration of methylglyoxal and naturally low pH, establishes a microenvironment that favours rapid

healing by facilitating autolytic debridement, lowering bacterial load, and stimulating the formation of healthy granulation tissue. Its therapeutic effect is attributed to several complementary mechanisms[5]. The antimicrobial property of Manuka honey arises from the synergistic action of hydrogen peroxide, methylglyoxal, and reduced water activity, which effectively suppress the growth of common oral pathogens such as *Staphylococcus aureus*, *Pseudomonas aeruginosa*, and *Streptococcus mutans*. In addition, it exerts a notable anti-inflammatory influence by modulating the release of cytokines, including tumor necrosis factor-alpha and interleukin-6, leading to early resolution of inflammation and subsequent pain reduction[6]. The osmotic nature of honey further attracts lymphatic fluid to the wound site, facilitating gentle debridement and improved nutrient supply to proliferating cells, while the stimulation of vascular endothelial growth factor enhances angiogenesis and tissue remodelling. The outcomes obtained in this study are consistent with those reported by Al-Waili and colleagues, who observed more rapid epithelial closure in extraction wounds treated with honey, and with the findings of Bensadoun et al., who demonstrated similar benefits in oral mucosal healing among patients undergoing radiation therapy[1,2]. In the present cohort, individuals treated with Manuka honey displayed healthier tissue coloration, more uniform epithelial coverage, and minimal postoperative discomfort compared with controls. The complete absence of infection in this group reinforces honey's strong antibacterial potential, which is particularly valuable in diabetic patients who are highly susceptible to wound contamination. The reduction in pain observed can be attributed not only to its anti-inflammatory effect but also to the protective, moist barrier created by the gel that shields exposed nerve endings and prevents tissue desiccation[7,8]. The viscous consistency of honey acts as a natural dressing, minimizing irritation from masticatory movements and environmental factors within the oral cavity[9,10]. While the results are promising, certain limitations should be acknowledged. The study was limited by a small sample size, and no histological evaluation was performed to confirm the extent of epithelial regeneration. Moreover, the assessment was confined to short-term healing, without examining the potential influence of honey on subsequent bone remodelling. Future investigations incorporating larger populations, extended follow-up periods, and molecular analyses of angiogenic and epithelial markers could further clarify the biological mechanisms underlying the observed outcomes. Despite these limitations, the present findings hold significant clinical relevance. The ease of application, availability, and safety profile of Manuka honey make it a practical adjunctive agent in the postoperative management of diabetic patients. Its integration into routine dental and surgical wound care aligns with the growing shift toward natural, biologically based materials that enhance healing while improving patient comfort and satisfaction.

Conclusion

Manuka honey gel significantly enhances soft tissue healing after tooth extraction in diabetic patients. Its antimicrobial, anti-inflammatory, and pro-healing properties contribute to faster epithelialization, reduced postoperative pain, and minimal infection risk. Given its safety, affordability, and patient acceptance, Manuka honey gel can be recommended as an effective adjunctive material for promoting optimal wound healing in diabetic individuals.

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