



## Maxillofacial Surgery

## ANALYZING THE ETIOLOGY, RISK FACTORS AND CLINICAL PRESENTATION OF DRY SOCKET FOLLOWING NON-SURGICAL EXTRACTION OF PERMANENT TEETH IN HEALTHY INDIVIDUALS

**Dr Anubhav Shivpuri**

MDS, Oral &amp; Maxillofacial Surgery, Army Dental Corps.

**Dr Vivek Saxena**

MDS, Oral &amp; Maxillofacial Surgery, Army Dental Corps.

**Dr H. Rangarajan**

MDS, Oral &amp; Maxillofacial Surgery, Army Dental Corps.

## KEYWORDS :

## INTRODUCTION:

Dry socket, also referred to as alveolar osteitis or fibrinolytic alveolitis, is a frequent postoperative complication observed after tooth extractions, whether surgical or non-surgical. Other synonyms include localized osteitis, alveolalgia, alveolar sicca dolorosa, and localized osteomyelitis. The condition is marked by intense pain originating from the extraction site, which can radiate to adjacent regions like the ear, temple, or face, thereby significantly affecting a patient's quality of life. Symptoms typically manifest between the second and third day post-extraction. Clinically, the affected socket often appears partially or entirely devoid of a blood clot and may contain necrotic tissue. Despite ongoing research, the exact cause of dry socket remains unclear. This study aims to explore its potential causes, associated risk factors, and clinical presentation in healthy individuals who experienced the complication after undergoing routine tooth extractions.<sup>1-5</sup>

## MATERIALS AND METHODS:

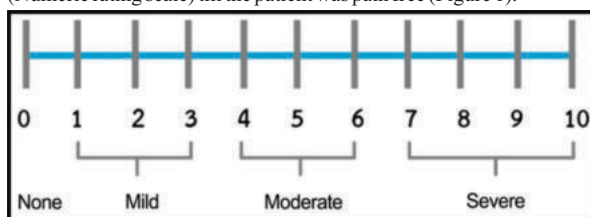
This study was conducted and data collected from multiple dental centres between July 2014 and June 2024. Patients who had undergone surgical extractions, patients having multiple simultaneous extractions from the same quadrant, patients with teeth having cysts or granulomas and medically compromised patients were excluded from the study. Only non-surgical dental extractions in healthy individuals that developed the complication were included in the study in the age bracket of 25 to 60 years.

The following data was recorded for each diagnosed patient: Age, sex, reason for extraction, tooth involved, local anaesthesia technique used (nerve block or local infiltration), difficult or simple extraction, smoking habit, any use of oral contraceptives by females, day of onset of symptoms, clinical presentation of dry socket and pain perception.

All the extractions were carried out under local anaesthesia using 2% lignocaine with 1:80,000 adrenaline and extraction forceps or elevators were used. Patients were advised a combination of paracetamol (325 mg) and Ibuprofen (400 mg) tablets, to be taken postoperatively for 3 days. No postoperative antibiotics were prescribed after tooth extraction in the patients included in the study.

The diagnosis of dry socket was made when a patient presented with persistent or increased post-operative pain in and around the tooth socket not relieved by mild analgesics, accompanied by a disintegrated blood clot or an empty socket. The diagnosis was confirmed clinically when an extremely sensitive exposed bone along with missing clot was seen on examining the extraction socket.

Pain perception was assessed and recorded daily using the NRS (Numeric rating scale) till the patient was pain free (Figure 1).

**Figure1:** Pain perception on NRS (Numerical Rating Scale)

In the cases included in the study, the treatment done for all the patients included Irrigation with saline to remove all food debris or necrotic material, placing Alvogyl dressing on alternate days, prescription of systemic analgesics (Ketorol 10 mg BD) and chlorhexidine mouth wash to be used thrice a day till pain resolved.

## RESULTS:

A total of 100 patients who satisfied the inclusion criteria and reported for postoperative review were included in the study. Most common age group that developed dry socket was between 40 to 45 (25%) followed by the age group 45 to 50 (20%) Table 1.

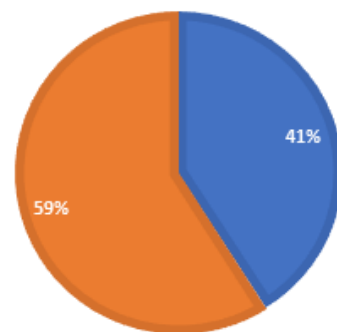
**Table 1: Dry Socket Distribution Based On Age**

| S No | Age (Years) | Total number |
|------|-------------|--------------|
| 1    | 25-30       | 1            |
| 2    | 30-35       | 4            |
| 3    | 35-40       | 15           |
| 4    | 40-45       | 25           |
| 5    | 45-50       | 20           |
| 6    | 50-55       | 16           |
| 7    | 55-60       | 19           |

In our study it was observed that more females (59) had developed dry socket than males (41) Pie chart 1.

## DISTRIBUTION BASED ON SEX OF PATIENT

■ Males ■ Females

**Pie Chart 1:** Dry socket distribution based on sex

72 of the 100 patients who developed dry socket in our study had a difficult extraction in which all had fracture of the tooth.

5 out of the 41 male patients were smokers while none of the female patients were smokers.

None of the female patients in the study were on oral contraceptives.

Dry socket was seen in 72 mandibular teeth (50 posterior and 22 anterior) and 28 (24 posterior and 4 anterior) maxillary teeth Table 2.

**Table 2: Tooth That Developed The Complication**

| S No | Tooth involved                   | Number |
|------|----------------------------------|--------|
| 1    | Mandibular 1 <sup>st</sup> molar | 8      |
| 2    | Mandibular 2nd molar             | 10     |
| 3    | Mandibular 3 <sup>rd</sup> molar | 13     |

|    |                                     |    |
|----|-------------------------------------|----|
| 3  | Mandibular 1 <sup>st</sup> premolar | 11 |
| 4  | Mandibular 2 <sup>nd</sup> premolar | 8  |
| 5  | Mandibular canine                   | 11 |
| 6  | Mandibular lateral incisor          | 6  |
| 7  | Mandibular central incisor          | 5  |
| 8  | Maxillary 1 <sup>st</sup> molar     | 7  |
| 9  | Maxillary 2 <sup>nd</sup> molar     | 10 |
| 10 | Maxillary 3 <sup>rd</sup> molar     | 4  |
| 10 | Maxillary 1 <sup>st</sup> premolar  | 2  |
| 11 | Maxillary 2 <sup>nd</sup> premolar  | 1  |
| 12 | Maxillary canine                    | 2  |
| 13 | Maxillary lateral incisor           | 2  |
| 14 | Maxillary central incisor           | 0  |

Out of the 100 patients that developed the complication infiltration anaesthesia was administered in 49 cases (10 mandibular anterior, 18 mandibular posterior, 19 maxillary posterior and 2 maxillary anterior) while 51 had been administered nerve blocks (32 mandibular posterior, 12 mandibular anterior, 5 maxillary posterior, 2 maxillary anterior).

88 patients underwent extraction due to caries and its sequelae while 12 had undergone extraction due to periodontitis.

The patients presented with dry socket from Day 2 to Day 4 postoperatively, with more than half presenting on the 3<sup>rd</sup> day (69%) (Table 3)

**Table 3: Day Of Presentation Of Dry Socket:**

| S No | Day of presentation after tooth extraction | Number |
|------|--------------------------------------------|--------|
| 1    | 1 <sup>st</sup> day                        | Nil    |
| 2    | 2 <sup>nd</sup> day                        | 4      |
| 3    | 3 <sup>rd</sup> day                        | 69     |
| 4    | 4 <sup>th</sup> day                        | 27     |
| 5    | 5 <sup>th</sup> day                        | Nil    |
| 6    | 6 <sup>th</sup> day                        | Nil    |
| 7    | 7 <sup>th</sup> day                        | Nil    |

Clinical presentation of partial loss of blood clot with exposed bone was seen in 23 patients, there was complete loss of blood clot with exposed bone in 3 patients, partially empty socket with necrotic debris in 54 patients while partially empty socket with food lodgement was noted in 20 patients (Table 4).

**Table 4: Clinical Presentation Of Dry Socket**

| S No | Clinical presentation                       | Number of patients |
|------|---------------------------------------------|--------------------|
| 1    | Partially empty socket with exposed bone    | 23                 |
| 2    | Partially empty socket with necrotic debris | 54                 |
| 3    | Partially empty socket with food lodgement  | 20                 |
| 4    | Completely empty socket with exposed bone   | 3                  |
| 5    | Inflamed and/or tender adjacent gingiva     | 91                 |
| 6    | Bad breath/ Halitosis                       | 52                 |
| 7    | Bad taste                                   | 8                  |

The maximum pain level during the entire episode reported by the patients was 8, although majority reported 7 based on NRS (Table 5)

**Table 5: Pain Perception: Daily Record Based On Numerical Rating Scale After Diagnosis Of Dry Socket**

| Pain perception on NRS | Day after extraction of tooth |       |       |       |       |       |       |       |        |  |
|------------------------|-------------------------------|-------|-------|-------|-------|-------|-------|-------|--------|--|
|                        | Day 2                         | Day 3 | Day 4 | Day 5 | Day 6 | Day 7 | Day 8 | Day 9 | Day 10 |  |
|                        | Number of patients            |       |       |       |       |       |       |       |        |  |
| 0                      | -                             | -     | -     | -     | -     | -     | 67    | 89    | 99     |  |
| 1                      | -                             | -     | -     | -     | -     | -     | 12    | 10    | 1      |  |
| 2                      | -                             | -     | -     | -     | -     | 17    | 11    | 1     | -      |  |
| 3                      | -                             | -     | -     | 6     | 18    | 59    | 9     | -     | -      |  |
| 4                      | -                             | 1     | 4     | 28    | 51    | 18    | 3     | -     | -      |  |
| 5                      | 2                             | 9     | 15    | 35    | 27    | 6     | -     | -     | -      |  |
| 6                      | 2                             | 28    | 38    | 9     | 2     | -     | -     | -     | -      |  |
| 7                      | -                             | 35    | 42    | 22    | 2     | -     | -     | -     | -      |  |

|    |   |   |   |   |   |   |   |   |   |
|----|---|---|---|---|---|---|---|---|---|
| 8  | - | - | 1 | - | - | - | - | - | - |
| 9  | - | - | - | - | - | - | - | - | - |
| 10 | - | - | - | - | - | - | - | - | - |

In addition to the pain in the tooth socket 11 patients reported pain that radiated to the forehead / temple region on the side of extraction, 03 patients reported pain radiating to the neck, 04 patients had pain radiating to the ear, 32 patients had pain that radiated to the adjacent teeth while 28 patients had pain radiating to multiple sites on the face. Table 6

**Table 6: Referred Pain To Other Areas Of Face**

| S No | Symptoms                                                   | Number of patients |
|------|------------------------------------------------------------|--------------------|
| 1    | Pain radiating to forehead/ temple                         | 11                 |
| 2    | Pain radiating to the neck                                 | 3                  |
| 3    | Pain radiating to the ear                                  | 4                  |
| 4    | Pain radiating to adjacent teeth on the side of extraction | 32                 |
| 5    | Pain radiating to multiple sites on the face               | 28                 |
| 6    | Pain isolated to the tooth socket                          | 22                 |

## DISCUSSION:

Dry socket remains one of the most frequently encountered complications following the removal of permanent teeth. Typically, affected patients report a noticeable decrease in pain during the initial 24 to 48 hours post-extraction, followed by a sudden onset of intense discomfort. This pain is often accompanied by symptoms such as a foul odour, unpleasant taste, and referred pain radiating to nearby anatomical structures including the temple, ear, neck, or adjacent teeth. Clinically, the socket may appear hollow, with exposed bone, and may contain residual food particles, necrotic tissue, or a combination of both. The surrounding gingival tissue is usually inflamed, tender, and swollen.<sup>6-7</sup>

The exact pathophysiology behind dry socket is still not fully understood, although several contributing factors have been proposed. These include smoking, difficult extractions, excessive use of local anesthetic infiltrations, hormonal changes related to the menstrual cycle, and use of oral contraceptives. The most widely accepted explanation involves increased local fibrinolytic activity, which leads to the dissolution of the initial blood clot. Both surgical trauma and microbial contamination are believed to play key roles in initiating this clot breakdown by activating tissue-derived fibrinolytic agents.<sup>6-10</sup>

In our study, the highest incidence of dry socket was noted in patients aged 40 to 45 years. A larger proportion of female patients (59%) were affected compared to males (41%), which aligns with findings from other studies. Although hormonal fluctuations and oral contraceptive use have been suggested as potential factors influencing this trend, none of the female participants in this study reported using oral contraceptives.<sup>11-14</sup>

The study also evaluated the type of local anesthesia used during extractions. Patients either received infiltration anesthesia or nerve blocks. Out of the 100 cases, infiltration was administered in 49 patients while 51 received nerve blocks. The infiltration method, particularly when using a vasoconstrictor like adrenaline, may contribute to temporary ischemia of the socket, possibly affecting blood clot stability. However, existing literature suggests that any ischemia caused by adrenaline typically resolves within 1–2 hours and is followed by a reactive increase in blood flow (hyperaemia), thus making its contribution to dry socket pathogenesis relatively insignificant.<sup>15-17</sup>

Another important finding from this research was the strong correlation between traumatic extractions, particularly those involving tooth or alveolar bone fractures, and the onset of dry socket. In 72% of the cases, difficult extractions with fractured teeth were documented. This supports the theory proposed by Blum and Birn, suggesting that residual bone or tooth fragments can act as foreign bodies and contribute to the development of alveolar osteitis. Moreover, trauma sustained during extraction can compress the surrounding bone, reducing vascular penetration and potentially leading to thrombosis, which impairs healing and promotes clot breakdown.

Although only 5 of the male patients were smokers, and no statistically significant correlation was found between smoking and dry socket in this study, other research has consistently shown that smokers have a

higher risk. Smoking is believed to impair clot formation by reducing socket vascularity and oxygenation, ultimately compromising wound healing. Studies have demonstrated that post-extraction blood clot formation is often delayed or diminished in smokers when compared to non-smokers.

Several treatment strategies for dry socket have been described in the literature, with a common element being the irrigation of the socket to eliminate necrotic debris or residual clot material. Traditional approaches include the use of gauze soaked in eugenol-based solutions, Whitehead's varnish, or wax-based dressings. Betts et al. have highlighted the potential benefit of adding topical viscous lidocaine to improve pain relief. Ideally, the medicated dressing should either dissolve gradually or be expelled naturally as healing occurs, avoiding interference with the formation of granulation tissue.

While some clinicians advocate the use of dressings to ensure higher local concentrations of analgesic agents and protect the socket from further contamination, others argue that such dressings may delay healing and introduce the risk of foreign body reactions. In our study, the treatment regimen included saline irrigation, application of Alveogyl on alternate days, systemic analgesics (Ketorol 10 mg twice daily), and chlorhexidine mouthwash. This approach resulted in noticeable granulation tissue formation within 4 to 5 days, along with significant pain relief.<sup>18-22</sup>

## CONCLUSION:

Dry socket remains one of the most frequently encountered complications after dental extractions. In this study, the most common reason for tooth removal was dental caries and its consequences. The complication was observed more frequently in cases where the extraction was traumatic, often involving tooth or bone fractures. Based on these findings, it is strongly recommended that in cases where extractions are difficult or traumatic, the socket should be thoroughly cleaned to eliminate any remaining debris or fragments that might contribute to delayed healing.

Furthermore, patients with known risk factors-such as smoking or potential hormonal influences-should be counseled beforehand about the possibility of developing dry socket. Clear and detailed postoperative instructions should be emphasized to minimize the risk and ensure early detection and management of this painful complication.

## REFERENCES:

1. Nitzan DW. On the genesis of "dry socket". *J Oral Maxillofac Surg* 1983;41: 706-710.
2. Birm H. Etiology and pathogenesis of fibrinolytic alveolitis (dry socket). *Int J Oral Surg* 1973;2:211-263.
3. Birm H. Kinins and pain in 'dry socket'. *Int J Oral Surg* 1972;1:34-42.
4. Vezeau PJ. Dental extraction wound management: medicating post extraction socket. *J Oral Maxillofac Surg* 2000; 58:531-537.
5. Oginni FO, Fatusi OA, Alagbe AO. A clinical investigation of dry socket in Nigerian teaching hospital. *J Oral Maxillofac Surg* 2003;61:871-876.
6. Jaafar N, Nor GM. The prevalence of post extraction complications in an outpatient dental clinic in Kuala Lumpur Malaysia: a retrospective survey. *Singapore Dent J* 2000;23:24-28.
7. Blum IR. Contemporary views on dry socket (alveolar osteitis): a critical appraisal of standardization, aetiopathogenesis and management: a critical review. *Int J Oral Maxillofac Surg* 2002;31:309-317.
8. Adeyemo WL, Ladeinde AL, Ogunlewe MO. Clinical evaluation of post-extraction site wound healing. *J Contemp Dent Pract* 2006;7:40-49.
9. Houston JP, McCollum J, Petz D, Schneck D. Alveolar osteitis: a review of its etiology, prevention, and treatment modalities. *Gen Dent* 2002;50:457-463.
10. Shepherd J. Rinsing with chlorhexidine may reduce dry socket after third molar surgery. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod* 2005;6:36-41.
11. Cohen ME, Simecek JW. Effects of gender-related factors on incidence of localised alveolar osteitis. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod* 1995;79:416-422.
12. Alexander RE. Dental extraction wound management: A case against medicating post-extraction sockets. *J Oral Maxillofac Surg* 2000;58:538-551.
13. Adeyemo WL, Ladeinde AL, Ogunlewe MO. Influence of trans-operative complications on socket healing following dental extractions. *J Contemp Dent Pract* 2007;8:52-59.
14. Haraji A, Rakhshan V. Single-dose intra-alveolar chlorhexidine gel application, easier surgeries, and younger ages are associated with reduced dry socket risk. *Journal of Oral and Maxillofacial Surgery*. (2014); 72(2): 259-265. 27.
15. Preetha S. An overview of dry socket and Its management. *IOSR Journal of Dental and Medical Sciences*, (2014); 13(5): 2.
16. Motamedi MRK. To irrigate or not to irrigate: Immediate post extraction socket irrigation and alveolar osteitis. *Dent Rest J (Isfahan)*, 2015;12(3):289-90.
17. Bijo Alexander, "Alveolar Osteitis: A Review of Current Concepts and Management protocols " *IOSR Journal of Dental and Medical Sciences (IOSR-JDMS)*, vol. 17, no. 9, 2018, pp 07-10.
18. Cardoso et al. Clinical Concepts of Dry Socket. *J Oral Maxillofac Surg* 2010 68:1922-1932.
19. Younis MHA, Ra'ed O. Dry socket: frequency, clinical picture, and risk factors in a palestinian dental teaching center. *The open dentistry journal*, (2011); 57.
20. Eshghpour M, Nejat A H. Dry socket following surgical removal of impacted third molar in an Iranian population: Incidence and risk factors. *Niger J Clin Pract* 2013;16:496-500
21. Taberner-Vallverdú M, Nazir M, Sánchez-Garcés MÁ, Gay-Escoda C. Efficacy of different methods used for dry socket management: A systematic review. *Med Oral Patol*

Oral Cir Bucal. 2015 Sep 1;20 (5):e633-9.

22. Almutairi BM (2019). Dry sockets - a systemic review. *Adv. Life Sci.* 7(1): 48-57.