OPEN ACCESS
Global Journal of Research in Dental Sciences
ISSN: 2583-2840 (Online)
Volume 04 | Issue 01 | Jan. – Feb. | 2024
Journal homepage: https://gjrpublication.com/gjrds/
Original Research Article

To Evaluate the Different Microorganisms and Antibiotic Sensitivities of Head and Neck Space Infections of Odontogenic Origin: A Clinical Study

*Dr. Neel Kamal[1], Dr. Vaz Ashwin Alwyn[2], Dr. Surendra Singh Khatana[3], Dr. Sumit Singh Lamba[4]

[1] Professor, Department of Oral & Maxillofacial Surgery, Rajasthan Dental College & Hospital, Jaipur, Rajasthan, India
[2] Consultant Oral & Maxillofacial Surgeon, Alwyn Dental Care, Mumbai, Maharashtra, India
[3] Post Graduate, Department of Oral & Maxillofacial Surgery, Rajasthan Dental College & Hospital, Jaipur, Rajasthan, India
[4] Consultant Oral & Maxillofacial Surgeon, Churu, Rajasthan, India

DOI: 10.5281/zenodo.10459915 **Submission Date: 10 Dec. 2023 | Published Date: 05 Jan. 2024**

***Corresponding author:** Dr. Neel Kamal
Professor, Department of Oral & Maxillofacial Surgery, Rajasthan Dental College & Hospital, Jaipur, Rajasthan, India

Abstract

The aim was to assess the microbes that cause infections in the oral and maxillofacial regions and to analyze the antibiotics that are used to treat these infections in terms of their sensitivity and resistance. The objectives of the study were to look into the microbes linked to infections in odontogenic space, to understand the frequency of involvement of fascial spaces in infections of the maxillofacial region, to evaluate the selection and effectiveness of different antibiotics and to evaluate the resistance to antibiotics. Patients were chosen for this prospective, longitudinal, observational trial using a simple randomization sampling method. There were fifty patients with fascial infections in the odontogenic area. According to the results of this prospective research, the most often affected areas were the buccal and submandibular spaces. The most potent combination of antibiotics for treating odontogenic infections caused by anaerobic micro-organisms and Streptococcus is amoxiclav with metronidazole. The combination of piperacillin and tazobactam, a beta lactamase inhibitor that has broad-spectrum antimicrobial action against the majority of aerobic and anaerobic Gram-positive and Gram-negative bacteria. Before beginning the empirical antibiotic medication, a pus sample was taken. Antibiotic sensitivity testing and culture were performed on the material. And the empirical antibiotic regimen was initiated. For the full coverage of both aerobic and anaerobic microorganisms in odontogenic infections, ciprofloxacin, amoxicillin/clavulanic acid, and clindamycin were advised in combination with metronidazole. and after the results were known, the final course of antibiotic treatment was administered.

Keywords: Fascial spaces, infection, micro-organisms, aerobic, anaerobic.

INTRODUCTION

Fascial space infection has been recognized and described since the time of Galen in the second century. A fight against microorganisms by man dates back to ancient civilization. Orofacial odontogenic infections are mixed aerobic-anaerobic infections. The etiology is usually a presence of decayed or nonvital teeth, postoperative infections, periodontal disease and pericoronitis. If dismissed, they generally spread into the contiguous fascial spaces and may lead to adverse life-threatening consequences. This mandates early recognition and prompt treatment; drainage must be established where possible. Most patients recover completely after precise surgical treatment and the removal of the odontogenic focus in combination with administration of appropriate adjunctive antibiotics.[1]

The pathogenic microorganisms present in the apical, periodontal or pericoronal lesions, after eroding the cortical bone, settle in the subperiosteum, which represents the so-called subperiosteal phase of suppuration; after breaking the periosteum, they freely colonize the anatomical space adjacent to the causative tooth, generating the entire spectrum of

symptoms of a fascial space infection.[2] Recent years have witnessed significant changes in the spectrum of microorganisms isolated from odontogenic infections. These infections are polymicrobial in nature, and a great variety of causative pathogens, mainly facultative and obligate anaerobic microorganisms, have been described; however, aerobic microorganisms have also been isolated. Gram-positive cocci of the genera Streptococcus, Enterococcus and Peptostreptococcus are mainly isolated from purulent exudates, but bacilli such as Prevotella, Lactobacillus and Bacteroides and, in some cases, yeasts such as Candida are also present in these infections.[3]

- Gram (+) cocci and gram (-) bacilli tend to predominate
- Streptococci are the most common aerobes isolated, Staphylococci are less frequent
  - Alpha hemolytic streptococci are the most common group among the aerobes
  - Beta hemolytic streptococci are less frequent
- Anaerobic streptococci are the most common anaerobic isolates
- Bacteroides are less common.[4]

AIM AND OBJECTIVES

AIM: To assess the causative micro-organisms responsible for oral & maxillofacial space infections and to evaluate the antibiotic sensitivity and resistance of antibiotics used in the treatment of these infections.

OBJECTIVES

A. To investigate the microorganisms associated with odontogenic space infection.
B. To understand the prevalence of fascial spaces involvement in maxillofacial infections.
C. To assess the efficacy and choice of various antibiotics.
D. To assess the antibiotic resistance.

MATERIALS AND METHOD

This study was a prospective, longitudinal, observational study in which patients were selected by simple randomization sampling method. 50 patients with odontogenic space fascial infections were included. This study was conducted in the department of Oral & Maxillofacial Surgery at Rajasthan Dental College & Hospital, Jaipur, Rajasthan from March 2022 to August 2023. The following study was approved by institutional ethical committee and was conducted as per the guidelines of committee.

Inclusion Criteria

1. Male and female patients from 20 to 70 years of age were included.
2. Patients with any oral & fascial space involvement were included.
3. Patients categorized as ASA I, II, III were included.
4. Patients who were willing to participate in the study.

Exclusion Criteria

1. Patients categorized as ASA IV, V were excluded.
2. Patients with non-odontogenic secondary infections were excluded.
3. Patients with HIV and Hepatitis were excluded as these patients could have low immune system which will allow other microorganisms of low virulence to be cultured not commonly found in fascial space infections, therefore interfere with the present study design.
4. Patients who were not willing to participate in the study.

PROCEDURE

Method of collection of Pus sample

Pus samples were collected either intraorally or extraorally in cases where drainage was intraoral pus samples were collected either through aspiration with a 18/22-gauge needle with 2- or 5-ml syringe or directly collected by swab stick from drainage site. Extra orally, pus sample was collected by sterile 18/22-gauge needle through intact skin or by swab stick. After aspiration, any free air syringe was expunged, and needle was capped immediately, and material was dispensed in sterilized vials and Stuart's transport medium.

Specimen culture

Clinical material was transported to the laboratory. The collected exudate was placed in two tubes with thioglycolate medium for culturing anaerobic microorganisms and one tube was placed in an anaerobic chamber with 85% nitrogen, 10% hydrogen and 5% carbon dioxide and incubated at 37 ± 2 °C for 48-72 h, until visible microbial growth appeared. The other tube was placed in a microbiological incubator under aerobic conditions for approximately 24-48 h, until microbial development was observed.

Biochemical identification of microorganisms

After incubation for 48-72 h, all sets of plates were visualized for growth and biochemical tests were done to identify the genus and species of bacteria. Biochemical tests were lactose, glucose, sucrose, maltose, mannitol, methyl red, Voges-Proskauer test, Urease test, Citrate test, oxidation fermentation test and motility test. After 24 h of observation, diagnosis of infection was made.

Macro- and microscopic characteristics were evaluated under a stereoscopic microscope including Gram staining and the presence of bacterial spores, respectively. Microbial identification was performed with biochemical tests using the following API systems according to the manufacturer's instructions: API 20 Strep for *streptococci* and related genera, API 20A for anaerobic microorganisms and API 20C AUX for yeast identification.

Antibiotic susceptibility tests

All isolated microorganisms, except yeasts, were submitted to antibiotic susceptibility tests using the Kirby-Bauer method with the following antibiotics: Antibiotic sensitivity was done by Kirby-Bauer disk diffusion method for the following drugs i.e., Penicillin G, Ampicillin, Amoxycillin, Amoxycillin-Clavulanic acid, Cotrimoxazole, Cefotaxime, Cephalexin, Gatifloxacillin, Gentamycin, Amikacin, Doxycycline, Metronidazole, Erythromycin, Azithromycin and Clindamycin.

The identified microorganisms were spread with a sterile cotton tip on anaerobic blood agar or blood agar; discs with antibiotics were placed on agar with sterile forceps, and the plates were incubated for 24-48 h. The measurements of inhibition halos were performed with a Vernier caliper according to the National Committee for Clinical Laboratory Standards (NCCLS).

RESULTS

The present study was carried out to assess the causative micro-organisms responsible for Oral & Maxillofacial space infections and to evaluate the antibiotic sensitivity and resistance of antibiotics used in the treatment of these infections. Out of 50 patients involved in the study, 16 patients were in the age group 21-40 years (32%), 30 patients were in the age group of 41-60 years (60%) and 4 patients were in the age group of 61-80 years (8%). In this study the age group that was affected the most was 41-60 years with a mean age 45.86±9.84. Total 50 patients were included in this study. Out of these, 29 were male (58%) and 21 were females (42%). In 7 patients maxilla was the site involved (14%) and in 43 patients mandible as the site involved (86%). After assessing the data collected from the samples.

Table 1: Type of Isolate in the study Population

S. No.	Type	Percentage
1.	Aerobes	8%
2.	Anaerobes	40%
3.	Mixed	52%
	Total	**100%**

Table 2: Type of Bacteria in Gram Stain Smear Study

S. No.	Type of bacteria	Percentage
1.	Gram Positive Cocci	68%
2.	Gram Positive Bacilli	6%
3.	Gram Negative Cocci	8%
4.	Gram Negative Bacilli	18%
	Total	**100%**

Table 3: Tooth causing odontogenic space infection

S. No.	Type of bacteria	No. of Patients	Percentage
1.	Mand. First molar	15	30.0
2.	Mand. First premolar	3	6.0
3.	Mand. Lateral incisor	1	2.0
4.	Mand. Second molar	16	32.0
5.	Mand. Second premolar	2	4.0

6.	Mand. Third molar	6	12.0
7.	Max. Canine	1	2.0
8.	Max. first molar	1	2.0
9.	Max. Lateral incisor	1	2.0
10.	Max. Second molar	2	4.0
11.	Max. Second premolar	1	2.0
12.	Max. Third molar	1	2.0
	Total	**50**	**100.0**

Table 4: Antibiotic sensitivity pattern for aerobic bacteria

S. No.	Antibiotic sensitivity pattern for aerobic bacteria	Percentage
1.	Amoxicillin+Clavulanic Acid	100%
2.	Ciprofloxacin	100%
3.	Gentamycin	85%
4.	Amikacin	80%
5.	Clindamycin	90%
6.	Cefotaxime	70%
7.	Piperacillin+Tazobactam	100%

Table 5: Antibiotic sensitivity pattern for anaerobic bacteria

S. No.	Antibiotic sensitivity pattern for anaerobic bacteria	Percentage
1.	Metronidazole	100%
2.	Amoxicillin+Clavulanic Acid	30%
3.	Azithromycin	90%
4.	Clindamycin	90%
5.	Ciprofloxacin	90%
6.	Cefotaxime	80%
7.	Piperacillin+Tazobactam	100%

Table 6: Space involved in odontogenic infection

S. No.	Space involved	No. of Patients	Percentage
1.	Buccal	10	20.0
2.	Canine	3	6.0
3.	Infratemporal	1	2.0
4.	Ludwig's Angina	1	2.0
5.	Osteomyelitis	3	6.0
6.	Pterygomandibular	1	2.0
7.	Sublingual	1	2.0
8.	Submandibular	29	58.0
9.	Submental	1	2.0
	Total	**50**	**100.0**

DISCUSSION

Present study evaluated the causative micro-organisms responsible for Oral & maxillofacial space infections and their antibiotic sensitivity and resistance to antibiotics used in the treatment of these infections. Origin of maxillofacial infection could be from a pulpal disease, periapical lesion, periodontal condition, pericoronal problem, post-surgical infection or direct trauma.[5] Mostly an ignored or ill-treated decayed tooth becomes the root cause of a serious and life-threatening infection. Complications such as retropharyngeal spread and intracranial extension or mediastinal spread and airway obstruction indicate the potentially serious nature of these infections. The concept of a mixed aerobic anaerobic infection is an important one relative to odontogenic infections. Odontogenic infection is due to the interdependent and synergistic metabolism of a variety of microorganisms. It has been demonstrated that individual members of the group

produce metabolites that are essential for the growth of other microorganisms in the group. They produce substances that create a favourable pH in the environment, or they consume oxygen and facilitate anaerobic growth.[6] Odontogenic infections caused by Gram positive aerobic organisms were Staphylococcus aureus, Enterococcus faecalis and Streptococcus angiosus. On the other hand, gram positive anaerobes included P. anaerobius and P. asaccharolyticus. Gram negative organisms found were 100% anaerobes (P. intermedia and P. melaninogenica).[7] The spaces most affected by odontogenic infections are submandibular and buccal spaces. In the present study, we found that in 57.5% of the patients, the submandibular space was affected, and in 20% of the patients, the buccal space was affected; because of their anatomic location, it is logical to expect that these fascial spaces are most commonly involved.

Most aerobes were found sensitive to Amoxicillin-Clavulanate and anaerobes to Metronidazole. Those patients who were allergic to Amoxicillin-Clavulanate were given Clindamycin. Aminoglycosides are effective in controlling infections due to aerobic gram-negative rods which are quite rarely encountered by oral and maxillofacial surgeons. Staphylococci were most frequently resistant to Penicillin's among aerobes. Organisms were sensitive to Cephalosporins to a higher degree than to Penicillins.[8] Unfortunately, the use of antibiotics causes an increase in bacterial resistance, and although antibiotic prescriptions are regulated in some countries, many patients report the use of antibiotics at home. The management of these patients can be significantly improved if infections are treated at early stages: however, on average, these patients seek medical care 1 week after the infection starts, and by that time, the infection usually spreads. The severity of these infections depends on the tissue affection grade and dissemination of infection to contiguous spaces, as well as on several other factors, such as the general state of patient's health, the presence of systemic disease, immunosuppression, etc. The complications of odontogenic infections are diverse, and many patients may require admission to an intensive care unit. Even though our patients had severe infections, none presented with rare complications. In some cases, deep head and neck infections in addition, tonsillopharyngitis and lymphadenitis can be caused by maxillofacial odontogenic infections.

In our study odontogenic infections are mainly associated with mandibular first molars followed by mandibular second molars and then by maxillary molars. Regardless of the causal tooth, the clinical management includes the elimination of the primary cause by extraction of the tooth or endodontic treatment, followed by a suction drainage and antibiotics. An essential factor for the treatment of these infections is performing local procedures, such as drainage and abscess incision, since penetration of antibiotics into oral tissues such as the infected jaw bone and abscess cavity is low, resulting in a low antibiotic concentration at the site of infection. In this study, all patients were treated with extraction of the causal tooth and drainage and debridement, along with oral or intravenous administration of antibiotics such as Augmentin and Metronidazole.

Rega AJ et al.[9] all patients in this study had culture and sensitivity performed. Patient demographics reviewed were gender, age, involved fascial space(s), micro-organisms identified and antibiotic resistance from culture and sensitivity testing. This study showed that there were 54% male and 46% female patients, but in our study 58% male and 42% female. The submandibular space was the most frequent location (30%), followed by the buccal space (27.5%) and the lateral pharyngeal space (12.5%); but in our study submandibular (58%) followed by buccal (20%), canine (6%) and osteomyelitis (6%) were more frequently involved. Hunt DE et al.[10] conducted a study on patients with odontogenic infections. In which 96% were gram-positive, 4% were gram-negative, 19% were anaerobics, 82% yielded pure cultures, and 18% produced mixed cultures. In our study, 74% were gram-positive, 26% were gram-negative giving similar results as our study; aerobes were 8%, anaerobes 40%, mixed were 52% which differs from the results of our study. Heim et al.[11], and Chunduri et al.[12], reported in different studies that the microorganisms isolated of these infections are Streptococcus mainly viridans group, up 70% among the aerobic bacteria, whereas Gram-negative and -positive bacillus as Bacteroides and Prevotellas were the most common bacterial species among anaerobes; in these reports they concluded that this type of infections has a mixed environment, which involve the presence of both aerobic and anaerobic microorganisms. The most frequent isolates in our study were from different species of Bacteroides, which are strictly anaerobic, Gram-negative bacilli were pathogens causing the odontogenic infections. There are several antibiotics that are used for the treatment of odontogenic infections. Although penicillin had been considered the standard treatment for dental infections for a long time, bacteriological spectra of the oral microbiota have shown resistant microorganisms since penicillin was introduced. Newer and more potent antibiotics are needed to fight against causal microorganisms of odontogenic infections. In this study, different antibiotics, such as betalactams, cephalosporins, lincosamides and carbapenems, were used to evaluate the susceptibility of microbial isolates from purulent exudates of patients with severe odontogenic infections, and it was found that among the antibiotics tested (except imipenem, which was used as a control antibiotic), all isolates showed high susceptibility to clavulanic acid/ amoxicillin. The use of amoxicillin with clavulanic acid increases the antimicrobial capacity of amoxicillin against bacteria producing beta-lactamases. This antibiotic combination is used for acute bacterial sinusitis, otitis, tonsillitis, cystitis, severe dental abscesses, and other infections. However, the disadvantages of this antibiotic combination are its high cost and insufficient availability of the intravenous formulation so that other antibiotics of the same family are used in the clinic. Other antibiotics used are lincosamides,

such as clindamycin, which was most frequently used to treat patients enrolled in this study: however, we observed low susceptibility of the isolated microorganisms to this antibiotic.

High resistance to antibiotic has been observed in dentistry in the last years, and therefore, it is progressively less prescribed by maxillofacial surgeons and dentists. It should be noted that one of essential causes of bacterial resistance is self-medication, and most of the patients treated had consumed antibiotics before their hospitalization. Despite the differences in the frequency of microorganisms isolated from this type of infections, the pharmacological management is similar in several countries. Chunduri et al[12], reported a good susceptibility at clavulanic acid amoxicillin and amoxicillin alone; in contrast, a high resistance at erythromycin was observed, in patients with orofacial infections in India, where the bacterial resistance represents a serious health problem. Comparatively in our study, as the majority of the isolates are found to be mixed (includes both aerobes and anaerobes), therefore they were more susceptible to the combined therapy of Amoxicillin-clavulanic acid and Metronidazole. Bahl R et al.[13], where the therapy with Co amoxiclav show a good susceptibility at aerobic and anaerobic microorganisms; these results agree with ours. Heim et al.[11], observed in a study where the susceptibility of antibiotics was evaluated in patients with odontogenic infections with inpatient and outpatient management that the microorganisms that show low susceptibility to one or more of the standard antibiotic regimens have a significantly higher chance of causing serious health problems. They compared the susceptibility and resistance of the antibiotics tested by classifying the microorganisms into anaerobes and aerobes, they observed in most cases, that the anaerobic microorganisms showed lower percentages of susceptibility than did aerobic microorganisms. In our study, a higher resistance was observed for anaerobic microorganisms than for aerobic microorganisms. The anaerobic microorganisms were threefold more resistant to piperacillin, 1.6-fold more resistant to amoxicillin/ clavulanic acid, 2.7-fold more resistant to dicloxacillin, 0.8-fold more resistant to piperacillin/tazobactam, 0.5-fold more resistant to each penicillin and amoxicillin, 1.1-fold more resistant to cefoxitin, and threefold more resistant to cefotaxime than were aerobic microorganisms.) Amoxicillin/ clavulanic acid and Metronidazole was the antibiotic combination to which the microorganisms were most susceptible, but the percentage of susceptibility to this antibiotic among the anaerobic microorganisms was lower than that among the aerobic microorganisms. The aerobic microorganism's resistant was sensitive to Amikacin and Gentamycin and the anaerobes were sensitive to Metronidazole. Shakya N et al.[14] carried out a prospective study on 100 consecutive cases of odontogenic infections treated at their institute over a period of 18 months by surgical intervention and intravenous antibiotics. Morphologic study of the isolates and antibiotic sensitivity testing was performed. The mandibular first molar was the most frequently involved tooth (41.9%) associated with the etiology of odontogenic infections; which is the same as in our study. The submandibular space was most commonly affected (44.26%) followed by buccal space (27%); our study gave similar findings, submandibular (57.5%) followed by buccal (8%). Umeshappa H et al.[15] conducted a study, and according to their study odontogenic space infections were more prevalent in Males, which is the same as our study; age group more involved in their study was in the third and fourth decade, but in our study, it was more prevalent in the fourth and fifth decades. According to Umeshappa et al, microorganisms were more susceptible to amoxicillin+clavulanic acid, metronidazole, secondly to clindamycin, which is similar findings in our study.

Conclusion

In the recent study of fifty patients, with diagnosis of fascial space infection of odontogenic origin who reported to the department of Oral and Maxillofacial surgery Rajasthan Dental College, Jaipur was evaluated for the different microorganisms and antibiotic sensitivities of odontogenic space infections. The findings of our prospective analysis indicate that the submandibular space followed by buccal space was most commonly involved. Amoxiclav and metronidazole is the highly effective antibiotic combination against Streptococcus and anaerobic microorganisms causing odontogenic infections. Piperacillin + Tazobactam is β-Lactamase inhibitor with a broad spectrum of anti- microbial activity encompassing most Gram positive and gram negative aerobic and anaerobic bacteria. The pus sample was obtained before the empirical antibiotic therapy was started. The sample was sent for culture and antibiotic sensitivity. And empirical antibiotic was started, Ciprofloxacin, Amoxicillin/clavulanic acid and Clindamycin are recommended in odontogenic infections in combination with metronidazole for complete coverage of aerobic and anaerobic microorganisms. and once the results were obtained, definitive antibiotic therapy was given. However, to arrive at a more precise conclusion we need studies involving a greater number of patients with more advanced techniques and equipment to evaluate the different microorganisms and their antibiotic sensitivities in odontogenic space infections.

References

1. Holmes CJ, Pellecchia R. Antimicrobial therapy in management of odontogenic infections in general dentistry. Dental Clinics. 2016 Apr 1;60(2):497-507.
2. Tent PA, Juncar RI, Onisor F, Bran S, Harangus A, Juncar M. The pathogenic microbial flora and its antibiotic susceptibility pattern in odontogenic infections. Drug metabolism reviews. 2019 Jul 3;51(3):340-55.

3. Sebastian A, Antony PG, Jose M, Babu A, Sebastian J, Kunnilathu A. Institutional microbial analysis of odontogenic infections and their empirical antibiotic sensitivity. Journal of oral biology and craniofacial research. 2019 Apr 1;9(2):133-8.
4. Taub D, Yampolsky A, Diecidue R, Gold L. Controversies in the management of oral and maxillofacial infections. Oral and Maxillofacial Surgery Clinics. 2017 Nov 1;29(4):465-73.
5. Singh M, Kambalimath DH, Gupta KC. Management of odontogenic space infection with microbiology study. Journal of maxillofacial and oral surgery. 2014 Jun;13:133-9.
6. López-González E, Vitales-Noyola M, González-Amaro AM, Méndez-González V, Hidalgo-Hurtado A, Rodríguez-Flores R, Pozos-Guillén A. Aerobic and anaerobic microorganisms and antibiotic sensitivity of odontogenic maxillofacial infections. Odontology. 2019 Jul 12;107:409-17.
7. Jindal S, Parmar S, Davessar J, Bawa AG, Singh G, Prinja S, Bali A. A study of head and neck space infections and their sensitivity pattern at tertiary care hospital. Int J Otorhinolaryng Head Neck Surg. 2019 Jan;5:165-71.
8. Warnke PH, Becker ST, Springer IN, Haerle F, Ullmann U, Russo PA, Wiltfang J, Fickenscher H, Schubert S. Penicillin compared with other advanced broad spectrum antibiotics regarding antibacterial activity against oral pathogens isolated from odontogenic abscesses. Journal of Cranio-Maxillofacial Surgery. 2008 Dec 1;36(8):462-7.
9. Rega AJ, Aziz SR, Ziccardi VB. Microbiology and antibiotic sensitivities of head and neck space infections of odontogenic origin. Journal of oral and maxillofacial surgery. 2006 Sep 1;64(9):1377-80.
10. Hunt DE, Meyer RA. Continued evolution of the microbiology of oral infections. The Journal of the American Dental Association. 1983 Jul 1;107(1):52-4.
11. Heim N, Jürgensen B, Kramer FJ, Wiedemeyer V. Mapping the microbiological diversity of odontogenic abscess: are we using the right drugs?. Clinical Oral Investigations. 2021 Jan;25:187-93.
12. Chunduri NS, Madasu K, Goteki VR, Karpe T, Reddy H. Evaluation of bacterial spectrum of orofacial infections and their antibiotic susceptibility. Annals of maxillofacial surgery. 2012 Jan;2(1):46.
13. Bahl R, Sandhu S, Singh K, Sahai N, Gupta M. Odontogenic infections: Microbiology and management. Contemporary clinical dentistry. 2014 Jul;5(3):307.
14. Shakya N, Sharma D, Newaskar V, Agrawal D, Shrivastava S, Yadav R. Epidemiology, microbiology and antibiotic sensitivity of odontogenic space infections in Central India. Journal of maxillofacial and oral surgery. 2018 Sep;17:324-31.
15. Umeshappa H, Shetty A, Kavatagi K, Vivek GK, Vaibhav N, Mohammed I. Microbiological profile of aerobic and anaerobic bacteria and its clinical significance in antibiotic sensitivity of odontogenic space infection: A prospective study of 5 years. National journal of maxillofacial surgery. 2021 Sep;12(3):372.

CITATION
Neel Kamal, Vaz A.A., Surendra S. K., & Sumit S.L. (2024). To Evaluate the Different Microorganisms and Antibiotic Sensitivities of Head and Neck Space Infections of Odontogenic Origin: A Clinical Study. In Global Journal of Research in Dental Sciences (Vol. 4, Number 1, pp. 1–7). https://doi.org/10.5281/zenodo.10459915