

Prevalence of Periodontal Abscess among Patients Visiting A Private Dental College and Hospital in Chennai, India

Ankita Komal Labh¹, Pratibha Ramani²,

¹Research Associate, Dental Research Cell, ²Professor and Head of Department, Department of Oral Pathology,

³Senior Lecturer, Department of Pedodontics and Preventive Dentistry, Saveetha Dental College and Hospitals,, Saveetha Institute of Medical and Technical Sciences, Saveetha University, Chennai- 600077

Abstract

Periodontal abscess is a frequently occurring condition in the oral cavity in which periodontal tissue such as bone, cementum, periodontal ligament and gingival are destroyed. It is more often than not associated with periodontal pockets and periodontitis and is a marker of active bone destruction in the periodontal region. It is the third most frequent dental emergency and its treatment has been a challenge for many years. The aim of this study is to assess the prevalence of periodontal abscess among patients reporting to a Dental University Hospital, Chennai. A retrospective cross-sectional study was conducted after reviewing patient records and analysing the data of 86000 patients between June 2019 and March 2020. Microsoft Excel® Data spreadsheet was used to tabulate the data. The variables involved were gender, age group, site and chief complaint. Data was then exported to the Statistical Package for Social Sciences (SPSS) for Windows (Version 19, 2010) for further analysis. The age groups were 11-20 years, 21-30 years, 31-40 years, 41-50 years, 51-60 years, 61-70 years and 71-80 years. From the data analysed through the Statistical Package for Social Sciences (SPSS) for Windows (Version 19, 2010), it was observed that the overall incidence of periodontal abscess was higher in males (68.2%) than females (31.8%). 31-40 year olds had the highest incidence at 39.4%. The most common site was sextant 4 (22.7%). Pain was the most observed complaint (45.5%). Most common site of occurrence was sextant 1 in males and sextant 4 in females. (Chi square = 0.832 < expected value of 2.55, data is statistically significant) Within the limitations of the current study, periodontal abscess has a male predilection between age group 31-40 years with most common site being sextant 4. Pain was the most common symptom reported.

Keywords: *Periodontal abscess, pain, bacterial infection, lower anterior teeth etc.*

Introduction

Periodontal abscess is a localised acute bacterial infection which is confined to the tissues of the periodontium.¹ It is a distinctive process occurring in the periodontium and not the tooth pulp, resulting in localised collection of pus and communicating with the oral cavity through the gingival sulcus. Based on the course of the disease it can have both acute and chronic origin.² Release of reactive oxygen species leads to heightened oxidative damage to gingival tissue, alveolar bone and periodontal ligament.³ Cytomegalovirus and EBV have often been found in periodontal lesions.^{4,5}

It is a moderately painful clinical condition which demands emergency treatment in over 60% patients. The abscess teeth with severe destruction, associated with deep periodontal probing depths, mobility, bleeding and suppuration.⁶

The prevalence of periodontal abscess is relatively high in the general population and it can affect the prognosis of the infected tooth.^{7,8} Among all emergency dental conditions periodontal abscess represents approximately 8% of all in the world.⁹ It is also the third most common dental emergency preceded by pulpal infection and pericoronitis.¹⁰ *Porphyromonas gingivalis*, *Prevotella intermedia*, and other *Prevotella* spp. are the predominant bacteria of human periodontal abscesses.

They are generally present in the oral cavity at various sites such as mucosa, saliva, pockets etc.^{11,12}

The most commonly involved teeth in the periodontal abscess have been reported as lower anterior teeth, upper anterior teeth and lower molars.⁷ Periodontal abscess in impacted third molars can have multiple complications and have poor prognosis.¹³ Ankyloglossia restricts the cleansing activity of saliva leading to gingivitis and periodontal abnormalities.¹⁴ The prevalence of periodontal abscess increases with age and it has a higher frequency in males than in females.¹⁵

Periodontal abscess if not treated in time can also lead to loss of a tooth. In such cases more furcated teeth are lost than non furcated teeth. Although periodontal abscesses are more common in anterior teeth the prevalence is found to be higher in posterior teeth due to furcation involvement.¹⁶

Members of the MMP family are known to cause local tissue breakdown and play an important role in periodontal abscess formation.¹⁷ Often, due to close proximity, squamous cell carcinoma^{18,19}, proliferative leukoplakia²⁰, inflammatory myofibroblastic tumour²¹, tongue carcinoma²² mimic benign inflammatory conditions such as dentoalveolar abscess, periodontal abscess etc. leading to misdiagnosis. Other differential diagnosis for periodontal abscess include pyogenic granuloma, peripheral giant cell granuloma etc.²³

The aim of the current study is to find the prevalence of periodontal abscess in the patients reporting to the outpatient department of Saveetha Dental College and Hospitals, Chennai.

Materials and Methods

Study Design And Setting

This is a retrospective cross-sectional study in which patient records from a Dental University Hospital were obtained. Data was collected for patients reporting to the Department of Periodontology from June 2019- April 2020 who were diagnosed with periodontal abscess.

Data Collection

A total of 66 cases of periodontal abscess (n=66) were identified after reviewing and analysing the data of 86000 patients. The inclusion criteria was patients

of all age groups and genders with periodontal abscess. Other relevant data such as gender, age, chief complaint, patient ID. were also recorded. Clinical photos and radiographs were used to verify the site of abscess. Data was also verified by an external reviewer.

Statistical Analysis

Data was recorded in Microsoft Excel® and later exported to the Statistical Package for Social Sciences after proper coding of the variables involved. Parameters included were gender, age, site and chief complaint including pain, swelling, pain with pus discharge, mobile teeth, pain with mobile teeth, pain with swelling and pus discharge, carious tooth, pain with swelling, food lodgement, missing teeth, pain with swelling and bleeding gums, pain with burning sensation, and pus discharge respectively.

Thereafter, the data was subjected to statistical analysis using Statistical Package for Social Sciences (SPSS) for Windows (Version 19, 2010). Chi square test was employed with the level of significance set at $p < 0.05$.

Results and Discussion

The sample size was n=66. The age distribution was 11-20 years (3%), 21-30 yrs (12.1%), 31-40 yrs (39.4%), 41-50 yrs (22.7%), 51-60 yrs (15.2%), 61-70 yrs (6.1%) and 71-80 yrs (1.5%). (Table 1) The gender distribution was Males (68.2%) and Females (31.8%). (Table 2) Incidence of periodontal abscess at various sites was sextant 1 (21.2%), sextant 2 (13.6%), sextant 3 (12.1%), sextant 4 (22.7%), sextant 5 (12.1%) and sextant 6 (18.2%). (Table 3) The chief complaint of reporting patients were distributed as Pain (45.5%), swelling (9.1%), pain with pus discharge (1.5%), mobile teeth (7.6%), pain with mobile teeth (1.5%), pain with swelling and pus discharge (1.5%), decayed tooth (4.5%), pain with swelling (18.2%), food lodgement (3%), missing teeth (1.5%), pain with swelling and bleeding gums (3%), pain with burning sensation (1.5%) and pus discharge (1.5%). (Table 4) The most common site was upper right posterior teeth in males and lower left posterior teeth in females. (Chi square = 0.832 < expected value of 2.55) (Graph 1)

The site of occurrence was found to be most common in age group 11-20 years was sextant 2 and 5,

in 21-30 years was sextant 4 and 6, in 31-40 years was sextant 1 and 4, in 41-50 years was sextant 4, in 51-60 years was sextant 1, in 61-70 years was sextant 3, 4, 5, 6 and in 71-80 years was sextant 3. (p=0.500, p>0.05 data is statistically not significant) (Graph 2)

Among all age groups the most common chief complaint was reported pain except for the group of 71-80 year olds where the most common complaint was

pain with swelling. (p=0.996, p>0.05, data is statistically not significant) (Graph 4)

At each site of periodontal abscess the most common chief complaint associated with it was pain except for sextant 4 where the most common complaint was pain with swelling. (p=0.802, p>0.05, data is statistically not significant) (Graph 3)

Table 1: Table showing frequency and percentage distribution of age in patients with periodontal abscess among patients reporting to the outpatient department of a Dental University Hospital, Chennai, India. 11-20 years (3%), 21-30 yrs (12.1%), 31-40 yrs (39.4%), 41-50 yrs (22.7%), 51-60 yrs (15.2%), 61-70 yrs (6.1%) and 71-80 yrs (1.5%)

| Age groups | Frequency | Percent |
|-------------|-----------|---------|
| 11-20 years | 2 | 3.0 |
| 21-30 years | 8 | 12.1 |
| 31-40 years | 26 | 39.4 |
| 41-50 years | 15 | 22.7 |
| 51-60 years | 10 | 15.2 |
| 61-70 years | 4 | 6.1 |
| 71-80 years | 1 | 1.5 |
| Total | 66 | 100.0 |

Table 2: Table showing frequency and percentage distribution of gender among patients with periodontal abscess reporting to the outpatient department of a Dental University Hospital, Chennai, India. Females 31.8%, Males 68.2%

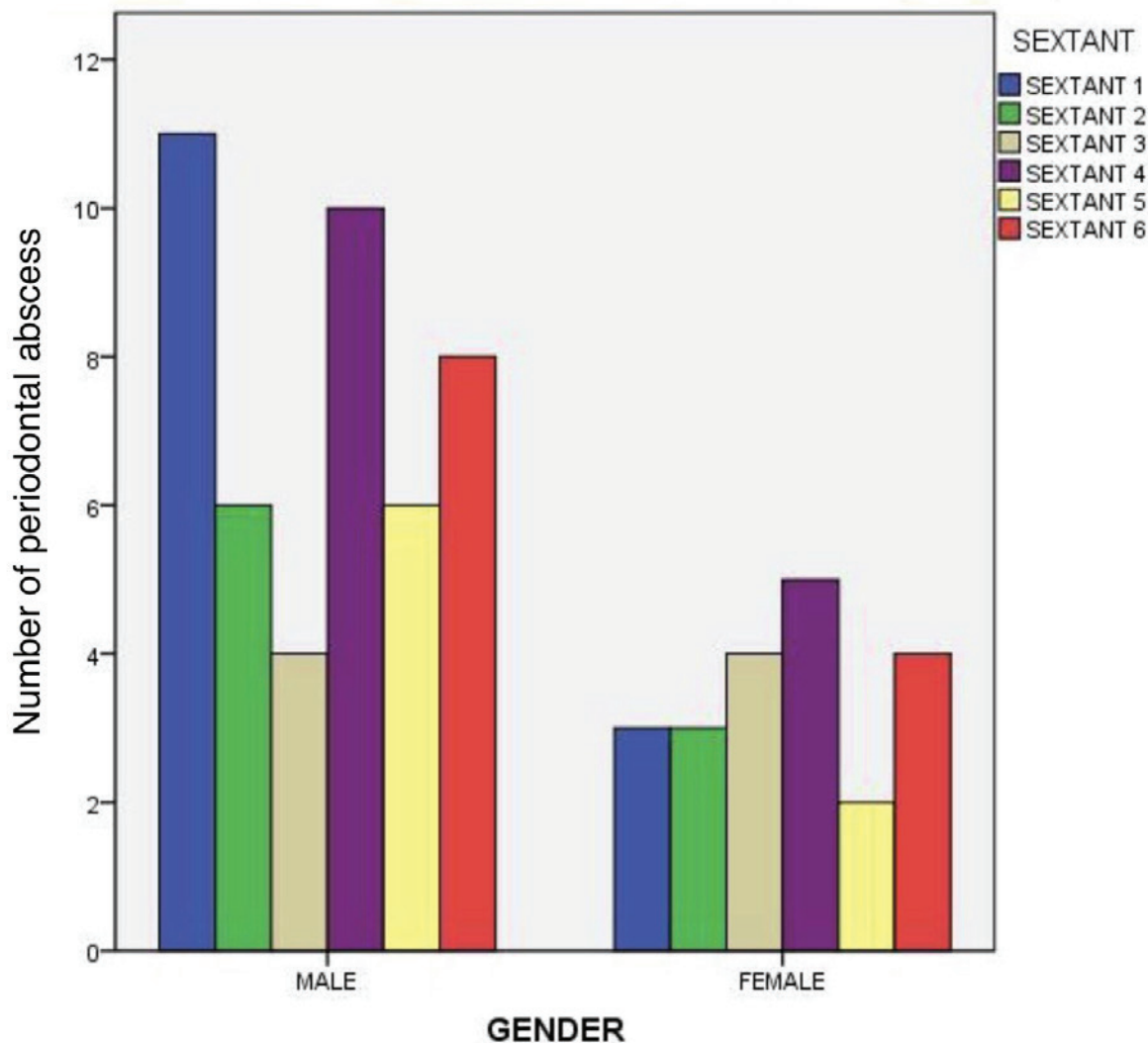
| Gender | Frequency | Percent |
|--------|-----------|---------|
| Male | 45 | 68.2 |
| Female | 21 | 31.8 |
| Total | 66 | 100.0 |

Table 3: Table showing frequency and percentage of distribution of site of occurrence of periodontal abscess patients reporting to the outpatient department of a Dental University Hospital, Chennai, India. sextant 1 (21.2%), sextant 2 (13.6%), sextant 3 (12.1%), sextant 4 (22.7%), sextant 5 (12.1%) and sextant 6 (18.2%)

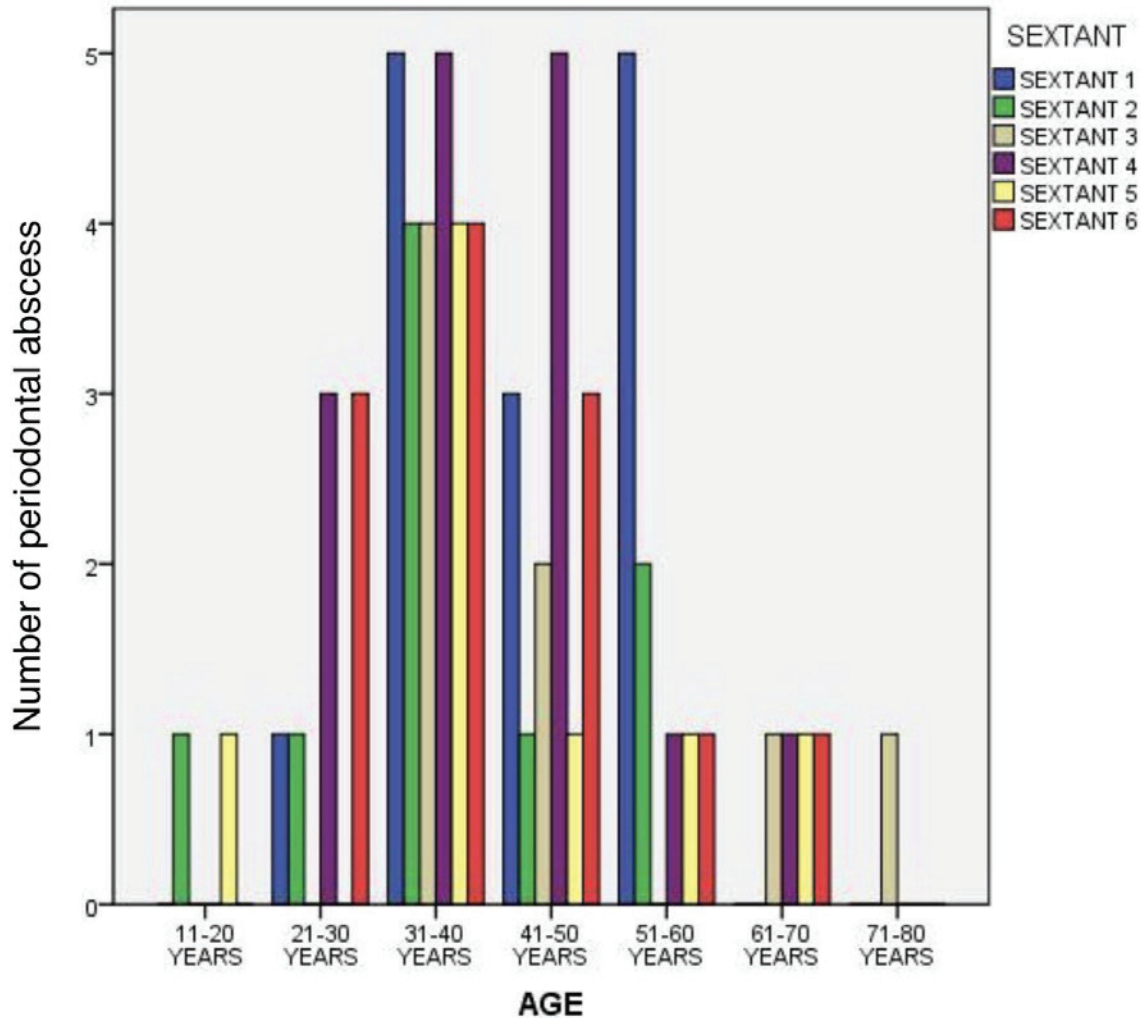
| Site | Frequency | Percent |
|-----------|-----------|---------|
| Sextant 1 | 14 | 21.2 |
| Sextant 2 | 9 | 13.6 |
| Sextant 3 | 8 | 12.1 |
| Sextant 4 | 15 | 22.7 |
| Sextant 5 | 8 | 12.1 |
| Sextant 6 | 12 | 18.2 |
| Total | 66 | 100.0 |

Table 4: Table showing frequency and percentage of distribution of chief complaint in patients with periodontal abscess reporting to a Dental University Hospital, Chennai, India. Pain (45.5%), swelling (9.1%), pain with pus discharge (1.5%), mobile teeth (7.6%), pain with mobile teeth (1.5%), pain with swelling and pus discharge (1.5%), decayed tooth (4.5%), pain with swelling (18.2%), food lodgement (3%), missing teeth (1.5%), pain with swelling and bleeding gums (3%), pain with burning sensation (1.5%) and pus discharge (1.5%)

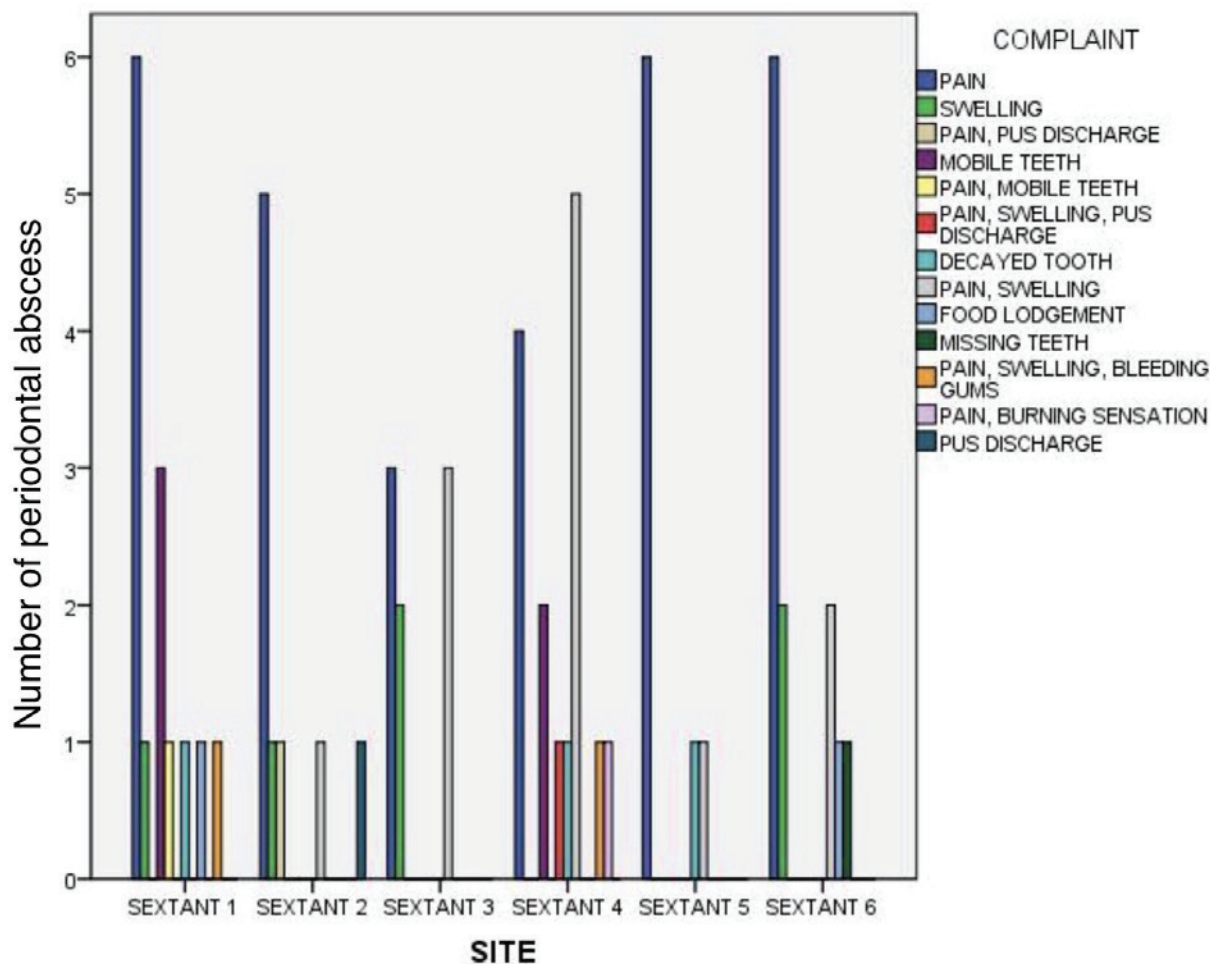
| Chief complaint | Frequency | Percent |
|----------------------------------|-----------|---------|
| Pain | 30 | 45.5 |
| Swelling | 6 | 9.1 |
| Pain and pus discharge | 1 | 1.5 |
| Mobile teeth | 5 | 7.6 |
| Pain and mobile teeth | 1 | 1.5 |
| Pain, swelling and pus discharge | 1 | 1.5 |
| Decayed tooth | 3 | 4.5 |
| Pain and swelling | 12 | 18.2 |
| Food lodgement | 2 | 3.0 |
| Missing teeth | 1 | 1.5 |
| Pain, swelling and bleeding gums | 2 | 3.0 |
| Pain and burning sensation | 1 | 1.5 |
| Pus discharge | 1 | 1.5 |
| Total | 66 | 100.0 |



Graph 1: Bar graph showing frequency of distribution of site of periodontal abscess in males and females. X axis denotes gender and Y axis denotes number of cases of periodontal abscess. This graph shows the number of cases of periodontal abscess in each sextant among males and females in patients reporting to a Dental University Hospital, Chennai, India. Blue colour represents sextant 1, green represents sextant 2, white represents sextant 3, purple represents sextant 4, yellow represents sextant 5 and red represents sextant 6. At all sites periodontal abscess occurs more commonly in males except at sextant 3 where there is equal predilection. However this data is statistically not significant. (Chi-square test; p -value=0.832; $p > 0.05$; statistically not significant)

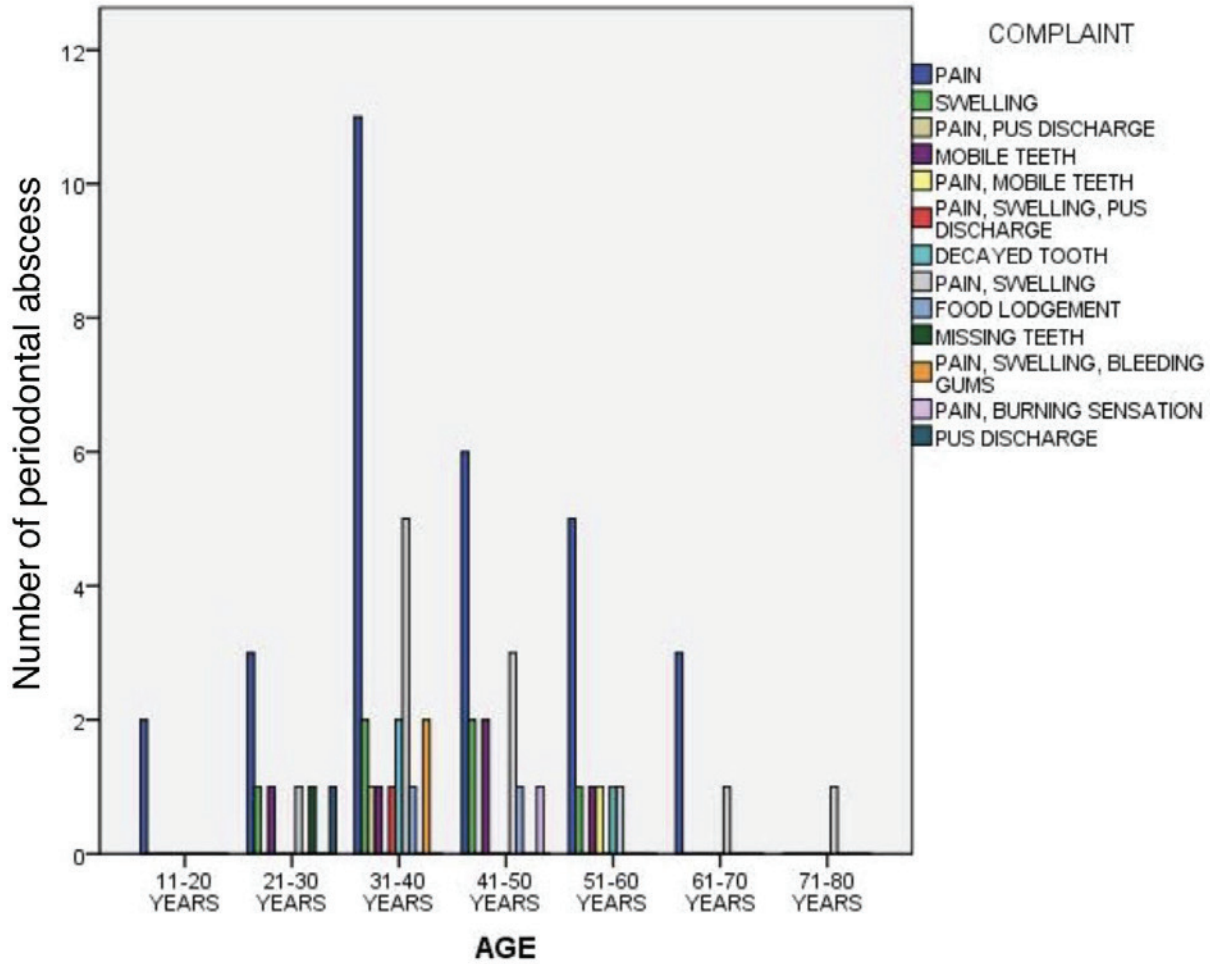


Graph 2: Bar graph showing frequency of distribution of site of periodontal abscess in different age groups. X axis denotes age group and Y axis denotes number of cases of periodontal abscess. This graph shows the number of cases of periodontal abscess in each sextant in different age groups among patients reporting to a Dental University Hospital, Chennai, India. Blue colour represents sextant 1, green represents sextant 2, white represents sextant 3, purple represents sextant 4, yellow represents sextant 5 and red represents sextant 6. Most common site of periodontal abscess in age group 11-20 years was sextant 2 and 5, in 21-30 years was sextant 4 and 6, in 31-40 years was sextant 1 and 4, in 41-50 years was sextant 4, in 51-60 years was sextant 1, in 61-70 years was sextant 3, 4, 5, 6 and in 71-80 years was sextant 3. However this data is statistically not significant. (Chi-square test; p-value=0.500; p>0.05; statistically not significant)



Graph 3: Bar graph showing frequency of distribution of chief complaints at each site.

X axis denotes site of periodontal abscess and Y axis denotes number of cases of periodontal abscess. Dark blue represents pain, light green represents swelling, light brown represents pain with pus discharge, purple represents mobile teeth, yellow represents pain with mobile teeth, red represents pain with swelling and pus discharge, cyan represents decayed tooth, grey represents pain with swelling, indigo represents food lodgement, dark green represents missing teeth, orange represents pain with swelling and bleeding gums, lilac represents pain with burning sensation and light blue represents pus discharge. Pain is the most common symptom at all sites. However this data is statistically not significant. (Chi-square test; p-value=0.996; p>0.05; statistically not significant)



Graph 4: Bar graph showing frequency of distribution of chief complaints within each age group.

X axis denotes age group and Y axis denotes number of cases of periodontal abscess. Dark blue represents pain, light green represents swelling, light brown represents pain with pus discharge, purple represents mobile teeth, yellow represents pain with mobile teeth, red represents pain with swelling and pus discharge, cyan represents decayed tooth, grey represents pain with swelling, indigo represents food lodgement, dark green represents missing teeth, orange represents pain with swelling and bleeding gums, lilac represents pain with burning sensation and light blue represents pus discharge. Pain is the most common symptom in all age groups except in 71-80 year olds where pain with swelling was seen more commonly. However this data is statistically not significant. (Chi-square test; p-value=0.802; p>0.05; statistically not significant)

In the present study the prevalence of periodontal abscess based on gender was observed to have a higher male predilection. There was a higher incidence in males at 68.2% while females were at 31.8%. A study done by Al. Zaidi et. al. stated similar findings with a higher percentage of involvement in males than females.¹⁵ Such a finding has been related to the higher prevalence of oral habits such as smoking among males when compared to females. Although the relation between smoking and periodontal abscess also exists among the female population.²⁴

The most common complaint of the reporting patients was observed to be pain (45.5%), followed by pain with swelling (18.2%) and swelling only at 9.1%. Pain with and without other symptoms were seen in overall 72.7% cases. Azodo et. al. stated that most patients with periodontal abscess reported severe,

spontaneous, throbbing, radiating or non-radiating types of pain which was relieved temporarily on usage of analgesics.²⁵ In another study by Herrera D et. al. 90% of patients with periodontal abscess reported with pain.²⁶ Study conducted by Ibrahim 2008, 90% of the patients reported pain and more than 75% of the abscesses had moderate to severe scores related to swelling, edema and redness. Bleeding occurred in all abscesses, while suppuration was detected in 70% and 85% of teeth.²⁷ Pain, swelling and erythema were noted to be the most common symptoms by Shweta et al. 2013.²⁸

The most common site affected by periodontal abscess were found to be sextants 1, 3, 4, 6 – 74.2% all of which include the premolars and molar. Studies done by Azodo et. al. and Pop MM et. al. all state that the most common site of periodontal abscess is posterior teeth.^{25,6} 69% of periodontal abscesses were associated with a molar tooth in a study by Herrera et al.²⁶ According to Lee 2011 more posterior teeth involved with periodontal abscess (64%) as compared to anterior teeth (36%).²⁹ However, there are other studies such as one by Arowojolu MO et. al which states that the most common site in decreasing order of incidence is – lower incisors, upper incisors, upper first molars, upper second molars, lower molars and premolars and finally canines.³⁰ Jaramillo A et. al. also stated that the most commonly affected teeth were lower anterior teeth, upper anterior teeth and lower molars.⁷ These studies are contradictory to our findings. A possible reason for such an opposing finding could be that in old age the immune responses of a person fades which leads to infection at unfavourable sites as well.³¹ The higher prevalence of posterior teeth could be due to the furcation involvement.⁶ Another study by Gary JL et. al. stated that maxillary incisors and premolars have the lowest rate of involvement.³² According to Chace and Low in 1993 the majority of teeth with periodontal abscesses extracted due to poor prognosis were maxillary second molars (38.2%), followed by maxillary first molars (25.5%), and mandibular second molars (16.4%).³³

In the current study periodontal abscess is most commonly seen in the middle age group (31-40 years) at approximately 40%. Studies by Tadjoeidin FM et. al. has shown that periodontal diseases increase in incidence as the person ages.³⁴ It has also been noted that chronic hyperglycemia such as in case of diabetes mellitus may

trigger deficiencies in the immune system, increasing the risk of infections, including in the oral cavity.³⁵

Periodontal abscess is highly prevalent in the population and should be managed at the earliest as its most common presenting feature is pain and swelling which causes extreme discomfort to the patient. If not treated at an early stage it can cause various complications such as septicemia, cavernous sinus thrombosis, brain abscess, shock, mandibular fracture and in some cases death. Periodontal abscess and its complications thus become a substantial burden on individuals, communities, and the health-care system.²⁸ A clinician should take these factors into consideration while treating a patient.

Limitations

This study is of shorter duration and limited population as it was conducted only among the South Indian population. The small size was small and thus the results obtained cannot be generalized. So, to ascertain the findings of our study we have to do further studies in the future with large sample size and longer duration.

Future Scope

The future scope of the study will be better and will yield accurate results if different ethnic groups are considered along with a larger sample size.

Conclusion

Within the limits of the study, it can be concluded that among the patients of Saveetha Dental College, the prevalence of periodontal abscess is higher in males of middle age group. The most common symptom is pain and the most common site of occurrence is upper right posterior teeth among males and lower left posterior teeth among females.

Acknowledgement: The authors would like to acknowledge the help and support rendered by the Department of Periodontology and Department of Information Technology of Saveetha Dental College and Hospitals and the management for their constant assistance.

Conflicts of Interest: None declared.

Source of Funding : Self

Ethical Clearance: It is taken from “Saveetha Institute Human Ethical Committee” (Ethical Approval Number- SDC/SIHEC/2020/DIASDATA/0619-0320)

References

- Meng HX. Periodontal Abscess [Internet]. Vol. 4, *Annals of Periodontology*. 1999. p. 79–82. Available from: <http://dx.doi.org/10.1902/annals.1999.4.1.79>
- Punit Vaibhav Patel, Sheela Kumar G, Amrita Patel. Periodontal Abscess: A Review. *J Clin Diagn Res*. 2011 Apr;5(2):404–9.
- Gheena S, Ezhilarasan D. Syringic acid triggers reactive oxygen species-mediated cytotoxicity in HepG2 cells [Internet]. Vol. 38, *Human & Experimental Toxicology*. 2019. p. 694–702. Available from: <http://dx.doi.org/10.1177/0960327119839173>
- Jayaraj G, Sherlin HJ, Ramani P, Premkumar P, Anuja N. Cytomegalovirus and Mucoepidermoid carcinoma: A possible causal relationship? A pilot study. *J Oral Maxillofac Pathol*. 2015 Sep;19(3):319–24.
- Saygun I, Yapar M, Ozdemir A, Kubar A, Slots J. Human cytomegalovirus and Epstein-Barr virus type 1 in periodontal abscesses. *Oral Microbiol Immunol*. 2004 Apr;19(2):83–7.
- Pop Mm Lazăr L Cormoș-Suciu. Clinical and Microbiological Aspects of the Periodontal Abscess. 1:468-71. *Acta Médica Transilvanica*. 2011 Sep;1:468–71.
- Jaramillo A, Arce RM, Herrera D, Betancourth M, Botero JE, Contreras A. Clinical and microbiological characterization of periodontal abscesses. *J Clin Periodontol*. 2005 Dec;32(12):1213–8.
- Swathy S, Gheena S, Varsha SL. Prevalence of pulp stones in patients with history of cardiac diseases [Internet]. Vol. 8, *Research Journal of Pharmacy and Technology*. 2015. p. 1625. Available from: <http://dx.doi.org/10.5958/0974-360x.2015.00291.7>
- W. B. The long term evaluation of periodontal treatment and maintenance in 95 patients. *Ins J Periodontics Restorative Dent*. 1984;4:55–71.
- Herrera D, Roldán S, Sanz M. The periodontal abscess: a review. *J Clin Periodontol*. 2000 Jun;27(6):377–86.
- Shree KH, Hema Shree K, Ramani P, Herald Sherlin, Sukumaran G, Jeyaraj G, et al. Saliva as a Diagnostic Tool in Oral Squamous Cell Carcinoma – a Systematic Review with Meta Analysis [Internet]. Vol. 25, *Pathology & Oncology Research*. 2019. p. 447–53. Available from: <http://dx.doi.org/10.1007/s12253-019-00588-2>
- Sridharan G, Ramani P, Patankar S, Vijayaraghavan R. Evaluation of salivary metabolomics in oral leukoplakia and oral squamous cell carcinoma. *J Oral Pathol Med*. 2019 Apr;48(4):299–306.
- Sivaramakrishnan SM, Ramani P. Study on the Prevalence of Eruption Status of Third Molars in South Indian Population. *Biol Med [Internet]*. 2015;07(04). Available from: <https://www.omicsonline.com/open-access/study-on-the-prevalence-of-eruption-status-of-third-molars-in-south-indian-population-0974-8369-1000245.php?aid=59465>
- Jangid K, Alexander A, Jayakumar N, Varghese S, Ramani P. Ankyloglossia with cleft lip: A rare case report [Internet]. Vol. 19, *Journal of Indian Society of Periodontology*. 2015. p. 690. Available from: <http://dx.doi.org/10.4103/0972-124x.162207>
- Al-Zaidi W. Prevalence of periodontal abscesses among patients suffering from chronic periodontitis in Iraq. *Journal of baghdad college of dentistry*. 2005;17(1):66–9.
- McLeod DE, Lainson PA, Spivey JD. Tooth loss due to periodontal abscess: a retrospective study. *J Periodontol*. 1997 Oct;68(10):963–6.
- Thangaraj SV, Shyamsundar V, Krishnamurthy A, Ramani P, Ganesan K, Muthuswami M, et al. Molecular Portrait of Oral Tongue Squamous Cell Carcinoma Shown by Integrative Meta-Analysis of Expression Profiles with Validations. *PLoS One*. 2016 Jun 9;11(6):e0156582.
- Gupta V, Ramani P. Histologic and immunohistochemical evaluation of mirror image biopsies in oral squamous cell carcinoma. *J Oral Biol Craniofac Res*. 2016 Sep;6(3):194–7.
- Jayaraj G, Ramani P, Herald J. Sherlin, Premkumar P, Anuja N. Inter-observer agreement in grading oral epithelial dysplasia – A systematic review

- [Internet]. Vol. 27, *Journal of Oral and Maxillofacial Surgery, Medicine, and Pathology*. 2015. p. 112–6. Available from: <http://dx.doi.org/10.1016/j.ajoms.2014.01.006>
20. Sridharan G, Ramani P, Patankar S. Serum metabolomics in oral leukoplakia and oral squamous cell carcinoma [Internet]. Vol. 0, *Journal of Cancer Research and Therapeutics*. 2017. p. 0. Available from: http://dx.doi.org/10.4103/jcrt.jcrt_1233_16
 21. Jayaraj G, Sherlin HJ, Ramani P, Premkumar P, Natesan A. Stromal myofibroblasts in oral squamous cell carcinoma and potentially malignant disorders [Internet]. Vol. 52, *Indian Journal of Cancer*. 2015. p. 87. Available from: <http://dx.doi.org/10.4103/0019-509x.175580>
 22. Viveka TS, Shyamsundar V, Krishnamurthy A, Ramani P, Ramshankar V. p53 Expression Helps Identify High Risk Oral Tongue Premalignant Lesions and Correlates with Patterns of Invasive Tumour Front and Tumour Depth in Oral Tongue Squamous Cell Carcinoma Cases [Internet]. Vol. 17, *Asian Pacific Journal of Cancer Prevention*. 2016. p. 189–95. Available from: <http://dx.doi.org/10.7314/apjcp.2016.17.1.189>
 23. Kumar A, Sherlin HJ, Ramani P, Natesan A, Premkumar P. Expression of CD 68, CD 45 and human leukocyte antigen-DR in central and peripheral giant cell granuloma, giant cell tumor of long bones, and tuberculous granuloma: An immunohistochemical study. *Indian J Dent Res*. 2015 May;26(3):295–303.
 24. Do GL, Loc Do G, John Spencer A, Roberts-Thomson K, Diep Ha H. Smoking as a risk indicator for periodontal disease in the middle-aged Vietnamese population [Internet]. Vol. 31, *Community Dentistry and Oral Epidemiology*. 2003. p. 437–46. Available from: <http://dx.doi.org/10.1046/j.1600-0528.2003.00009.x>
 25. Azodo C, Umoh A. Periodontal abscess among patients attending a Nigerian specialist periodontology clinic [Internet]. Vol. 19, *Tropical Journal of Medical Research*. 2016. p. 24. Available from: <http://dx.doi.org/10.4103/1119-0388.172071>
 26. Herrera D, Roldán S, González I, Sanz M. The periodontal abscess (I). Clinical and microbiological findings. *J Clin Periodontol*. 2000 Jun;27(6):387–94.
 27. Ibrahem LM. Evaluation of periodontal abscess clinically and microbiologically. *Journal of Baghdad College of Dentistry*. 2008;20(1):58–61.
 28. Shweta, Prakash SK. Dental abscess: A microbiological review. *Dent Res J*. 2013 Sep;10(5):585–91.
 29. Lee PAD. “Malaysian Dental Association Council 2009-2010.” 2011.
 30. Arowojolu MO. Prevalence of periodontal pocketing and tooth mobility according to tooth types in Nigerians--a pilot study. *Afr J Med Med Sci*. 2002 Jun;31(2):119–21.
 31. Hr. A. Prevalence of periodontal abscess among controlled and uncontrolled type 2 diabetic patients (comparative study). *Journal of baghdad college of dentistry*. 2011;23(3):92–6.
 32. Gray JL, Flanary DB, Newell DH. The prevalence of periodontal abscess. *J Indiana Dent Assoc*. 1994 Jan 1;73(4):18–20, 22.
 33. Chace R Sr, Low SB. Survival characteristics of periodontally-involved teeth: a 40-year study. *J Periodontol*. 1993 Aug;64(8):701–5.
 34. Tadjoeidin FM, Fitri AH, Kuswandani SO, Sulijaya B, Soeroso Y. The correlation between age and periodontal diseases. *Journal of International Dental and Medical Research*. 2017 May 1;10(2):327.
 35. Premkumar J, Ramani P, Chandrasekar T, Natesan A, Premkumar P. Detection of species diversity in oral candida colonization and anti-fungal susceptibility among non-oral habit adult diabetic patients. *J Nat Sci Biol Med*. 2014 Jan;5(1):148–54.