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EFFECT OF MELATONIN APPLICATION AROUND IMMEDIATE IMPLANTS

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ABSTRACT

Background: The aim of the current study was designed to evaluate the clinical and radiographic effects of the melatonin gel around immediately placed dental implants in maxillary anterior teeth. **Methods**: Fourteen patients were selected from those who attended the outpatient clinics of Oral and Maxillofacial Surgery Department of Al-Azhar University Hospitals. Group A: beta tri-calcium phosphate bone graft mixed with melatonin gel was packed around the implant to fill the buccal gap. For Group B: beta tri calcium phosphate bone graft mixed with saline was packed around the implant to fill the buccal gap. PRF membrane is prepared to cover the graft. **Results**: Implant stability showed increasing value in both groups a higher mean value was recorded in group A. Increased bone density throughout follow-up period.at 3 months follow-up, a higher mean value was recorded in group A, with a significant difference. **Conclusion**: Melatonin achieve increased bone density and stability in the healing period. Immediate post extraction implant offers patient satisfaction due to less time and less pain.

INTRODUCTION

The potential advantages of the immediate implants are decrease in number of surgical interventions, shortened time of treatment, bone preservation around the socket especially the buccal bone [1-3].

Orientation of dental implants is easier and more ideal, good aesthetics for soft tissue, absence of active infections, Adequate mechanical retention due to intact buccal bone and narrow alveolar bone [4, 5] . Clinicians have also used other materials and methods to augment edentulous ridges and small bony defects or vertical gap between the bony walls of the socket and the cervical part of the implant especially in upper anterior region owing to conical shape of the socket.

Melatonin is chemically recognized as N-acetyl-5-methoxytryptamine. It is a compound occurring naturally in plants, microbes and animals. Melatonin called hormone of night is secreted by the pineal gland, and its plasma levels concentration are 50 folds higher in night in comparison to daytime. A variety of peripheral cells play a role in production of melatonin such as epithelial cells, bone marrow cells, and lymphocytes[6]. Though melatonin is a hormone, it does not act on a specific organ, it has several functions; stimulation of the synthesis of type I collagen fibers, regulation of the body temperature, sexual development, antioxidant scavenging and detoxifying free radicals thus inhibiting the process of bone resorption through interfering with the function of osteoclasts [7] .

Melatonin has been investigated relative to bone remolding osteoporosis, osseointegration of dental implants and dentine formation It is hypothesized that melatonin, perhaps through three principle actions, modulates bone metabolism. Firstly, melatonin directly affects the actions of osteoblast and osteoclast [8, 9] .

Numerous studies documented that melatonin increases pre-osteoblast/osteoblast/osteoblast-like cell proliferation, promotes the expression of type I collagen and bone marker proteins (e.g., alkaline phosphatase, osteopontin, bone sialoprotein

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and osteocalcin), and stimulates the formation of a mineralized matrix in these cells[10-14]. Besides, melatonin inhibits the differentiation of osteoclasts via decreases in the expression of RANK mRNA and increases in both the mRNA and protein levels of osteo-protegerin[15,16]. Secondly, melatonin indirectly regulates bone metabolism through the interaction with systemic hormones (e.g., PTH, calcitonin, and estrogen) or other molecules. This study aims to assess melatonin application around immediate dental implant to improve bone synthesis and ensure better results.

PATIENTS AND METHODS

Fourteen patients with teeth indicated for extraction in aesthetic zone were selected from those who attended the outpatient clinics of Oral and Maxillofacial Surgery Department of Al-Azhar University Hospitals. Patients were divided into two groups: Group A (beta-tri calcium phosphate mixed with melatonin gel was applied into the buccal jumping gap), Group B (The beta tri calcium phosphate mixed with saline was applied into the gap around the immediately placed dental implant).

Preoperative preparation:

All patients were prepared for surgery by the same protocol as follow:

1. Preoperative photographs.
2. Preoperative radiographs. (periapical, and cone beam computed tomography (CBCT).

Operative procedures

Injectable Local anesthesia. (infiltration technique) for anaesthetizing of the site of surgery had been given to the patient. Full thickness mucoperiosteal flap was then reflected Started with small elevator in the interproximal area mesial and distal between the tooth and the interdenal bone to allow luxation of the tooth by cutting the periodontal ligaments interproximaly. After the tooth has been started to luxate, we used either remaining root forceps or large size tissue forceps in up and down motion (i.e. push and pull) the socket was cleaned and irrigated with normal saline to flush any debris from the socket. The socket has been curated by bone curate as it is mandatory procedures for any immediate implant case to remove the remnant of periodontal ligament and any granulation or fibrous tissue inside the socket. Drilling has been extended 2 - 3mm apically beyond the apex of the root or the base of the socket to gain primary stability for the implant from the apical bone. Implant was installed in the prepared socket

For Group A: beta tri-calcium phosphate bone graft mixed with melatonin gel was packed around the implant to fill the buccal gap. **For Group B:** beta tri calcium phosphate bone graft mixed with saline was packed around the implant to fill the buccal gap. PRF membrane is prepared to cover the graft. Flap repositioned and sutured.

Post-operative evaluation

A- Clinically

Stability

Probing depth

B- Radiographically (CBCT)

Bone density

Crestal bone loss

RESULTS

The present study was done to evaluate the effect of melatonin gel when used with immediate implant in upper anterior region. Fourteen implants were placed into fourteen patients each patient receives one implant. The patients were divided into 2 groups: Group A beta tri calcium phosphate bone substitute mixed with melatonin gel. Group B beta tri calcium phosphate bone substitute mixed with saline. All implants were placed into maxilla. Follow-up for bone density, crestal bone loss, probing depth and stability.

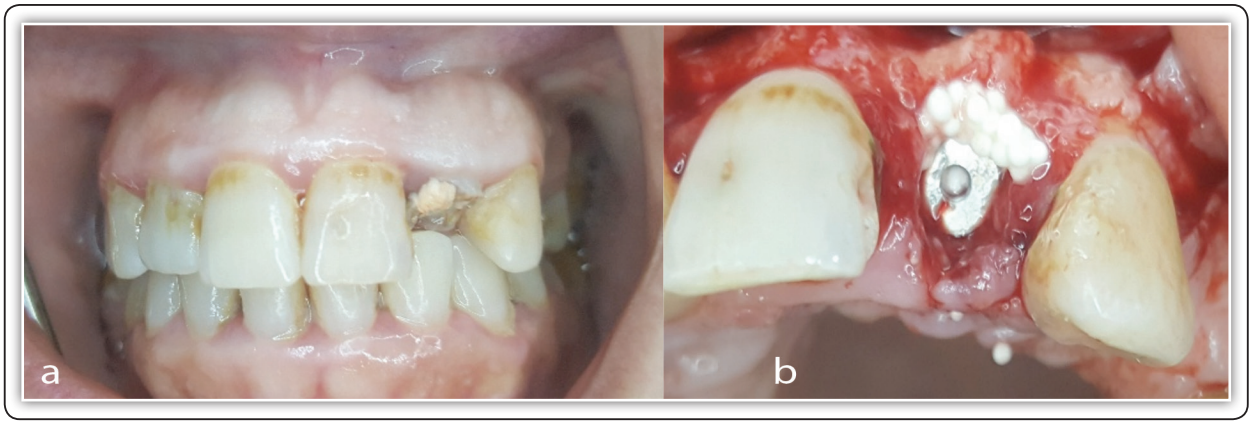

FIG (1) Aspire-operative photo showing non-restorable upper left lateral toot b, graft condensed into the buccal gap between implant and buccal bone

TABLE (1) Comparison between the two studied groups according to different parameters

	Group A	Group B	Test of Sig.	p
Gender				
Male	4 (57%)	3(43%)	χ^2= 0.4	0.527
Female	3(43%)	4(57%)		
Age	35.4 ± 3.07	36.6 ± 3.7	t=0.1314	0.899
Implant stability (ISQ units)				
At surgery	47.42^{c} ± 4.34	47.28^{c} ± 5.23	t=0.017	0.98
3 months	60^{b} ± 4.61	54.7^{b} ± 4.02	t=2.29*	0.041*
6 months	77.7^{a} ± 10.3	70.8^{a} ± 12.68	t=1.12	0.286
Probing depth (mm)				
2 weeks	1.54 ± 0.32	1.6 ± 0.3	t=0.36	0.72
3 months	1.55 ± 0.4	1.61 ± 0.38	t=0.29	0.78
6 months	1.64 ± 0.37	1.7 ± 0.45	t=0.27	0.79
Bone density				
1st week	972c ± 74.1	971.4c ± 81.7	t=0.014	0.99
3 months	1093.63b ± 69.4	1006.71b ± 63.2	t=2.45*	0.031*
6 months	1158.28a ± 67.8	1081.7a ± 71.5	t= 2.06	0.0622
Crestal bone loss (mm)				
After 1 week	0b ± 0	0b ± 0	t=0	1
3 months	0.38a ± 0.1	0.4a ± 0.12	t=0.34	0.74
6 months	0.41a ± 0.12	0.43a ± 0.13	t=0.014	0.99

c^2: **Chi square test** **t: Student t-test**

p: p value for comparing between the two studied groups

Means in the **column** *with* **common letters** *are not significant for comparing between different periods*

**: Statistically significant at p ≤ 0.05*

DISCUSSION

In this study, Osstell Mentor was used for recording Implant Stability Quotient (ISQ) measurement at the time of implant placement and after 3, 6 months in both groups. The higher the ISQ value, the more stable the implant [17, 18] . Many studies have shown that implants whose ISQ values exceed 65 before functional loading have 99% survival rate and ISQ values of 57 to 82 have been used as threshold values for implant success [19] . ISQ values less than 45 indicate failure of the implant. The current study has indicated successful implants for all patients throughout this study. The ISQ values recorded in this study at time of surgery, revealed almost similar mean value (Group A 47.42±4.34, Group B 47.28±5.23) with no statistically significant difference, After 3 months , a higher mean value was recorded in group A (60±4.61) than group B (54.7±4.02), with a significant difference (p=0.041), At 6 months, a higher mean value was recorded in group A, with no significant difference

Probing depth when comparing both groups at two weeks, revealed a higher mean value in group B, with no statistically significant difference (p=0.72). At 3 months, a higher mean value was recorded in group B, with no significant difference (p=0.78). At 6 months, a higher mean value was recorded in

group B, with no significant difference (p=0.79). Pre-implant crestal bone level was evaluated on the mesial and distal surface of implant using (CBCT) at 3 and 6 months after the operation by using the measuring tools on CBCT system. Reference points for the linear measurements were the most coronal margin of the implant collar in relation to the most coronal point of bone -to- implant contact. Descriptive statistics of crestal bone loss results expressed in (mm). Comparing both groups after 1 week, revealed a value of 0±0 in both groups, with no statistically significant difference (p=1). At 3 months, a higher mean value was recorded in group B, with no significant difference (p=0.74). At 6 months, a higher mean value was recorded in group B, with no significant difference (p=0.99) Studying the effect on time in group A revealed a statistically significant gradual increase in the mean value to reach its highest level at 6 months (p<0.0001). Studying the effect on time in group B revealed a statistically significant gradual increase in the mean value to reach its highest level at 6 months (p<0.0001)

Numerous studies have shown that bone resorption around the implant neck does not start until the implant is uncovered and exposed to the oral cavity. This invariably leads to bacterial contamination of the gap between the implant and the superstructure. Bone remodeling will progress until the biological width has been created and stabilized. This width progresses not only apically along the vertical axis, but also 1 to 1.5 mm horizontally, according to studies conducted by Tarnow et al [20] . Esposito et al [21]. This is the reason for maintaining a minimum distance of 3 mm between two implants and platform switching in the aesthetic reconstruction zone in order to obtain intact papillae and stable inter-implant bone.

Silva et al [22], concluded that CBCT images is a reliable tool for bone density, so in the current study, CBCT images were used for evaluating presence of radiolucency, bone density around the implant sides all over. The parameters for production of the image were constant for all images. Comparing both groups at one week, revealed almost similar mean value, with no statistically significant difference (p=0.99). At 3 months, a higher mean value was recorded in group A, with a significant difference (p=0.031). At 6 months, a higher mean value was recorded in group A, with no significant difference (p=0.062), Studying the effect on time in group A revealed a statistically significant gradual increase in the mean value to reach its highest level at 6 months (p<0.0001). Studying the effect on time in group B revealed a statistically significant gradual increase in the mean value to reach its highest level at 6 months (p<0.0001).

In accordance with Joly et al [23] assessment of bone density was radiographically evaluated which is a non-invasive and fast technique. Increased bone density and stability associated with Melatonin implantation around implant fixtures with significant difference in the 3 months follow-up can be attributed to Kasuhito et al [24] advocations that melatonin showed increase in the activity of alkaline phosphatase (ALP) when applied in osteotomy sites and enhanced mRNA expression of the early phase type I collagen and shortened time of mature osteoblast differentiation. Bone grafting and melatonin are thus considered as bone stimulators through enhancing osteoblastic differentiation, proliferation and potential early matrix production and mineral deposition

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