

Impact of Vitamin C on Wound Healing Following Dental Implantation

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ABSTRACT:

Background: The present study was conducted to assess role of vitamin C in wound healing following dental implantation. **Materials & Methods:** 60 patients receiving dental implants were divided into 4 groups of 15 each. Group I received dental implants supported by the guided bone regeneration (GBR) technique. Group II received dental implants and Bio-Oss Collagen grafts. Group III patients received dental implants, they had chronic periodontitis. Group IV patients received dental implants without using any bone grafts. The Landry index was used to evaluate the soft tissue healing at 3, 7 and 14 days post-surgery. **Results:** The mean wound healing score in experimental and control subgroup in group I was 4.98 and 3.80, in group II was 4.28 and 4.10, in group III was 4.78 and 4.16 and in group IV was 4.68 and 4.60 respectively. The mean pain score was significantly higher in control subgroups as compared to experimental groups in group I, II, III and IV respectively. **Conclusion:** Vitamin C supplementation improves postoperative healing following dental implant surgery in patients with chronic periodontitis and patients treated with GBR or Bio-Oss Collagen grafts. **Key words:** dental implant, vitamin c, wound healing.

INTRODUCTION

Dental implants are the best treatment option for the rehabilitation of aesthetic and functional problems that result from tooth loss. The concept of osseointegration was introduced by Dr Brånemark at the Toronto Conference on Osseointegration in Clinical Dentistry in 1982.¹ Since the conference, dental implants have become increasingly popular, improving the quality of life for patients suffering from tooth loss. The process of wound healing that follows dental implant surgery is an important factor that effects the survival and clinical success of dental implants, particularly in patients with existing periodontal disease or in patients requiring complex implant surgery.²

Vitamin C can enhance the protective mechanism of the immune system to accelerate the healing process.³ This vitamin protects the skin against ultraviolet rays, free radicals and damages and besides its anti-inflammatory effect it is also a major agent in depigmentation of skin. 250-500 mg of oral vitamin C is prescribed for patients under the age of 13 and up to

1000 mg/day is prescribed for those over 13 years old. Topical vitamin C reduces inflammatory responses.⁴

Vitamin C especially promotes keratinocyte proliferation and fibroblast migration, enhances synthesis collagen, and stabilizes the collagen molecule tertiary structures; it appears crucial for the healing/regeneration process and wound healing. In addition, vitamin C is an effective antioxidant that relieves oxidative stress and participates in a variety of biochemical reactions.⁵ Vitamin C is an important cofactor for several enzymatic reactions occurring in the body, and it can promote anti-inflammatory progression through multipotent mechanisms in macrophages.⁶ The present study was conducted to assess role of vitamin C in wound healing following dental implantation.

MATERIALS & METHODS

The present study comprised of 60 patients receiving dental implants of both genders. All patients were informed regarding the study and their written consent was obtained.

Data such as name, age, gender etc. was recorded. Patients were divided into 4 groups of 15 each. Group I received dental implants supported by the guided bone regeneration (GBR) technique. Group II received dental implants and Bio-Oss Collagen grafts. Group III patients received dental implants, they had chronic periodontitis. Group IV patients received dental implants without using any bone grafts. Each group was divided into two subgroups, including an experimental group that received vitamin C supplements and a control group that did not receive vitamin C. The Landry index was used to evaluate the soft tissue healing at 3, 7, and 14 days post-surgery, while the visual analogue scale (VAS) was used to assess postoperative pain at 1, 3, and 7 days post-surgery. Results thus obtained were clubbed and assessed statistically. P value less than 0.05 was considered significant.

RESULTS

Table I Distribution of patients

Groups	Group I	Group II	Group III	Group IV
Method	Dental implants + GTR	Dental implants+ Bio-Oss Collagen grafts	Dental implants, Chronic periodontitis	Dental implants + bone grafts
M:F	10:5	8:7	9:6	7:8

Table I shows that there were 10 males and 5 females in group I, 8 males and 7 females in group II, 9 males and 6 females in group III and 7 males and 8 females in group IV.

Table II Assessment of wound healing scores

Groups	Subgroups	Mean	SD	P value
Group I	Experimental	4.98	0.32	0.05
	Control	3.80	0.40	
Group II	Experimental	4.28	0.32	0.01
	Control	4.10	0.30	
Group III	Experimental	4.78	0.28	0.02
	Control	4.16	0.26	
Group IV	Experimental	4.68	0.32	0.18
	Control	4.60	0.30	

Table II, graph I shows that mean wound healing score in experimental and control subgroup in group I was 4.98 and 3.80, in group II was 4.28 and 4.10, in group III was 4.78 and 4.16 and in group IV was 4.68 and 4.60 respectively. The difference was significant ($P < 0.05$).

Graph I Assessment of wound healing scores

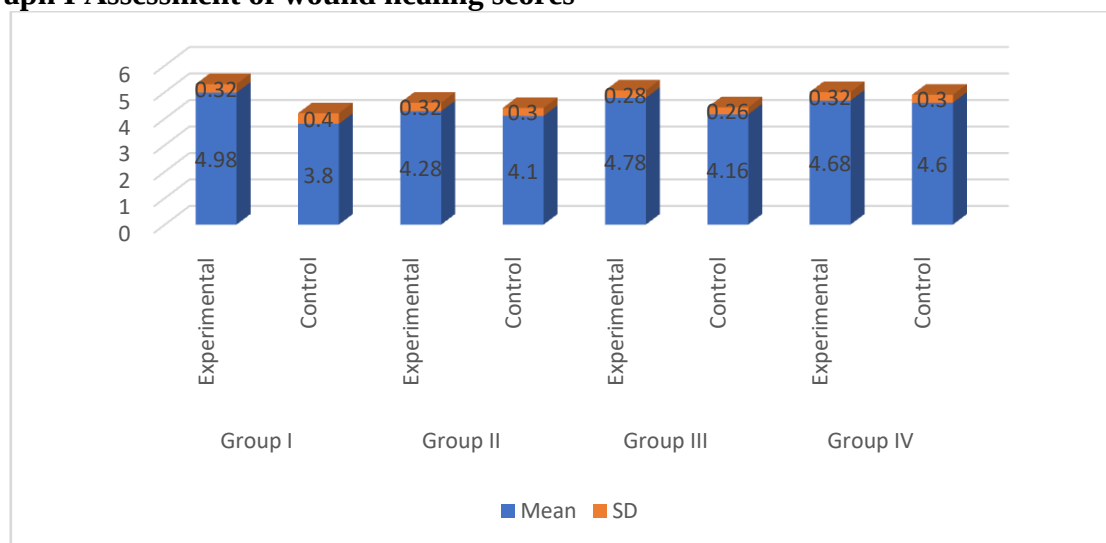
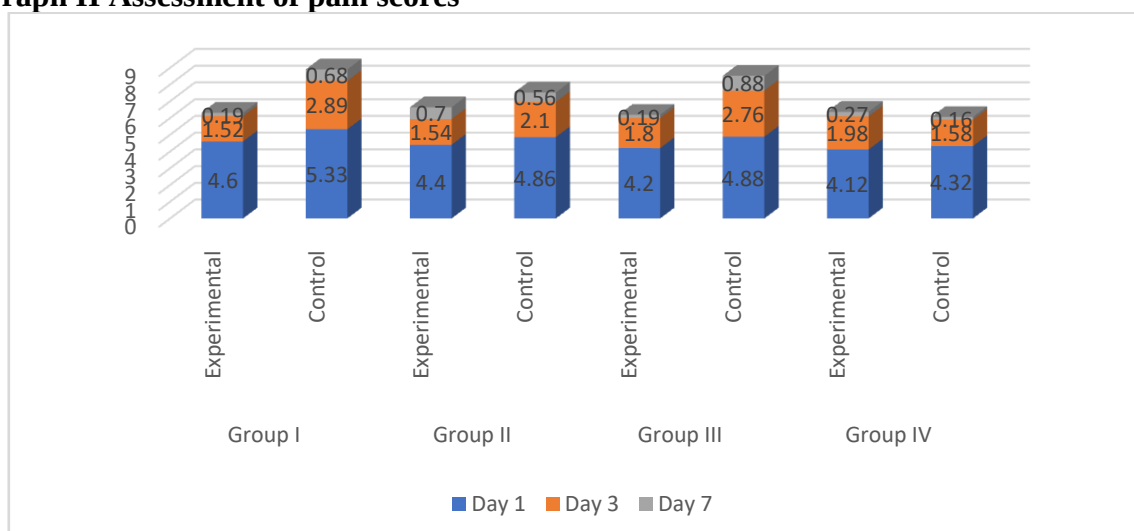


Table III Assessment of pain scores

Groups	Subgroups	Day 1	Day 3	Day 7	P value
Group I	Experimental	4.60	1.52	0.19	0.02
	Control	5.33	2.89	0.68	
Group II	Experimental	4.40	1.54	0.70	0.04
	Control	4.86	2.10	0.56	
Group III	Experimental	4.20	1.80	0.19	0.05
	Control	4.88	2.76	0.88	
Group IV	Experimental	4.12	1.98	0.27	0.01
	Control	4.32	1.58	0.16	

Table III, graph II shows that mean pain score was significantly higher in control subgroups as compared to experimental groups in group I, II, III and IV respectively.

Graph II Assessment of pain scores



DISCUSSION

Vitamin C solution is necessary to cross-link collagen molecules to enhance tissue strength. Finally, it stimulates collagen genes to synthesize collagen in order to heal the wounds. Previous studies on pigs have shown that using 10% vitamin C solution increases the concentration of this vitamin in the skin.⁷ Moreover, the positive effect of different fruits such as kiwifruit and jujube on burn wounds have been proven; fruits which are mainly composed of vitamin C.⁸ Various studies have demonstrated the role of fatty acids and antioxidants such as vitamin C, in accelerating the wound-healing process. Numerous evidences have proven the significant effect of oral effect of vitamin C on wound-healing process and also the topical application of vitamin C-containing fruits on burn wounds.⁹ The present study was conducted to assess role of vitamin C in wound healing following dental implantation.

In present study, there were 10 males and 5 females in group I, 8 males and 7 females in group II, 9 males and 6 females in group III and 7 males and 8 females in group IV. Li et al¹⁰ explored the effects of vitamin C supplementation in wound healing, following the placement of dental implants with or without bone grafts and patients with chronic periodontitis. This clinical trial included 128 patients requiring dental implants to replace missing teeth. Patients were divided into four groups, group A received dental implants supported by guided bone regeneration (GBR) technique, group B received dental implants with Bio-Oss Collagen, group C received dental implants in patients with chronic periodontitis, and group D received dental implants without any bone grafting or periodontal disease. Each group was divided into an experimental subgroup, who received vitamin C, and a control subgroup. Follow-up appointments were performed at day 3, day 7, and day 14 post-surgery, during which soft tissue healing and pain response scores were evaluated using the Landry index and visual analogue scale, respectively. The experimental subgroups had significantly higher healing indices than the controls ($P < .05$) at day 7 post-surgery for group B and day 14 post-surgery for groups A, B, and C. Group D displayed no difference between the experimental and control groups at any time point. In reference to vitamin C for pain relief, there were no statistically significant differences between the study groups.

We found that mean wound healing score in experimental and control subgroup in group I was 4.98 and 3.80, in group II was 4.28 and 4.10, in group III was 4.78 and 4.16 and in group IV was 4.68 and 4.60 respectively. The mean pain score was significantly higher in control subgroups as compared to experimental groups in group I, II, III and IV respectively.

Vitamin C (ascorbic acid) is a water-soluble micronutrient required for human health. As the body is unable to synthesize vitamin C endogenously, humans require external sources of vitamin C from dietary intake and supplementation.¹¹ The Food and Nutrition Board of the National Academy of Sciences recommends a vitamin C daily intake of 60 mg for adults, while the World Health Organization recommends a daily intake of 45 mg. In order for the body to properly function, it has been recommended that adults should receive no less than 200 mg of vitamin C from their daily diet. Vitamin C deficiency, also known as scurvy, occurs when plasma vitamin C concentrations decrease to less than 11 $\mu\text{mol/L}$, which interferes with collagen synthesis and delays wound healing in patients.¹¹ In addition, patients with marginal vitamin C deficiency, with plasma vitamin C concentration below 23 $\mu\text{mol/L}$, may go undiagnosed for years.¹²

CONCLUSION

Authors found that vitamin C supplementation improves postoperative healing following dental implant surgery in patients with chronic periodontitis and patients treated with GBR or Bio-Oss Collagen grafts.

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