Comparison of Post-tooth extraction Wound healing in Patients with Optimal Diabetes control and Poor Diabetes control

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ABSTRACT

Objective: To determine frequency of wound healing in diabetic patients after tooth extraction and to compare the healing process in diabetics with optimal and poor glycemic control.

Study Design: Comparative Observational Cross-sectional Study

Place and Duration: Department of Oral and Maxillofacial Surgery, Armed Forces Institute of Dentistry(AFID) Rawalpindi from 12th February 2016 to 12th August 2016.

Methodology: Diabetic patients undergoing surgical tooth extraction and their non-fasting blood glucose levels and updated Glycosylated hemoglobin values were checked pre-operatively. Healing of the extraction sockets were measured on 0 and 14th day post-operatively by assessing epithelialization rate with periodontal probe from buccal to lingual gingival margins. Epithelialization up to 75% were considered as healed socket .Post stratification chi square test was applied and p value ≤ 0.05 was considered significant.

Results: Among total of 100 patients had extraction, 75% patients achieved wound healing within 14 days. No significant delay of wound healing was observed with poor glycemic control.

Conclusion: Glycemic control has no influence on post-tooth extraction healing in diabetic patients

Keywords: Diabetics, Glycosylated hemoglobin, Tooth extraction, Wound healing.

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INTRODUCTION

Diabetes mellitus is a chronic metabolic disease affecting almost about 29 million people in United States only[1]. It is the major cause of renal failure, blindness, lower limb amputation and a main risk factor for peripheral neuropathies, poor periodontal health, cardiovascular disease and stroke[2-4]. Oral complications related to diabetes include tooth loss, gingivitis, oral soft tissue pathologies and periodontitis[5]. Bone is a complex mineralized connective tissue having a considerable potential for healing[6]. Healing of bone is an intricate process achieved by interaction of extracellular matrix and osteoblasts under the influence of growth factors. These growth factors help in the differentiation and proliferation of bone progenitor cells into osteoblasts (bone forming cell) leading to the bone matrix formation and subsequent bone mineralization[7].

After tooth extraction, healing of the empty socket begins. Woven bone forms which remodels and ultimately restore the defect. This process is influenced by many factors which can delay or enhance the process of bone healing. These factors include type of tissue, condition and location of the wound, its microbial condition, vascular supply, and local and systemic factors. Systemic factors like growth factors proliferation and differentiation[8]. In diabetes, patients may suffer from healing problems related to ill-fitting dentures, dental extractions and periodontal surgery and are more likely to have infections[9].

Healing of socket in diabetics is debatable. Delayed wound healing may occur due to the following reasons. In healthy individual, daily average insulin secretion is about 35 units. Healing process may require specific molecules such as insulin like growth factors, transforming growth factor β_3, bone morphogenetic proteins etc. Insulin cause direct effect on these growth factors which are required for healing. Similarly higher blood sugar levels have negative effect on immune system. It weakens the macrophage function and increases the chances of infection. Also higher ketone levels in diabetics may cause delay in wound healing. Increase blood glucose levels reduce vasodilator NO (nitric oxide) causing blood vessels narrowing and delay in oxygen and nutrients delivery, this may cause delayed healing[10].

In dento-alveolar surgery, diabetic patients are expected to suffer from more serious post-operative complications as seen in other surgical procedures, however oral cavity and its environment with the saliva, forces of mastication and reservoirs of microorganisms, high turnover rate, is different from the other body parts making generalization from other surgical sites limited[9].

Rational of this study is to investigate whether glycemic control have any effect on the process of socket healing after tooth extraction and whether differences in Glycosylated hemoglobin and random blood glucose level are of any significance regarding healing, as there are a lot of concerns regarding wound healing after extraction in uncontrolled diabetic patients. The result will have a profound effect on antibiotic therapy associated with healing after tooth extraction in diabetic patients. The study was conducted to determine frequency of healing after tooth extraction and to compare the healing process in diabetic patients with optimal and poor control. There are no enough studies conducted at local levels.

METHODOLOGY

This Comparative Observational Cross-sectional study was conducted at the Department of Oral and Maxillofacial Surgery, Armed Forces Institute of Dentistry, Rawalpindi from 12th February 2016 to 12th August 2016. Total sample size was 100 by taking anticipated proportion of healing in diabetic patient with tooth extraction 70.5%. The Non-Probability Consecutive Sampling was used to include Patients of both gender of age group between 18 to 65 years who were diagnosed case of controlled or uncontrolled diabetes mellitus, having partially impacted/ impacted tooth requiring extraction and Not allergic to drugs and anesthetic agents used in surgical protocol; while those patients with non- localized odontogenic infection ,on medications that can alter wound healing, Pregnant or breast-feeding women, patients having Tooth associated with pathologies i.e. (cysts, mandibular fractures ,tumors) or Patients on radiotherapy, chemotherapy, bisphosphonates, bone diseases were excluded .

Demographic details (including name, age, gender, contact) were obtained and recorded on specific data collection forms. Duration of the diabetes was asked and noted on form and Preoperatively Glycosylated hemoglobin values (HbA1c) were taken with the help of the patient's primary care physician or from the laboratory and blood glucose levels (random) were taken with a glucose meter. Extraction of the teeth was done and sutures were placed to re-approximate soft tissues in patients with controlled or uncontrolled diabetes. Patients were followed for the healing of the extraction socket on 0 and 14th day post-operatively by assessing epithelialization rate with a periodontal probe from lingual to buccal gingival margins. Epithelialization up to 75% (3/4th) was considered as healed socket.

Data Analysis: Data was analyzed using SPSS version 22.0. Quantitative variables like diabetes mellitus duration, age of the patients was presented by standard deviation and mean. Qualitative variables like gender and healing were calculated by frequencies and percentages. Effect modifiers like gender, age and diabetes mellitus duration were controlled by the stratification. P value ≤0.05 was obtained by applying post stratification chi square test and value is considered as significant.

RESULTS

A total of 100 patients were recruited. Majority 42% (n=42) of the patients were in range of 45-56 years. Mean age was 42 years with SD ± 6.591. 52% (n=52) patients were male. 33% (n=33) patients were suffering from diabetes for last 5-10 years, 40% (n=40) patients had diabetes for 11-15 years and 27% (n=27) patients had diabetes for 15-20 years. Mean diabetes mellitus duration was 12 years with SD ± 2.77. 44% (n=44) patients had well controlled diabetes (HbA1C up to 7%) while 56% (n=56) patients had poor glycemic control (HbA1C >7%). 75% (n=75) patients had healing of wound within 14 days while 25% (n=25) patients didn't have healing of wound within 14 days (Table-I).

Table-I: Frequency distribution of different variables (N= 100)

Variables		Frequency, n(%)
Duration of Diabetes	5-10 years	33 (33%)
	11-15 years	40 (40%)
	16-20 years	27 (27%)
Glycemic Control	7% (good glycemic control)	44 (44%)
	>7% (Poor glycemic control)	56 (56%)
Healing at 2 Weeks	Yes	75 (75%)
	No	25 (25%)

Stratification of wound healing with respect to age shows that incidence of wound infection (no healing) was found more in elderly diabetic patients as compared to young diabetic patients as in our study 12 patients (12%) had wound infection in age 56-65 years followed by 4 patients (4%) in age group 20-35 years and 9 patients (9%) in age range 45-55 years. Stratification with respect to gender showed that the incidence of wound infection (no healing) was found equal in male and female diabetic patients and stratification with respect to duration of diabetes revealed incidence of wound infection to

be more with duration of diabetes as in our study 11 patients (11%) had wound infection in diabetics of 16-20 years followed by 9 patients (9%) in 11-15 years and 5 patients (5%) in 5-10 years (Table-II).

Stratification of wound healing with respect to glycemic control revealed that incidence of wound infection didn't have any significant difference between poor glycemic control and good glycemic control diabetic patients as in our study 10 patients (10%) had wound infection in good glycemic control patients while 15 patients (15%) had wound infection in poor glycemic control patients having a p value of 0.6417 which was statistically not significant (Table-II).

Table-II: Post Stratification healing with respect to variables (N = 100)

Variables		Healing (n = 100)		p value
		Yes	No	
Gender	Male	39 (39%)	13 (13%)	1.00
	Female	36 (36%)	12 (12%)	
Age	20-35 years	27 (27%)	4 (4%)	0.0169
	45-55 years	33 (33%)	9 (9%)	
	56-65 years	15 (15%)	12 (12%)	
Duration of Diabetes	5-10 years	28 (28%)	5 (5%)	0.0669
	11-15 years	31 (31%)	9 (9%)	
	16-20 years	16 (16%)	11 (11%)	
Glycemic Control	7% (good glycemic control)	34 (34%)	10 (10%)	0.6417
	>7% (Poor glycemic control)	41(41%)	15 (15%)	

DISCUSSION

Traditionally in dentistry patients suffering from diabetes are observed to have more healing problems related to periodontal surgery, wearing ill-fitting dentures and tooth extractions. They are considered to have more infections. Although this may be so for Type 1 diabetics (poorly controlled), there is less literature and clinical support for this view for Type 2 diabetics on oral hypoglycemics[11]. Diabetes Mellitus effects the metabolic processes of the body involving multiple organs due to the deficiency of insulin either via autoimmune insulin cells destruction in pancreas (type 1, Insulin dependent diabetes mellitus) or via resistance to cellular metabolic effects (type 2 diabetes mellitus which is non-insulin dependent)[11,12] Studies on non-diabetic and diabetic rats provide the histological evidence of inadequate or delayed wound healing of wound after implant placement and dental extractions in the hyperglycemic group[13]. Normally socket heals within 1-2 months after extraction[14].The tooth socket healing begins with the formation of blood clot which organizes into granulation tissue, then transforms into connective tissue to woven bone and finally matures into lamellar bone[15] Initially connective tissue formation can be seen consistently during first week of healing but during this time less bone formation occurs[16-18]. For healing of the bone Chondro-osteoprogenitor cell population and mesenchymal cells recruited to the site. Recruitment of cells and their differentiation into osteoblasts are important. These steps require growth factors for neovascularization and angiogenesis for bone formation after extraction[19]. Many local and systemic factors affect the process of bone healing. Systemic factors such as hormones, cytokines, growth factors proliferation, differentiation, survival and function of bone cells[8]. When diabetic patient requires tooth extraction there are greater chances of post-operative complications caused by impaired wound healing[20]. Poor glycemic control leads to complications that are mainly characterized as macrovascular, neuropathic and microvascular. In particular microvascular complications have profound effect on wound healing after dental procedures.

An intact micro-circulation is necessary for inflammatory responses and nutrition of tissues. In diabetics, changes in the blood vessels such as thickening of the basement membrane of capillaries results in changed permeability and density with poor leucocyte migration[9,21,22], impaired hyperemia which cause under perfusion during tissue hypoxia and tissue stress. These changes result in wound infection and poor wound healing but it is presumed that oral cavity and its environment is different from other parts of body owing to various factors like forces of mastication, saliva and reservoirs of microorganisms and a substantially high turnover rate. Therefore certain factors like diabetic control might not influence oral wound healing as much as it is anticipated.

As a routine practice dentists determine the stability and the status of known diabetic patient with the help of history, random blood glucose levels and Glycosylated hemoglobin values either via advice from medical specialist or by performing the test directly prior to surgery[9]. In present study frequency of wound healing after 2 weeks post-op tooth extraction was found to be 75%. It was more in young adults as compared to old age diabetic patient however no significant difference of wound healing was observed in either gender or in patients with poor diabetic control as compared to good control of diabetes mellitus. Similar results were observed in another study conducted by Aronovich et al in which 72.74% of patients with controlled diabetes (BG level up to 180 mg/dl) had epithelization 3.58 mm and 65.21% of patients with uncontrolled diabetes (BG level greater than 180 mg/dl) had epithelialization 3.73 mm on 14th post-operative day (P value 0.85).

Similar findings were observed in another study conducted by Joshipura et al in which they reported that there was no gross significant difference in the healing of socket measured by post-extraction epithelialization among patients with diabetes with BG levels (preoperative) of greater than 180 mg/dL and those with levels of 180 mg/dL or less. There was no gross difference in the rate of post-extraction epithelialization among patients with diabetes with glycosylated hemoglobin levels of 7.0% or less, greater than 9.0% or between 7.1% to 9.0%[23]

Similar findings were observed in another study conducted by Fernandes et al had enrolled 115 patients who were diagnosed cases of type 2 diabetes (including people treated with oral

hypoglycemic or insulin) and required dental extractions. The frequency of healing after tooth extraction was 74.3%[24]. Incidence of healing had significant difference with age group. No significant difference of wound healing was seen in either gender or in poor glycemic control and good glycemic control of diabetes mellitus.

Huang et al also reported analogous results in their study in which among twenty-eight patients, 5% diabetic and 7% control group, had delayed healing of the socket for more than a week but all sockets healed within four weeks[9].

Gupta also reported in a study in which there were 30 patients with diabetes and were called for review on 3rd, 7th - and 21st - day post extraction. On 3rd day few patients reported with burning sensation, pain and swelling. On 7th day few complaints of bony flakes. On 21st day few patient's complaint of dry socket. Conclusion of the study was that diabetic patients on oral hypoglycemic must be treated same as non-diabetic patients but with uncontrolled type 1 diabetics somewhat delay in healing was observed[25].

Our study has some limitations. Based on socioeconomic and demographics our patient populations may differ from private clinic. Sample sizes in both groups were not equal and patients with poor glycemic control (>7%) were greater in number. As this is the first study to measure healing in glycemic patients by epithelialization rate at local level so there is no study present at local level for comparison.

Follow up of these patients for longer period of time to access the bone density and mineralization would be helpful with respect to implant placement. Unnecessary use of antibiotics and thus antibiotic resistance would be avoided in future. The standard principles of hemostasis and infection control can be enough for postoperative healing of patients.

CONCLUSION

Glycemic control has no influence on post-tooth extraction healing in diabetic patients

AUTHOR'S CONTRIBUTION

Muzaffar A: Conceived idea, Manuscript writing
Murtaza B: Critical Review of manuscript, Literature search
Muzaffar A: Data Collection
Qunain R: Designed methodology. Manuscript writing, Literature search
Iqtidar Z: Data Analysis, Data collection
Sherazi U: Data Collection, Data analysis

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