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ODONTOGENIC SPACE INFECTION: SEVERITY, CLINICAL AND TREATMENT OUTCOMES WITH SEASONAL VARIATION: 7 – YEARS RETROSPECTIVE HOSPITAL BASED STUDY

Dental Science

Kaustubh Bhad	MDS.
Keval Bhavsar	MDS.
Ramita Sood	MDS.
Hu Weihsin	MDS.
Arpana Ludhwani	MDS.
Sanjay Makwana	MDS.

ABSTRACT

Introduction: The aim of the study is to find a relationship between variations of atmospheric temperature as season changes with indicators reflecting the severity of odontogenic space infections, such as day of presentation, isolated microbes, treatment methods, period of drain maintenance and hospital stay, with atmospheric temperature variations in different seasons. **Methods:** This study included 259 patients with odontogenic infections who were admitted to AMC Dental College and Hospital in Ahmedabad between January 2013 and December 2020. All indicators of odontogenic infections in terms of severity and treatment outcomes are to be considered with seasons. **Results:** In the summer season, we noticed a statistical correlation between the incidences of odontogenic infections, the early day of presentation, and the longer drain maintenance period. It means that reported cases were more prevalent in high temperatures present during the summer season, with higher clinical incidence and severity. **Conclusion:** The study result reveals the relationship between atmospheric temperatures as seasons vary with the incidence of odontogenic infection. The high atmospheric temperature in the summer season has higher cases of incidence of infections and drain maintained for more days in terms of severity. **Clinical Implications:** Treatment of odontogenic infections poses a significant financial burden for public health service providers. The results of this study can be used to adjust the number of doctors/dental surgeons on duty to reflect changing weather conditions. Either way, it serves as an important tool for innovation and creativity.

KEYWORDS

Odontogenic space infection, Seasonal variation, atmospheric temperature, Temperature

INTRODUCTION

Odontogenic infections are still prevalent in rural and urban areas of India due to a lack of public awareness and education. According to dentists and oral surgeons, these infections are still thought to be related to meteorological variables such as air temperature or barometric pressure. Hypotension and odontogenic abscesses were first proposed by Nissen et al[1] and supported by Harlfinger et al[2] In general, medical meteorology is a broad field of study with a variety of challenging arguments. Ruan et al. A 2015 found an association between the onset of atrial fibrillation in heart patients and exposure to dry air and cooler temperatures. According to Yilmaz et al. there appears to be a link between the occurrence of migraines and high temperatures and low humidity.[3,4]

We hypothesized that abrupt fluctuations in atmospheric temperature (one of the meteorological parameters) during seasonal changes in India could have a significant impact on the severity of spatial odontogenic infection cases. India's climate is diverse, with various weather patterns spanning a large geographic range and varying terrain, making it difficult to generalize. Gujarat, especially Ahmedabad, needs a hot semi-arid climate with less rainfall than a savanna climate.[4-7]

In Path of Truth in Medical Metrology, we retrospectively analysed 259 patients admitted to Oral and Maxillofacial Surgery at Ahmedabad Municipal Corporation (AMC) School of Dentistry and Hospital from 2013 to 2020 Patients with odontogenic space infection.

The aim of this study was to find the relationship between seasonal variations, i.e. changes in atmospheric temperature and different parameters associated with severity and outcome of treatment of odontogenic space infection such as day of presentation, isolated microbes, treatment methods, drain maintenance period, and hospital stay in Ahmedabad, Gujarat, India.

MATERIALS AND METHOD

Data Sources:

The complete analysed retrospective data of 259 cases with odontogenic space infections admitted in Department of Oral and Maxillofacial Surgery, Ahmedabad Municipal Corporation (AMC) Dental College and Hospital, Ahmedabad from 2013 to 2020. The study included admitted patients who were severe in terms of presenting with extra-oral swelling, fever, trismus, and/or pre-existing medical conditions and had complete medical records. The study did not include patients that were not admitted to our facility. The Institute of Meteorology and Climatology at Ahmedabad provided meteorological data for Ahmedabad city throughout this time period.

Study Design:

The variables were included in the study from medical records of 259 cases: day of patient presentation (within 5 days of history or more than 5 days), isolated micro-organisms, treatment modalities [Conservative/ Extraction/ Incision and Drainage (I and D) associated with empirical antibiotic coverage followed by cultural and Sensitivity report], drain maintenance period (up to 3 days/ 7 days after I and D) and length of hospital stay (up to 5 days/ more than 5 days) to compare with seasons. The study was conducted after obtaining approval from the AMC Institutional Ethical Committee (IEC) and registration number is AMC/IEC/OS/PG46/19 dated 22th August, 2019.

Statistical Analysis:

All the statistical analyses were performed using the Chi Square test in Medcalc 20.0.2. The analyses included Chi Square test with to assess if different variable would have relationship with seasonal variation. A p value of < 0.05 was considered statistically significant.

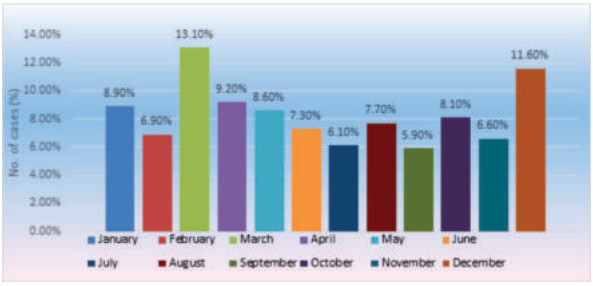
RESULTS

This study comprised 259 individuals with odontogenic maxillofacial space infections, ranging in age from 5 to 65 years, with 131 men (50.57 %) and 128 females (49.42 %). The patients were distributed based on seasonal variations, and the mean value of seasonal variations for each month from 2013 to 2020 was received from the Meteorological Department in Ahmedabad.

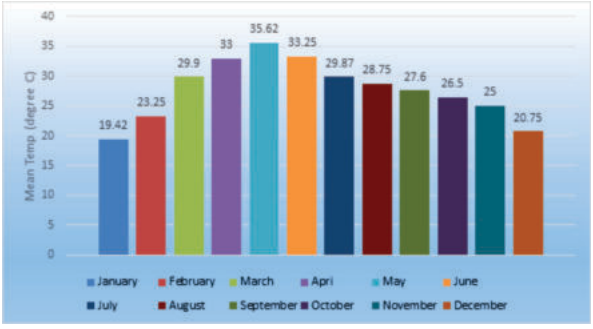
Meteorological Characteristics And Patient Distribution:

From 2013 to 2020, the annual mean atmospheric temperature was 27.97 ±2.83℃. The summer season started in March and ended in June, with a mean temperature of 32.9 ±1.9℃ and 99 cases reported (38.2 %). The monsoon season started in July and ended in October, with a mean temperature of 28.1 ±1.2 ℃ and 72 cases reported (27.8%). The winter season began in November and ended in February, with 88 cases (34%) reported. and a mean temperature of 22.1 ±2.1 ℃. The greatest mean temperature (35.6°C) was noted in May, while the

lowest mean temperature (19.4 °C) was noted in January. (Graph 1,2)



Graph 1 Total No. Of Cases (%) In Each Month From 2013 To 2020

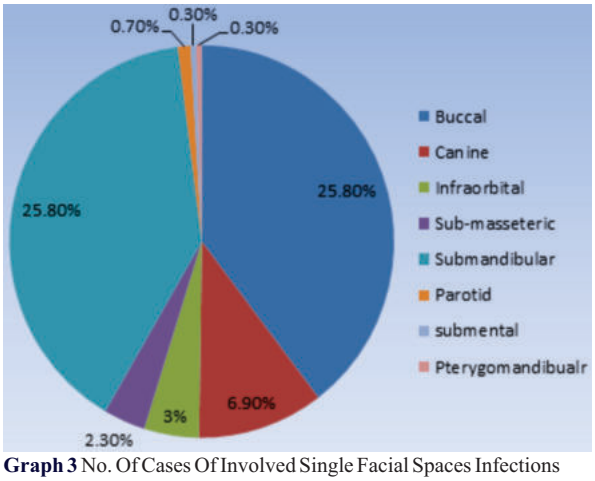


Graph 2 Mean Temperature Value Of Each Month From 2013 To 2020

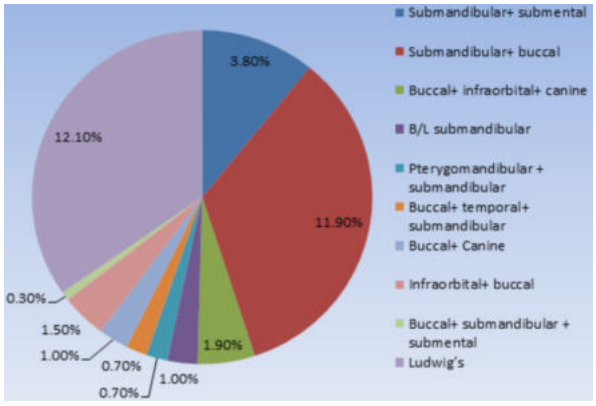
In this study, there were 34 (13.1%) out of 259 cases with pre-existing medical disorders, including diabetes mellitus, kidney transplant, HIV (Human Immunodeficiency Virus), and coronary artery disease.

Reported cases who were presented to our facility divided into two groups; within 5 days from onset of symptoms and after 5 days. Out of total numbers of cases in particular season, the majority of cases were presented in the summer season (65.7%), then the monsoon (39.8%), and finally the winter (51.4%) within 5 days group. After 5 days group, the majority of cases were found to be in the winter season (60.2%), followed by the monsoon season (48.2%), and the summer season (34.3%). Statistical analysis reveals a higher significant difference in both groups. (p=0.001). (Table 1)

Buccal (25.8%) and submandibular (25.8%) were the most commonly involved single facial spaces (25.8 %). Canine infection was the second most prevalent (6.9%), followed by infraorbital space infection (3%), Sub-masseteric Space infection (2.3%), parotid space infection (0.7%), submental (0.3%), and pterygomandibular space infection (0.3%). (0.3 %). The most prevalent combination of spaces was submandibular + buccal spaces (11.9 %), followed by Ludwig angina patients who had bilateral submandibular + Submental facial spaces (12.1 %). The other combination spaces were Submandibular + Submental (3.8 %), Buccal + Infraorbital + Canine (1.9 %), Infraorbital + buccal (1.5 %), bilateral submandibular (1%), buccal + Canine (1%), pterygomandibular + submandibular (0.7 %), Buccal + Temporal + Submandibular (0.7 %), buccal + submandibular + Canine (0.3%). (Graph 3,4)



Graph 3 No. Of Cases Of Involved Single Facial Spaces Infections



Graph 4 No. Of Cases Of Involved Various Combination Facial Space Infections

Data from the Pus Culture and Sensitivity Report revealed that streptococcus species were more abundant in the winter (89.8%), the monsoon (88.9%), and the winter (79.8%). In the summer (11.1%), the monsoon (8%), and the winter (9.7%), more Staphylococcus species were isolated. Pseudomonas species were isolated in significant numbers during the summer season (7%), winter (2.2%), and monsoon season (1.4%). MRSA was isolated in a modest percentage of cases only during the summer season (2.1%). The categories of streptococcus, staphylococcus species, pseudomonas species, and MRSA species have no statistically significant difference found with seasonal variation. (Table 1)

According to data sources, empirical antibiotics were started through I.V. (Intravenous route) route to all indoor cases. Data also revealed that some cases were resistant to empirical antibiotic therapy therefore they were switched to more appropriate antibiotics based on pus & culture sensitivity report.

Treatment modalities were classified based on the collected data into three groups: empirical antibiotics with conservative treatment (Root Canal Treatment), empirical antibiotics with extraction, and empirical antibiotics, I and D associated with extraction. The monsoon season had the highest incidence of cases (11.1%) in the group of empirical antibiotics with conservative treatment followed by the summer (10.5%) and the winter (6.8%). In the group of empirical antibiotics with extraction, more cases were treated in the winter (53.4%), the monsoon (48.6%), and summer (48%). In the empirical antibiotics, I and D associated with extractions group, cases were treated more in the summer (41.5%) than in the monsoon (40.3%) followed by the monsoon (39.8%). With seasonal changes, statistical analysis revealed no significant difference found in the treatment modalities group. (Table 1)

According to the data, corrugated rubber drains were used in I and D associated with extractions group and maintained for up to 7 days. The drain maintenance period was divided into two main categories: up to three days and up to seven days. More cases were recorded in the winter (78.4%) then the monsoon (64%) followed by the summer (52.2%) season in up to three days category. In up to seven days category, The summer had a significant number of cases (47.8%) than the monsoon (36%) and the winter (21.6%). Statistical analysis shows significant difference found in both the categories with seasonal variation. (p=0.04) (Table 1)

According to data sources, the cases who visited to our institute presented with a fever, extra-oral swelling, fever, trismus and/or with pre-existing medical conditions required hospitalized. Incision and Drainage was performed on the same day in indicated cases after hospitalization.

Based on the data acquired, the average length of stay in the hospital for indoor cases was 5 days, with a range of 3 to 10 days. It was divided into two groups: those who stayed for up to five days and those who stayed for more than five days. The winter season showed (78.4%) of cases admitted to the hospital within 5 days group, followed by the monsoon (77.8%) and the summer season (73.7%). For more than 5 days hospital stay group, more numbers of cases were reported in the summer season (26.3%) followed by monsoon season (22.2%) and the

winter season (21.6%). In both categories, statistical analysis indicates no significant difference. (Table 1)

Table 1 Number Of Cases With Day Of Presentation, Facial Spaces Involved, Isolated Micro-organisms, Treatment Modalities Used, Drain Maintenance Period, Duration Of Hospital Stay

Numbers of cases [n=259](%) according to Seasons				P- value
Day of Presentation				
	SUMMER	WINTER	MONSOON	
Within 5 days (n=137)	65 (65.7%)	35 (39.8%)	37(51.4%)	0.001 (HS)
More than 5 days (n=122)	34 (34.3%)	53 (60.2%)	35 (48.6%)	0.001 (HS)
Isolation of Micro-organisms				
Streptococcus species (n=222)	79 (79.8%)	79 (89.8%)	64 (88.9%)	0.09 (NS)
Staphylococcus species (n=25)	11 (11.1%)	7 (8%)	7 (9.7%)	0.7 (NS)
Pseudomonas species (n=10)	7 (7%)	2 (2.2%)	1 (1.4%)	0.1 (NS)
MRSA species (n=2)	2 (2.1%)	0	0	-
Treatment Modalities used				
Empirical Antibiotics + Conservative (n=34)	10 (10.5%)	6 (6.8%)	8 (11.1%)	0.1 (NS)
Empirical Antibiotics + Extractions (n=127)	47 (48%)	47 (53.4%)	35 (48.6%)	0.7 (NS)
Empirical Antibiotics + I and D + Extractions (n=108)	41 (41.5%)	35 (39.8%)	29 (40.3%)	0.1 (NS)
Drain Maintenance Period				
Up to 3 days (n=70)	24 (52.2%)	29 (78.4%)	16 (64%)	0.04 (S)
Up to 7 days (n=38)	22 (47.8%)	8 (21.6%)	9 (36%)	0.04 (S)
Duration of Hospital Stay				
Up to 5 days (n=176)	73 (73.7%)	69 (78.4%)	56 (77.8%)	0.7 (NS)
More than 5 days (n=83)	26 (26.3%)	19 (21.6%)	16 (22.2%)	0.7 (NS)
Total Cases (n=259)	99 (100%)	88 (100%)	73 (100%)	0.04 (S)

DISCUSSION

The impact of meteorological parameters on disease is being evaluated by a variety of research groups from multiple fields. For example, different weather conditions have been related to diseases like ischemic colitis[8], high blood pressure[9], and peritonsillar abscesses.[10] The several other studies have evaluated the impact of meteorological parameters on odontogenic abscess but the results are varied.[2-4,11,12]

Ristow et al.[11] found no relationship with meteorological parameters such as temperature and humidity and odontogenic abscess. However, increased barometric pressure was found to reduce abscesses, as per the authors. Seemann et al. found rise in abscesses when barometric pressure was lower but no significant correlation found with temperature.[12] Keller et al.[4] found statistically significant increase in incidence over the winter and spring.

Infections should be more common during periods of higher temperature, such as summer, according to physical medical principles; however it appears that these rules do not apply to the human body. They postulated that extreme temperature variations, such as those found between indoors and outside or between winter and spring, could affect the autonomic nervous system and, as a result, the system , rendering people more vulnerable to infections.

Harlfinger and Graup[2] found that abscesses were significantly more common during the transition from anticyclonic to cyclonic weather conditions involving warm air advection but no possible correlation mentioned.

According to Jean-Paul Meningaud[7], odontogenic infections are more common from May to October, and abrupt temperature changes increase the amount of odontogenic infections, as we observed in our study with abrupt increase in mean temperature (29.9℃) in March from February (23.25℃) with highest number of cases reported (13.1%). Another abrupt decrease in mean temperature noted in December (20.75℃) from November (25℃) with second higher numbers of cases (11.6%) found. These can happen as a results of a major rise or fall in temperature because of seasonal changes.[11,12] Carl F et al.[13] also found the significant relationship between temperature and abscesses.

We statistically established with a high significant difference that higher number of cases with earlier presentation of odontogenic infections were more prevalent in summer, when the mean atmospheric temperature increased during this season as in accordance with Jean-Paul Meningaud[7] and Carl F et al.[13]

Although, in the winter season, there were late presenting cases because there were more celebrations, such as Diwali, New Year, Uttarayan, and so on. In the case of incision and drainage, it is statistically proven that drain maintenance period was longer in most cases in the summer due to an increase in cases of combined facial space infection, more cases of staphylococcus, pseudomonas, and MRSA-like species, and more hospitalisation but these are not statistically proven.[14-18]

The current research has a few limitations such as relatively small number of cases and limited to a small geographic area. To confirm our findings, more research with a larger sample size in different geographic regions is required. Although this current study provided a statistical correlation between extreme temperatures in summer season and incidence of odontogenic infections but the patho-physiological mechanisms were not found. Furthermore, many personal and environmental factors that influence patients' judgements to obtain medical advice were overlooked.

CONCLUSION:

Although the exact correlation could not be established, the findings revealed a relation between odontogenic space infection and atmospheric temperature, which is one of the meteorological variables linked to seasonal variation in India. The high ambient temperature in the summer has a major impact on clinical incidence and severity.

AVAILABILITY OF DATA:

The data is obtained from Department of oral and maxillofacial surgery, AMC Dental College and Hospital, Ahmedabad, Gujarat.

ETHICS APPROVAL:

The study was approved by AMC Institutional Ethical Committee (IEC). [AMC/IEC/OS/PG46/19]

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Nil.

Conflict Of Interest:
The authors of this manuscript declare no conflict of interest.

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