

PREVALENCE AND DETERMINANTS OF DRY SOCKET IN DIABETIC PATIENTS UNDERGOING TOOTH EXTRACTION: A CROSS-SECTIONAL STUDY

¹MUHAMMAD NAWFAL SAHI, ²AROOJ ASLAM, ³MAIDAH HANIF, ⁴FATIMA ATHER, ⁵ZAIN IFTIKHAR

ABSTRACT

Objective: To determine the prevalence of dry socket in diabetic patients and its associated risk factors.

Methodology: A cross-sectional study was conducted in the Oral & Maxillofacial Surgery Department, Foundation University College of Dentistry & Hospital (FUCD&H), Islamabad, from March to September 2024. A total of 499 diabetic patients who underwent tooth extractions were included. Data was collected for gender, age, number of visits, type of extraction, endodontic status, smoking history, physician's experience, and blood sugar levels (BSR) at extraction. Statistical analyses, including chi-square and t-tests, were conducted to determine associations between these factors and dry socket occurrence.

Results: Out of 499 diabetic patients, 83 (16.6%) developed dry socket. The condition occurred more frequently in females (88%) than males (12%). Most patients with dry socket had two visits (83.1%). Dry socket was more common in non-surgical extractions (92.8%) than surgical (7.2%). Most cases (79.5%) were treated by students, with significantly fewer in patients treated by senior doctors, indicating the impact of operator experience. Non-root canal treated teeth had a higher incidence (89.2%). A significant association was found with smoking, as 36.1% of smokers developed dry socket. The mean BSR (Blood sugar random test levels) for affected patients was 188.42mg/dl.

Conclusion: The prevalence of dry socket in diabetic patients was significantly associated with the number of dental visits, smoking history, physician's experience, and elevated blood sugar levels. These findings emphasize managing blood sugar and smoking cessation to reduce dry socket risk in diabetic patients.

Keywords: Dry Socket, Smoking, Tooth extraction, Diabetes

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INTRODUCTION

Tooth extraction is one of the most common minor surgical procedures done in dental institutions. The formation of a blood clot is the initial step of healing

following an extraction; this clot subsequently serves as a scaffold for the granulation tissue and subsequent deposition of bone. The recovery process takes one week on average. Maintaining and keeping the initial congealed blood clot is therefore essential for the healing process following surgery. If this blood clot moves or doesn't form at all, it can cause an excruciating condition called alveolar osteitis, which is also referred to as dry socket¹.

¹ Muhammad Nawfal Sahi, BDS, House Surgeon at Foundation University College of Dentistry and Hospital, Foundation University Islamabad. Email: nawfalsahi@gmail.com, Cell: 03317370710

² Arooj Aslam, BDS, House Surgeon at Foundation University College of Dentistry and Hospital, Foundation University Islamabad. Email: aroojajjua@gmail.com, Cell: 03145253586

³ **Correspondence:** Maidah Hanif, BDS, FCPS, FFDRCSI, MHPE, Assistant Professor in the Department of Oral & Maxillofacial Surgery at Foundation University College of Dentistry and Hospital, Foundation University Islamabad. Email: md7534@hotmail.com, Cell: 03325542885

⁴ Fatima Ather, BDS, House Surgeon at Foundation University College of Dentistry and Hospital, Foundation University Islamabad. Email: fatimamather4321@gmail.com, Cell: 03055570009

⁵ Zain Bin Iftikhar, BDS, Resident in the Department of Prosthodontics at School of Dentistry, Pakistan Institute of Medical Sciences. Email: zainiftikhar98@hotmail.com, Cell: 03235893856

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In 2022, there were approximately 33,000,000 cases of diabetes globally, affecting 26.7% of adult Pakistanis, according to the International Diabetes Federation². Diabetes is a long-term metabolic disease that has been associated with poor wound healing because it tends to interfere with the initiation and maintenance of the healing cascade by blocking the action of certain growth factors, such as reduced levels of TGF, which attracts fibroblasts, keratinocytes, immune cells, and vascular cells and is involved in angiogenesis and the formation of

the extracellular matrix (ECM)³. Furthermore, because hyperglycemia impedes the healing process, diabetic wounds have been discovered to have decreased levels of TIMPS (tissue inhibitor of metalloproteinase) and increased numbers of MMPs⁴.

Consequently, individuals with diabetes frequently experience slower healing, weakened immune systems, and impaired blood circulation, all of which may raise their chance of experiencing post-extraction complications such as Dry Socket⁵. Alveolar osteitis is a condition that causes excruciating pain for the patient. It also worsens the patient's experience at the dentist, making them less likely to visit, which leads to a vicious cycle of continued poor oral hygiene and infrequent dental checkups. To make matters worse, the patient's diabetes makes them even more vulnerable⁶.

Based on the description provided above and the abundance of theoretical literature pertaining to it, the aim of this study is to ascertain the prevalence of dry socket in diabetic patients. The information gathered from this study will help drive the creation of specific treatment guidelines for people with diabetes, enhance preventative efforts, and support medical professionals in their therapeutic decision-making. In the end, lowering the prevalence of dry socket and the issues it raises will improve the general health and dental outcomes for patients with diabetes.

METHODOLOGY

A Cross-sectional study was carried out in the Oral & Maxillofacial Surgery Department, Foundation University College of Dentistry & Hospital (FUCD & H), Islamabad from March 2024 to September 2024. The duration of the study is 6 months after approval from the Ethical Review Committee. A non-probability purposive sampling technique was used by using WHO calculator for sample size calculation with level of Confidence of 95%, Population Mean value of 6%.

Sample Size included 499 Patients presenting to Oral & Maxillofacial Surgery department at FUCD & H after fulfilling the inclusion criteria. The inclusion criteria include the age of the patient between 15-50 years, either gender, Patients undergoing nonsurgical extraction, Patients diagnosed with diabetics both type 1 and type 2, pre-diabetic patients, Patients requiring extraction of Premolars and molars in mandible, Patients with controlled diabetes. Whereas the exclusion criteria include the patients not giving consent to participate in this study, Patients with the history of radiation therapy, History of blood Dyscrasias, Patients taking blood thinners, Hypertensive Patients, Pregnant females (gestational diabetes), Patients undergoing extensive procedures like sinus lift, implants, non-bacterial infections.

Permission for research work has already been taken from the Ethical Review Committee (IRB no. FF/FUCD/632/ERC/70) of Foundation University College of Dentistry and Hospital (FUCD & H), for the study. Detailed history and clinical examination of patients reporting to OMFS department of FUCD & H for removal of tooth under Local anesthesia. An informed written consent of the patient was obtained on consent form. The patients fulfilling the inclusion criteria in our sample were selected. Extraction procedure was performed by the either final year BDS students, House surgeons or senior doctors. Prevalence of dry socket developing post extraction in diabetic patients was examined. A comparison was done between the diabetic patients developing dry socket after extraction and the diabetic patients not developing dry socket, using a cross-sectional prospective study. Followed by checking healing in both the groups who develop dry socket. Data was collected via a pre validated questionnaire (12).

Data was analyzed by entering into the Statistical Package for Social Sciences software (SPSS) for windows (version 23, IBM Corporation Chicago, IL, USA). An independent sample t test was performed to get mean values of quantitative variables like the patients presented with dry socket after surgical and non-surgical extraction, prevalence of dry socket after extraction by students, house surgeons and senior doctors, dry socket and association of smoking. Quantitative variables like age and gender were measured as mean and SD. Effect modifiers like age and gender were controlled by stratification (as exposure has different effects among these groups to identify vulnerable population). Chi – square test will be used for post stratification (sample distribution on key variables are similar to known population distribution). P-value of 0.05 or less was considered statistically significant.

RESULTS

During the period, 499 patients were evaluated for the prevalence of dry socket. The data was divided into two groups: those who developed dry socket and those who did not, along with the total cases for each category. The prevalence of dry socket among these patients was further compared with following variables.

Out of a total of 499 individuals, 83 patients experienced dry socket, with a higher prevalence among females, 73(88%) of the 83 cases occurred in females, whereas only 10 cases (12%), were reported in male patients. (See Figure 1)

For the patients that did not experience dry socket it was observed that out of the 416 individuals that were unaffected, 356 (85.6%) were female and 60 (14.4%) were male. This result signifies gender disparity in comparison to the prevalence of dry socket. (See table 1)

Among the 83 patients who developed dry socket, 69 of them (83.1%) came in for a second visit, 11 of them (13.3%) needed three visits, and 3 patients (3.6%) had to visit for a fourth time. This showed that the majority cases of dry socket had to visit twice.

On the other hand, the 416 patients who did not develop dry socket, all 416 did not require more than two visits. Considering the total patient data, 485(97.2%) visits were required for those with two visits, while 11 visits (2.2%) involved three visits, and only 3 patients (0.6%) involved four visits. (Table 1).

Out of the total 83 patients that experienced dry socket 77(92.8%) had a non-surgical extraction while the remaining 6(7.2%) had a surgical procedure. The remaining 416 that were not affected by dry socket 385(92.5%) had a non-surgical extraction and 31(7.5%) had a surgical one. (Table 2).

Among the patients who developed dry socket, 74 cases (89.2%) were associated with extractions of non-RCT treated teeth, while 9 (10.8%) extractions were those of RCT treated teeth. Patients who did not develop dry socket, 383 cases (92.1%) were associated with non-RCT treated teeth, and 33 cases (7.9%) involved RCT treated teeth. As for all the extractions taken into account, out of the total 499 cases, 457 (91.6%) involved non-RCT

treated teeth, while 42 cases (8.4%) were that of RCT treated teeth. (Table 2).

Of the 83 patients who developed dry socket, 66 cases (79.5%) were handled by students, 13 cases (15.7%) by house officers, and 4 cases (4.8%) by senior doctors. It's noteworthy that the majority of dry socket cases were treated by students. In comparison, the patients who did not develop dry socket, 34 cases (8.2%) were treated by students, 45 cases (10.8%) by house officers, and the majority of 337 cases (81%) by senior doctors. While analyzing the total 499 cases, 100 (20%) were operated on by students, 58 (11.6%) by house officers, and 341 (68.3%) by senior doctors. (Table 3)

A total of 30(36.1%) out of 83 patients who developed dry socket, had a history of smoking while the remaining 53(63.9%) did not. For the other 415 patients that did not experience dry socket, 397(95.7%) had no history of smoking and 18(4.3%) had a positive history for smoking. (Table 3).

When we compared BSR with prevalence of dry socket among diabetic patients, we observed that patients who experienced dry socket exhibited a higher mean BSR of 188.42 mg/dl in comparison to those who did not, mean BSR was 173.34 mg/dl. As seen in the above diagram (Fig 2)

TABLE 1: DRY SOCKET IN MALE/FEMALE PATIENTS & NUMBER OF VISITS

Variable	Dry Socket (n = 83)	No Dry Socket (n = 416)	Total (n = 499)
Gender	n (%)	n (%)	n (%)
Male	10 (12.0)	60 (14.4)	70 (14.0)
Female	73 (88.0)	356 (85.6)	429 (86.0)
Visits			
2 Visits	69 (83.1)	416 (100)	485 (97.2)
3 Visits	11 (13.3)	0 (0.0)	11 (2.2)
4 Visits	3 (3.6)	0 (0.0)	3 (0.6)

TABLE 2: DRY SOCKET AND RELATIONSHIP WITH SURGICAL AND NON-SURGICAL EXTRACTION & RCT TREATED AND NON RCT TREATED TOOTH EXTRACTION.

Variable	Dry Socket (n = 83)	No Dry Socket (n = 416)	Total (n = 499)
Extraction Type	n (%)	n (%)	n (%)
Non-surgical	77 (92.8)	385 (92.5)	462 (92.6)
Surgical	6 (7.2)	31 (7.5)	37 (7.4)
Tooth Vitality			
Non-RCT	74 (89.2)	383 (92.1)	457 (91.6)
RCT-treated	9 (10.8)	33 (7.9)	42 (8.4)

TABLE 3: DRY SOCKET AND EXPERTISE OF EXTRACTION (PHYSICIAN STATUS) AND ASSOCIATION WITH SMOKING.

Variable	Dry Socket (n = 83)	No Dry Socket (n = 416)	Total (n = 499)
Operator Experience	n (%)	n (%)	n (%)
Student	66 (79.5)	34 (8.2)	100 (20.0)
House Officer	13 (15.7)	45 (10.8)	58 (11.6)
Senior Doctor	4 (4.8)	337 (81.0)	341 (68.4)
Smoking History			
Smoker	30 (36.1)	18 (4.3)	48 (9.6)
Non-Smoker	53 (63.9)	398 (95.7)	451 (90.4)

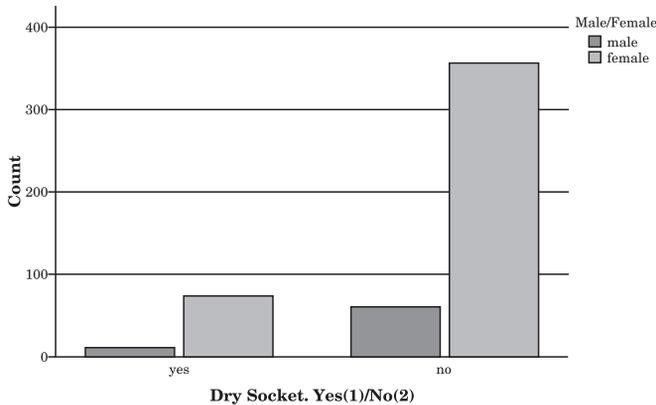


Fig 1: Dry Socket in relation to Gender

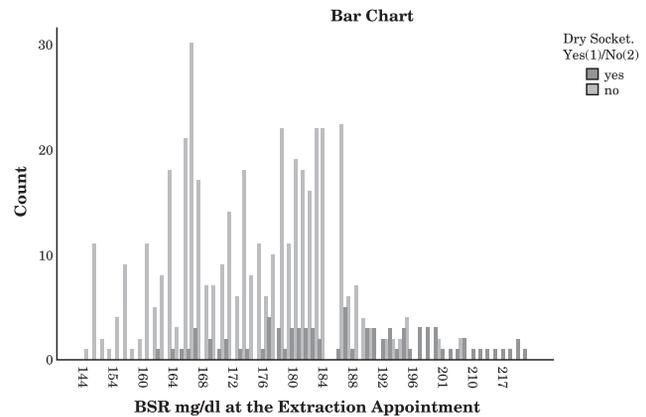


Fig 2: Dry Socket in relation to BSR at the time of Extraction

DISCUSSION

Dry socket is a frequent postoperative complication that typically arises 2 to 3 days following a tooth extraction¹. This condition is marked by severe pain, foul breath, inflammation of the adjacent gum tissue and an empty or exposed socket that is covered with a grayish-yellow necrotic material. While general symptoms such as fever are rarely noted, the patient typically presents as being unwell due to intense pain, as well as a diminished appetite and disrupted sleep². This study's findings indicate the occurrence of dry socket among the diabetic patient population at Foundation University College of Dentistry and Hospital in Islamabad, along with the associated risk factors identified in the literature. The research demonstrated that 16.6% of diabetic patients experienced dry socket after tooth extraction, a percentage consistent with existing literature that suggests diabetic individuals face an elevated risk for this postoperative complication due to impaired healing mechanisms¹⁰.

In this research, the average age of diabetic patients who experienced dry socket was 47.92 years. This finding indicates a higher likelihood of older diabetic individuals being at risk for developing dry socket compared to their younger counterparts. Lehner et al. highlight that this condition is rarely observed in indi-

viduals under the age of 18, a time when blood supply is typically robust³. Additionally, the mean age of 47.92 may also be influenced by other confounding variables, such as smoking behaviors or elevated blood sugar levels, which tend to be more common among younger diabetic patients. This study revealed a significant disparity between male and female diabetic patients in the incidence of dry socket, with 88% of those affected being females, a finding that aligns with existing literature⁴. The previously mentioned studies indicate that hormonal factors and the use of oral contraceptive pills increase the likelihood of females developing dry socket after tooth extraction. Nevertheless, the precise rationale or mechanism underlying this variability remains unclear⁵.

Additionally, a noteworthy correlation was identified between glycemic control, as indicated by HbA1c levels and random blood sugar measurements at the time of extraction, and the occurrence of dry socket. Uncontrolled diabetes is a persistent condition that results in impaired wound healing and diminished microcirculation, which according to the findings in this study led to an increased risk of Alveolar Osteitis⁶. A systematic review by Gaith Gazal indicates that the safe threshold for blood sugar levels (BSR) during extraction procedures is 180 mg/dl. Exceeding this

limit results in diminished production of nitric oxide, a potent vasodilator, which can cause inadequate blood circulation and delayed healing of the extraction site. Furthermore, individuals with uncontrolled diabetes face an elevated risk of infection due to elevated ketone levels in their bloodstream⁷. The results of this study are consistent with the previously referenced systematic review, as we observed that patients who experienced dry socket exhibited a higher mean BSR of 188.42 mg/dl in comparison to those who did not, mean BSR was 173.34 mg/dl⁸.

A study identified smoking as another major risk factor, with 36.1% of smokers experiencing dry socket, which aligns with existing literature on the subject⁹. Smoking interferes with the blood supply and clot stability. However, this research presents findings that are at odds with those of Jhonson and Bleton, who reported no association between smoking and the occurrence of dry socket¹⁰. The failure of smokers to adhere to postoperative instructions, attributed to the addictive properties of nicotine, has led to a higher incidence of dry socket within this demographic. This observation aligns with the research conducted by Mohammed H Abu Younis and Abu Hantash¹¹.

This research further emphasizes that teeth not subjected to root canal treatment (RCT) exhibited a higher susceptibility to the occurrence of dry socket (89.3%) in comparison to those that underwent RCT. This observation aligns with the conclusions drawn by Gautam et al, which indicated that dry socket occurs in approximately 18.3% of extractions involving vital teeth compared to 10.2% in non-vital teeth¹². This phenomenon can be attributed to the increased brittleness of teeth that have undergone root canal treatment, particularly after the application of sodium hypochlorite, which makes them more susceptible to fracture¹³. Consequently, the extraction of such teeth necessitates a more careful and precise technique, typically performed by experienced residents and consultants, resulting in improved case outcomes^{14,15}. The findings of this study indicate that the incidence of dry socket was higher in nonsurgical extractions than in surgical extractions. This is particularly noteworthy, as previously reported that surgical extractions were associated with an increased likelihood of postoperative complications, including dry socket¹⁶. Nonsurgical extractions at Foundation University College of Dentistry and Hospital may result in a higher occurrence of alveolar osteitis, as surgical extractions are typically conducted by junior residents or consultants. In contrast, nonsurgical extractions are carried out by students who possess comparatively less clinical experience and proficiency in the use of forceps¹⁷. Furthermore, individuals receiving non-surgical extractions may receive fewer postoperative care guidelines and typically do not have sutures placed at

the extraction site to secure the clot, as is customary in surgical extractions, thereby raising the risk of clot dislodgement.

A study revealed that operator experience is a significant factor, as less experienced individuals, such as final-year students, tend to exhibit reduced precision and inferior tactile control during forceps movements. This lack of experience can inadvertently result in the application of excessive or traumatic forces during extraction procedures. Some authors are of the opinion that trauma during extraction is the main cause of Dry Socket¹⁸. A study showed that the number of cases of alveolar osteitis in 10,199 extractions rose from 3.3 % in non-difficult extractions to 10.3 % in extractions with complications (fractured roots). Ailing and Kerr were able to induce alveolar osteitis in rhesus monkeys by inflicting damage to the alveolus using a metallic instrument. From this experiment, they deduced that trauma is the underlying cause of alveolar osteitis¹⁹. Consequently, the findings from this research, in conjunction with previous investigations, indicate an increased likelihood of alveolar osteitis occurring in cases of traumatic extractions. The data from this study further substantiates this assertion, revealing that the highest incidence of dry socket was observed among patients whose extractions were performed by a student or a junior doctor (house officer), in contrast to those conducted by a consultant²⁰.

Individuals suffering from dry socket demonstrated a higher rate of dental visits, with 83.1% attending two appointments. This finding suggests a relationship between an increased number of dental visits and a higher incidence of dry socket. Frequent appointments, especially those involving additional dental treatments or assessments, may disrupt the initial healing process, consequently raising the risk of developing dry socket, as evidenced by Martinez and Cabanillas et al²¹.

Frequent visits, especially when involving additional dental manipulations or check-ups, can disturb the initial healing process, potentially leading to a higher risk of developing dry socket which is consistent with the findings of Mian RM et al. It is believed that elements such as recurrent trauma, patient anxiety, and the postponement of clot stabilization during these appointments contribute to the heightened risk.

LIMITATIONS OF THE STUDY:

This study was conducted in a single tertiary care hospital, limiting the generalizability of the findings to broader populations. Reliance on self-reported data, such as smoking history, may also influence the results. Additionally, the unequal distribution of participants across age group and gender may impact the robustness of conclusions.

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CONCLUSION

Our study underscores the heightened risk of dry socket among diabetic patients both males and females, particularly those over the age of 40, with poorly controlled blood sugar levels. Smoking significantly increases the risk by two folds, further compounding the challenges faced by diabetic patients. Interestingly, non-surgical extractions, often performed by less experienced operators, were associated with a higher incidence of dry socket, highlighting the critical role of surgical technique and operator experience in preventing this complication.

Moreover, the study emphasizes the importance of optimal glycemic control, as elevated blood sugar levels especially over 180mg/dl at the time of extraction were closely linked to the occurrence of dry socket.

Overall, this research reinforces the need for tailored preventative strategies, including thorough preoperative assessments, minimizing extraction trauma, and ensuring comprehensive postoperative care, particularly in high-risk diabetic patients. Future studies should further explore this subject in a larger sample size and consider HbA1c as a more reliable marker of long-term glycemic control than random blood sugar (mg/dL), in order to better stratify risk in diabetic patients and study underlying mechanisms in greater depth and evaluate the effectiveness of targeted interventions in reducing the incidence of dry socket.

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CONTRIBUTIONS BY AUTHORS

1. Nawfal Sahi:

was the primary investigator, responsible for the conception of the study design, drafting the manuscript, and acquisition and analysis of the study data.

2. Dr. Maidah Hanif:

conducted the critical review of the manuscript and was responsible for the acquisition, analysis, and interpretation of the data as well as final approval of the version to be published.

3. Arooj Aslam

contributed to the acquisition and analysis of data, as well as the drafting of the manuscript.

4. Fatima Ather

5. Zain Iftikhar