

# ALPHA TOCOPHEROL AS AN ADJUVANT IN DIABETIC PATIENTS-EXTENDING BENEFITS BEYOND EXTRACTION SOCKET HEALING

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## ABSTRACT

**Background:**Diabetic patients often present with delayed wound healing and increased risk of post-operative complications following dental extractions due to impaired microvascular function, oxidative stress, and altered immune response. Alpha-tocopherol (Vitamin E), a potent lipid-soluble antioxidant, has been shown to reduce oxidative damage and enhance tissue repair. This study aims to evaluate the effectiveness of vitamin E as an adjunct to reduce post operative complications in extraction in diabetic Patients.**Materials and Methods :**A total of 30 patients were randomly allocated to Group E and Group S. Vitamin E was applied to Gelfoam in extraction socket in Group E, while Group S received Gelfoam with saline. Postoperative pain, incidence of dry socket were evaluated on 3<sup>rd</sup> day and healing progression were evaluated on 3<sup>rd</sup> and 7<sup>th</sup> day using standardized clinical criteria **Results:** Vitamin E group showed significantly reduced postoperative pain, faster healing, and lower incidence of dry socket compared to control sites and no adverse effects related to Vitamin E application were observed .**Conclusion:** Intrasocket Vitamin E application appears to be a safe and effective adjunct for improving postoperative outcomes in diabetic patients following tooth extraction, by promoting healing, reducing pain, and minimizing the risk of dry socket.

**Keywords:** Vitamin E; Diabetic patients; extraction; Postoperative complications; Dry socket

## Introduction

Diabetes mellitus is a chronic metabolic disorder characterized by insufficient insulin production or impaired insulin utilization. Insulin regulates blood glucose levels, and its dysfunction results in persistent hyperglycemia. Poor glycemic control predisposes patients to systemic complications including nephropathy, neuropathy, retinopathy, and impaired wound healing. Diabetic wounds are often chronic, with delayed and disrupted repair due to altered cellular and molecular mechanisms<sup>1</sup>. Normal wound healing is a complex process involving four overlapping phases: hemostasis, inflammation, proliferation, and remodeling. Hyperglycemia prolongs the inflammatory phase and enhances susceptibility to infection and septicemia<sup>2</sup>. In addition, vascular dysfunction, oxidative stress, nerve hypoxia, impaired angiogenesis, defective collagen synthesis, and immune dysregulation collectively delay tissue repair<sup>3</sup>. Excess glucose metabolism during mitochondrial oxidation increases ATP generation and produces reactive oxygen species (ROS). Sustained ROS accumulation causes oxidative stress, leading to oxidative damage of proteins, lipids, and nucleic acids, and ultimately apoptosis. Thus, oxidative stress is considered a major contributor to diabetic wound pathology, and the use of antioxidants has emerged as a therapeutic strategy to improve wound healing<sup>4,5</sup>. Vitamin E is a lipid-soluble antioxidant that scavenges free radicals such as peroxy radicals and singlet oxygen. It comprises two major subgroups: tocopherols (TF) and tocotrienols (T3). Tocopherols exert anti-inflammatory effects, enhance fibroblast growth factor secretion, promote gingival tissue repair, and preserve alveolar bone integrity. Vitamin E supplementation also improves insulin sensitivity and reduces oxidative stress<sup>6,7</sup>. Tocotrienols enhance osteoblast proliferation, differentiation, and mineralization, while reducing apoptosis. Both tocopherols and tocotrienols promote angiogenesis, re-epithelialization, extracellular matrix formation, and collagen synthesis, supporting the proliferative and remodeling phases of wound healing<sup>8,9</sup>. However, in diabetic patients, impaired perfusion and microcirculation

may limit systemic absorption of vitamin E. Therefore, local application—such as in extraction sockets—can provide more direct therapeutic benefits compared to oral supplementation<sup>10,11</sup>.

### **Materials and methods:**

A Randomized split mouth study was conducted in the Department of Oral and Maxillofacial Surgery in Sibar institute of dental sciences from May 2025 to July 2025 with a sample size of 30 patients. Approval was taken from Institutional Ethical Committee before the commencement of the study. Consent was taken from all the patients involved in the study. Inclusion criteria were Patients who require bilateral extractions, Patients between 45-60 years of age, Patients falling under physical status classification (American society of Anaesthesiologists) ASA 2 individuals. Exclusion criteria were Patients with any medical condition that may influence the outcome uncontrolled diabetes (>200mg/dl), Hyperparathyroidism, Hyperthyroidism, Cushing's disease, Paget's disease, Glucocorticoids, Patients with systemic disease affecting bone healing (osteoporosis, Rickets, and osteomalacia). Pathologic lesions in the site of extraction, history of Smoking and alcohol. Patients who visited the Department of Oral and Maxillofacial Surgery for extraction were randomly categorized into Group E and Group S. In Group E Vitamin E was applied to Haeamostat (gel foam) and was placed in extraction socket and in Group S 0.9% normal saline was placed in extraction socket.

### **Evaluation of study outcomes:**

### **Surgical procedure:**

Following the standard precautions of scrubbing and draping the patient under aseptic conditions nerve block with local anaesthesia (2% lidocaine containing 1: 80,000 epinephrine) is administered in accordance with the tooth to be extracted. After achieving sufficient

anaesthesia the standard procedure was followed by elevation of muco-periosteal flap with molt 9 periosteal elevator, luxation of the tooth to be extracted, application of extraction forceps as apically as possible and removal of the tooth was done atraumatically without damaging the buccal and lingual cortical plates (Figure 1) . In group E patients Vitamin E was applied to gel foam (Figure 2 ) and was placed in extraction socket while in group S 0.9% normal saline was placed in extraction socket. Figure of eight suturing was done to close the extraction socket using 3-0 silk suture..Post extraction instructions and medications were given to both groups. Pain was assessed on 3 rd day by using Visual analogue scale (VAS). Incidence of dry socket was assessed . Healing of extraction socket was assessed on 3<sup>rd</sup>(Figure 3) and 7 th day (Figure 4) by using modified Landry's scale. The patient was recalled on 3<sup>rd</sup> and 7<sup>th</sup> day to evaluate the paramaters and to same procedure was carried out in the opposite quadrant.



Figure 1: Atraumatic tooth extraction



Figure 2: Extraction socket with Vitamin E



Figure 3: Wound healing on 3<sup>rd</sup> day



Figure 4: Wound healing on 7<sup>th</sup> day

**Statistical analysis:**

The data were analyzed in SPSS-V28. Descriptive statistics were represented with percentages and mean with standard deviation. A parametric test independent - T test is used for the statistical analysis. A non-parametric test (Mann-Whitney U test) is used for the analysis of wound healing. The results were averaged (mean + standard deviation) for parameters of each group. Results were considered significant if the p values were less than 0.05.

**RESULTS:**

A total of 30 patients were taken into the study, who were randomly divided into two groups.

**Table 1: Comparison of mean VAS Score between Group E and Group S**

VAS SCORE	N	MEAN RANK	SUM OF RANKS	Z VALUE	P VALUE
GROUP E	30	39.02	1170.50	-3.813	0.000*
GROUP S	30	21.98	659.50		

In the present study, VAS scores were significantly lower in the Vitamin E group (mean rank = 39.02, sum of ranks = 1170.50) compared to the Saline group (mean rank = 21.98, sum of ranks = 659.50), with a Z value of -3.813 and a highly significant p-value (p = 0.000), indicating superior pain reduction with Vitamin E.

**Table 2: Comparison of incidence of dry socket between Group-E and Group-S**

VARIABLE	GROUP E	GROUP S	$\chi^2$ Value	P VALUE
<b>INCIDENCE OF DRY SOCKET</b>				
YES	03 (10%)	09(30%)	7.778	0.005*
NO	27(90%)	21 (70%)		

The incidence of dry socket was significantly lower in the Vitamin E group (70%) compared to the Saline group (90%). The difference was statistically significant ( $\chi^2 = 7.778$ ,  $p = 0.005$ ), indicating that Vitamin E application reduced the occurrence of dry socket.”

**Table 3: Comparison of wound healing on 3<sup>rd</sup> day between Group-E and Group-S**

		N	Mean	SD	Median	Mean rank	P Value
<b>WOUND HEALING ON 3RD DAY</b>	Group -E	30	3.87	0.39	4	38.12	0.021
	Group -S	30	3.46	0.44	3	22.88	
<b>WOUND HEALING ON 7TH DAY</b>	Group -E	30	4.23	0.32	4	37.56	0.011
	Group -S	30	3.88	0.51	4	23.44	

On the 3rd postoperative day, the Vitamin E group (Group-E) showed a higher mean wound healing score ( $3.87 \pm 0.39$ ) compared to the saline group (Group-S) ( $3.46 \pm 0.44$ ). The difference was statistically significant ( $p = 0.021$ ), indicating that early healing response was

better in patients treated with Vitamin E. By the 7th postoperative day, the mean wound healing score further improved in the Vitamin E group ( $4.23 \pm 0.32$ ) compared to the saline group ( $3.88 \pm 0.51$ ), and this difference was also statistically significant ( $p = 0.011$ ). Overall, these findings suggest that Vitamin E application significantly enhanced wound healing both in the early and late postoperative periods.

## DISCUSSION

Healing following tooth extraction is often delayed in diabetic patients due to hyperglycemia-induced alterations in cellular and molecular processes. Elevated blood glucose levels disrupt extracellular matrix components, including hyaluronan, impair fibroblast and keratinocyte migration, and induce persistent oxidative stress, all of which contribute to delayed socket healing and higher risk of postoperative complications<sup>1-5</sup>. These challenges underscore the need for effective local interventions to enhance tissue repair in high-risk patients. Intra-socket application of Vitamin E offers a targeted approach to mitigate these complications. Vitamin E, including  $\alpha$ -tocopherol and tocotrienols, is a potent antioxidant that reduces oxidative stress, promotes cellular proliferation, and supports tissue regeneration<sup>7-9,13-15,25</sup>. Preclinical studies have demonstrated that topical tocopherol accelerates mucosal wound healing in diabetic models<sup>10,16,18</sup>, while tocotrienol-rich nano-emulsion systems enhance local antioxidant mechanism and tissue repair<sup>11,23</sup>. These findings suggest that local delivery of Vitamin E directly into extraction sockets can create a favourable microenvironment for faster healing. Clinical evidence supports the benefits of intra-socket or topical Vitamin E application in reducing postoperative complications. Studies report that Vitamin E reduces postoperative pain, minimizes inflammation, and decreases the incidence of dry socket in patients following tooth extraction<sup>26</sup>. Additionally, prophylactic use of Vitamin E, often combined with agents like pentoxifylline, has shown efficacy in preventing osteoradionecrosis and enhancing healing

in compromised sites <sup>12,20</sup>. By modulating oxidative stress and promoting local tissue regeneration, intrasocket Vitamin E can accelerate epithelialization and bone remodelling, which are critical for successful socket healing in diabetic patients. The antioxidant effects of Vitamin E are central to its therapeutic action. It reduces lipid peroxidation, enhances endogenous antioxidant enzyme activity, and mitigates hyperglycemia-induced oxidative damage that delays wound closure <sup>13-15,25</sup>. Improved local redox balance not only promotes faster mucosal and bone healing but also reduces the risk of complications such as infection, delayed healing, and alveolar bone loss <sup>22,24</sup>. Evidence supports the efficacy of Vitamin E in improving post-extraction healing, variability in dosing, formulation, and delivery method highlights the need for standardized clinical protocols <sup>6,15</sup>. Emerging studies utilizing nano-formulations and optimized topical delivery shows promising results in maximizing local bioavailability and therapeutic effect <sup>11,23</sup>. Intrasocket Vitamin E application appears to be an effective adjunctive strategy for managing postoperative complications in diabetic patients following tooth extraction. By reducing oxidative stress, promoting tissue regeneration, alleviating pain, and lowering the incidence of dry socket, it may improve overall healing outcomes and patient comfort <sup>7,10-12,16-20,23,26</sup>. These findings support the potential of Vitamin E as a safe and effective local intervention in high-risk extraction sites, warranting further controlled studies to establish standardized protocols.

## Conclusion

Vitamin E is very effective in controlling post operative pain, incidence of dry socket, and promotes good wound healing by its anti-oxidant property. Intrasocket Vitamin E application appears to be a safe and effective adjunct for improving postoperative outcomes in diabetic patients following tooth extraction, by promoting healing, reducing pain, and minimizing the risk of dry socket.

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