ORIGINAL ARTICLE OPEN ACCESS

Steroids in Maxillofacial Space Infections: A Prospective Comparative Study

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ABSTRACT

Background: Maxillofacial space infections are common and can lead to severe complications if not managed effectively. Standard treatment includes antibiotics and surgical drainage, but inflammation-related morbidity remains a concern. Corticosteroids, due to their anti-inflammatory effects, may help reduce swelling, pain, and hospitalization duration.

Methods: A Prospective comparative study was started at the Armed Forces Institute of Dentistry, CMH Rawalpindi, from April 2023 to November 2024. The current study included 130 patients with maxillofacial space infection involving the maxilla and mandible. Non-probability consecutive sampling technique was used. Demographic data and the size of the swelling and the mouth opening was measured. Empirical therapy of Augmentin 1.2g was given to all the patients of both groups. Group S was given IV dexamethasone 8 mg, 8-hourly. Incision and drainage were performed on a need basis. After 3 days of the start of treatment, changes in the size of the swelling and the mouth opening were recorded. SPSS version 27 was used for data analysis. Student t test or chi-square tests were used to compare the data between groups. P value ≤ 0.05 was significant.

Results: Change in size of swelling was 2.93±0.62cm in group-A and 3.26±0.67cm in group-S (p=0.004). Change in mouth opening was 0.93±0.74cm in group-A and 1.24±0.56cm in group-S (p=0.003). Surgical intervention was needed in 46.2% and 35.4% of group A and S, respectively (p=0.212). Hospital stay was 4.46±1.10 days in group A and 3.89±1.00 days in group S (p=0.010).

Conclusion: Corticosteroids with antibiotics in MSIs have a significant impact on the outcomes as evident from a significant increase in mouth opening and reduction in size of swelling after 3 days of treatment.

Keywords: Maxillofacial Space Infections, Abscess, Odontogenic Infections, Systemic Steroids, Antibiotics.

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Doi: https://doi.org/10.36283/ziun-pjmd14-2/008.

How to cite: Suleman S, Khan AA, Bibi S, Raja LAA, Younas A, Razzaq H Steroids in Maxillofacial Space Infections: A Prospective Comparative Study. Pak J Med Dent. 2025 April ;14(2): 42-47. Doi: https://doi.org/10.36283/ziun-pjmd14-2/008.

Received: Wed, March 5, 2025 **Accepted:** Sat, April 12, 2025 **Published:** Sun, April 13, 2025

INTRODUCTION

The maxillofacial region has a very complex anatomy and is often affected by chronic facial plane conditions[1]. Maxillofacial space infections (MSIs) are amongst the most common dental-related cases seen in the emergency department. The primary causes of MSIs include odontogenic infections - the most common reason, followed by trauma and lymphadenitis[2]. A national survey of emergency departments of 450 hospitals in 27 U.S. states was conducted in 2007 which logged 302,507 visits due to facial cellulitis caused by odontogenic infections[3].

Severe dental infections are a substantial public health concern and impose a substantial economic burden on the public healthcare system. For instance, a 2012 study analyzed inpatient records of 42 cases who were treated for dental infections, and they reported that total treatment costs were $749,382, averaging $17,842 per patient[4]. Additionally, a 2008 countrywide inpatient sample from 1,056 hospitals in 42 U.S. states analyzed 4,044 cases who were discharged after treatment of the primary diagnosis of cellulitis or mouth abscess. They reported a total cost of $98 million for hospitalization and treatment, with an average cost of $24,240 per case[5].

MSIs pose significant risks, including severe morbidities and potential mortality to the patients. Delayed, incorrect, or no treatment can result in deadly complications including airway obstruction, carotid artery erosion and rupture, descending necrotizing mediastinitis[6], pericarditis, Lemierre syndrome[7], cavernous sinus thrombosis[8], brain abscess[9], meningitis[10], necrotizing fasciitis[11], abscess extension to thoracic and abdominoperineal regions[12], and sepsis. Dental infections carried a mortality rate of 10% - 40% before the discovery of antibiotics[13]. The introduction and widespread use of modern antibiotics have dramatically reduced the mortality rate associated with dental infections[4]. Effective management of MSIs requires timely recognition, accurate diagnosis, and timely administration of antibiotics, as well as elimination of the infection source, which may require surgery.
The typical clinical manifestations of MSIs include pain, swelling, trismus, dysphagia, and odynophagia. These symptoms are partially driven by the inflammatory response associated with the infection, which can often result in an overstated clinical outcome.

Use of corticosteroids has been effective in the management of edema and inflammation in numerous head and neck conditions, suggesting they may also have therapeutic advantage in MSI management[14]. Their patients were managed with antibiotics along with surgical drainage if needed, and adjunctive corticosteroid therapy. Their findings highlight functional improvements following the administration of corticosteroids[14].

This prospective comparative study aims to assess the effectiveness and safety of adjunctive corticosteroid therapy in the management of MSIs. By comparing outcomes between patients receiving standard treatment alone and those receiving steroids as an adjunct, we seek to determine whether corticosteroids can enhance recovery, reduce morbidity, and improve overall patient outcomes without increasing the risk of complications. The findings of this study could contribute valuable insights into optimizing treatment strategies for MSIs in clinical practice.

METHODS

This prospective comparative study was conducted at the Armed Forces Institute of Dentistry, CMH Rawalpindi, from April 2023 to November 2024. The study was approved by the Institutional Review Board (Ref. No. 918/Trg dated 13 May 2020). A reference study calculated the sample size to be 129, taking the frequency of improvement after steroid injection14, i.e., 86% with a 5% margin of error and a 95% confidence level. The OpenEpi sample size calculator was used. The current study included 130 patients using a nonprobability consecutive sampling technique.

Both male and female patients of 18-60 years of age, who were diagnosed with space infection which required hospital admission were included in the study. Criteria for the hospital admission included presence of fever, dysphagia, trismus, dyspnea, odynophagia, and/or worsening general condition. All patients who were anemic, diabetic, or with history of suspected gastrointestinal ulcerative disease, not compliant to complete the mandatory stay in ward, patients with compromised host defenses i.e., on immunosuppressive/cytotoxic therapy or having diseases which compromise the host immunity (e.g., Leukemia and AIDS) were excluded from the study.

Age and gender of all the patients were recorded. The diagnostic protocol consisted of a complete history, examination of the oral cavity and site of infection, and imaging modalities. Imaging techniques included intraoral occlusal radiographs, periapical radiographs, or orthopantomogram. Complete blood count, viral markers for hepatitis B, C and HIV was performed for all the cases. Other required tests were performed on case-based requirements. Involvement of area (maxilla or mandible), side of involvement (left / right), and number of sites involved (submental, submandibular, sub masseteric, sublingual, buccal

and canine spaces) were documented for all the patients. Size of the swelling and mouth opening was measured in all the patients before the start of treatment.

All the patients were equally divided into 2 equal groups via lottery method, i.e., group A for antibiotics only, and group S for steroids plus antibiotics. Empirical therapy of intravenous antibiotics (injection Augmentin 1.2g IV TDS) was given to all the patients of both the groups. Group S was given IV dexamethasone at a dose of 8 mg, 8-hourly, which was started on the first day of admission after obtaining a complete blood count and confirming the parameters were in range. Injection paracetamol 1g IV TDS was given to control the pain. Opioids were given as rescue analgesia when demanded by the patient. Incision and drainage were performed in patients needing evacuation of underlying collection, and the need for surgical intervention recorded.

After 3 days of start of treatment, changes in size of the swelling and mouth opening were recorded. Patients were discharged once the criteria were met as assessed by the treating surgeon and length of hospitalization was recorded. All the recorded data were collected on a predesigned proforma by the researcher.

Data was analyzed by SPSS 27. Descriptive data were expressed as mean and standard deviation for age, size of swelling, mouth opening, and length of hospitalization. Frequencies and percentages were calculated for categorical variables like gender, area, side, and number of spaces involved. Student t test or chi-square tests were involved to compare the data between groups. P value ≤ 0.05 was taken as significant.

RESULTS

Table 1: Demographic and Baseline Data

Variable	Group A (N=65)	Group S (N=65)	P-value
Age, years	43.64 ± 10.83	44.63 ± 12.66	0.635
Gender, N (%)			
Male	39 (60.0 %)	40 (61.5 %)	0.857
Female	26 (40.0 %)	25 (38.6)	
Area involved, N (%)			
Maxilla	15 (23.1 %)	21 (32.3 %)	0.240
Mandible	50 (76.9 %)	44 (67.7 %)	
Side involved, N (%)			
Right	37 (56.9 %)	43 (66.2 %)	0.279
Left	28 (43.1 %)	22 (33.8 %)	
Number of sites involved, N (%)			
1	33 (50.8 %)	26 (40.0 %)	0.218
2	32 (49.2 %)	39 (60.0 %)	
Size of swelling, cm	3.98 ± 0.58	3.82 ± 0.58	0.112

Data is entered as mean ± S.D. unless mentioned otherwise

Total of 130 patients, divided into 2 equal groups, were enrolled in the study. Study group A included patients of 43.64 ± 10.83 years while group S included patients of 44.63 ± 12.66 years of age. There were 39 (60.0 %) males and 26 (40.0 %) females in group A, while 40 (61.5 %) males and 25 (38.6) females in group S. Maxillary area was involved in 15 (23.1 %) of group A and 21 (32.3 %) of group S, while mandibular area was involved in 50 (76.9 %) of group A and 44 (67.7 %) of group S patients. Right side was involved in 37 (56.9 %) of group A and 43 (66.2 %) of group S, while left side was involved in 28 (43.1 %) of group A and 22 (33.8 %) of group S patients. Only one site was involved in 33 (50.8 %) of group A and 26 (40.0 %) of group S, while 2 sites were involved in 32 (49.2 %) of group A and 39 (60.0 %) of group S patients. Before the start of treatment, mean size of swelling was 3.98 ± 0.58 cm in group A and 3.82 ± 0.58 cm in group S. Both study groups were comparable based on mean age, gender distribution, area and side involved, number of sites involved and mean size of swelling before the start of treatment (p value 0.635, 0.857, 0.240, 0.279, 0.218 and 0.112, respectively) **Table 1.**

Table 2: Outcome Variables of The Study

Variable	Group A (N=65)	Group S (N=65)	P- value
Change in Size of Swelling, Cm	2.93 ± 0.62	3.26 ± 0.67	0.004
Change in Mouth Opening, Cm	0.93 ± 0.74	1.24 ± 0.56	0.003
Need for Surgery	30 (46.2 %)	23 (35.4 %)	0.212
Hospital Stays, Days	4.46 ± 1.10	3.89 ± 1.00	0.010

Data is entered as mean ± S.D. or Number (percentage)

After 3 days of start of treatment, change in size of swelling was 2.93 ± 0.62 cm in group A and 3.26 ± 0.67 cm in group S, with statistically significant difference (0.004). Change in mouth opening was 0.93 ± 0.74 cm in group A and 1.24 ± 0.56 cm in group S, with statistically significant difference (0.003). Surgical intervention was needed in 30 (46.2 %) of group A and 23 (35.4 %) of group S (p=0.212). Mean hospital stay was 4.46 ± 1.10 days in group A and 3.89 ± 1.00 days in group S and the difference was statistically significant (p=0.010) **Table 2**.

DISCUSSION

The study compared the efficacy of steroids in managing maxillofacial space infections between two groups. Before treatment, the mean swelling size was similar in both groups: 3.98 ± 0.58 cm in Group A and 3.82 ± 0.58 cm in Group S. Both groups had comparable demographic and clinical parameters, with no significant differences ($p > 0.05$), ensuring valid comparisons. These results align with previous studies, confirming the reliability of corticosteroids as an adjunct therapy[15,16].

Researchers have been exploring the ongoing use of glucocorticoids, with variable findings about their safety. Likewise, when considering the administration method, the intramuscular route is often observed as one of the most efficacious options, as it has been shown to better decrease postoperative pain and inflammation compared to the oral route. However, some researchers prefer the oral route as their alternate choice[17]. Preoperative administration of NSAIDs with or without corticosteroids averts central and peripheral sensitization because it inhibits the release of inflammatory mediators[18].

Systematic reviews suggested that preoperative corticosteroid administration effectively delayed and prevented postoperative complications. This is attributed to the presence of therapeutic drug levels in the tissue at the onset of the inflammatory response[19,20].

Dexamethasone is a long-acting corticosteroid and works synergistically with NSAIDs; however, its use is restricted by adverse effects such as nausea and an amplified risk of gastrointestinal tract bleeding. The intramuscular route is favored, as studies have shown it to be more efficacious in easing postoperative pain and inflammation compared to the oral route[18].

Many authors advocate for the use of systemic corticosteroids in managing acute pharyngitis and peritonsillar abscesses, supported by findings from clinical trials and systematic reviews[21,22]. However, the importance of steroids in managing maxillofacial space infections (MSI) has not been systematically investigated.

The evidence to confirm that the role of corticosteroids in improving the outcomes when used for MSI management needed to come from a study comparing two groups: one receiving intravenous antibiotics with adjunctive corticosteroids and the other receiving antibiotics alone. In the majority of the retrospective studies, patient data are often inadequate, which makes the comparisons between the steroid and non-steroid groups challenging and potentially biased.

In a previous study all patients were given 3 doses of dexamethasone 8mg. They performed incision and drainage under local anesthesia in 50% of the patients. Their patients had an average hospital stay of 3.46 days. In their study, 33% of patients experienced a 0.5 cm increase in mouth opening, with the maximum improvement being 2 cm in 6.6% of the patients. Moreover, 86% of patients experienced a 2-4 cm reduction in the size of the swelling within 24 hours when steroids were administered[16].

To overcome problems faced in the majority of the retrospective studies and inadequacy of previously available data regarding the role of corticosteroids in the management of MSIs, the current study was planned as a randomized controlled trial. The current study showed a significant decrease in the size of swelling after steroids administration, i.e., 3.26 ± 0.67 cm against 2.93 ± 0.62 cm in patients who were given antibiotics only. The observed difference

was statistically significant (p=0.004). Change in mouth opening was also significantly better after steroid administration, with a significant difference (p=0.003). Duration of hospitalization was also significantly decreased after steroid administration (p=0.010). It is safe to say that the use of dexamethasone in the management of MSIs can help in countering the inflammatory effects and reducing the duration of hospitalization. However, there is a need to conduct further clinical trials to validate the results of this study.

The role of steroids in maxillofacial infections remains a subject of debate. Corticosteroids are known for their potent anti-inflammatory effects, which may help in reducing edema, pain, and trismus in space infections[23]. Several studies have suggested that adjunctive steroid therapy can accelerate resolution and improve patient comfort without significantly increasing the risk of complications. However, concerns regarding potential immunosuppressive effects and delayed infection resolution warrant careful evaluation of their use in such clinical settings[24,25].

CONCLUSION

Synergistic use of IV corticosteroids with antibiotics in MSIs has a significant impact on the outcomes as evident from a significant increase in mouth opening and reduction in size of swelling after 3 days of treatment, in the group of patients receiving corticosteroids.

CONFLICT OF INTEREST

No conflict of interest was found.

FUNDING

The cost of hospitalization and treatment was covered by the respective healthcare facility.

ETHICAL APPROVAL

The study was approved by the Institutional Review Board, Armed Forces Institute of Dentistry, CMH Rawalpindi (Ref. No. 918/Trg dated 13 May 2020).

AUTHORS' CONTRIBUTIONS

SS and AAk designed the study further **SS and SB** collected the data. **SS and LAAR** write the paper. **AAK and AY** did a critical review of the article. **HR** involved in data analysis.

REFERENCES

1. Qian Y, Ge Q, Zuo W, Cheng X, Xing D, Yang J, et al. Maxillofacial space infection experience and risk factors: a retrospective study of 222 cases. Ir J Med Sci. 2021;190:1045-1053. doi: 10.1007/s11845-020-02431-z.
2. Li P, He Y, Zhang Y, An J, Yang Y. Risk factors for maxillofacial space infection complications: a retrospective analysis of 457 patients. J Craniofac Surg. 2023;34(8):2390-2394. doi: 10.1097/SCS.0000000000009422.
3. Caruso SR, Yamaguchi E, Portnof JE. Update on antimicrobial therapy in management of acute odontogenic infection in oral and maxillofacial surgery. Oral Maxillofac Surg Clin. 2022;34(1):169-177. doi: 10.1016/j.coms.2021.08.005.
4. Bhagania M, Youseff W, Mehra P, Figueroa R. Treatment of odontogenic infections: An analysis of two antibiotic regimens. J Oral Biol Craniofac Res. 2018 May 1;8(2):78-81. doi: 10.1016/j.jobcr.2018.04.006.
5. Kim MK, Nalliah RP, Lee MK, Allareddy V. Factors associated with length of stay and hospital charges for patients hospitalized with mouth cellulitis. Oral Surg Oral Med Oral Pathol Oral Radiol. 2012;113(1):21-28. doi: 10.1016/j.tripleo.2011.01.012.
6. Neal TW, Schlieve T. Complications of severe odontogenic infections: a review. Biol. 2022 Dec 8;11(12):1784. doi: 10.3390/biology11121784.
7. Sada-Urmeneta Á, Agea-Martínez M, Monteserín-Martínez E, Antúnez-Conde R, Gascón-Alonso D, Arenas-De-Frutos G, et al. Survival rate of odontogenic descending necrotizing mediastinitis. Our experience in last 5 years. Med Oral Patol Oral Cir Bucal. 2022 Sep 29;28(1):e65–e71. doi: 10.4317/medoral.25585
8. Kim JM, Kang KW, Kim H, Lee SH, Kim TS, Park MS. Septic cavernous sinus thrombosis after minor head trauma: A case report. Medicine. 2022 Mar 11;101(10):e29057. doi: 10.1097/MD.0000000000029057.
9. Jespersen FV, Hansen SU, Jensen SS, Omland LH, Helweg-Larsen J, Bjarnsholt T, et al. Cerebral abscesses with odontogenic origin: a population-based cohort study. Clin Oral Investiga. 2023 Jul;27(7):3639-3648. doi: 10.1007/s00784-023-04976-6.
10. Attouchi I, Dammak N, Zouaghi H, Ben Khelifa M. Intracranial infections arising from an odontogenic infection: a report of 2 cases. Clin Med Insights Case Rep. 2024 Jun 17:17:11795476241261883. doi: 10.1177/11795476241261883. eCollection 2024.
11. Böttger S, Zechel-Gran S, Schmermund D, Streckbein P, Wilbrand JF, Knitschke M, et al. Odontogenic cervicofacial necrotizing fasciitis: microbiological characterization and management of four clinical cases. Pathogens. 2022;11(1):78. doi: 10.3390/pathogens11010078.
12. Faustova M, Nazarchuk O, Dmytriiev D, Avetikov D, Loban G, Babina Y, et al. CCL2/MCP-1 serum chemokine level in patients with odontogenic infectious and inflammatory diseases of the soft tissues of the maxillofacial area and mediastinum. Acta Fac Med Naissensis. 2022;39(3):209–215. https://repository.pdmu.edu.ua/handle/123456789/20126
13. Bayetto K, Cheng A, Goss A. Dental abscess: A potential cause of death and morbidity. Aust J Gen Pract. 2020;49(9):563-567. doi:

10.31128/AJGP-02-20-5254.
14. Low LF, Audimulam H, Lim HW, Selvaraju K, Balasundram S. Steroids in maxillofacial space infection: A retrospective cohort study. Open J Stomatol. 2017;7(9):397-407. DOI: 10.4236/ojst.2017.79034
15. Pucci R, Cassoni A, Di Carlo D, Bartolucci P, Della Monaca M, Barbera G, et al. Odontogenic-related head and neck infections: from abscess to mediastinitis: our experience, limits, and perspectives—a 5-year survey. Int J Environ Res Public Health. 2023 Feb 16;20(4):3469. doi: 10.3390/ijerph20043469.
16. Hounsome J, Pilkington G, Mahon J, Boland A, Beale S, Kotas E, et al. Prophylactic removal of impacted mandibular third molars: a systematic review and economic evaluation. Health Technol Assess. 2020 Jun;24(30):1-116. doi: 10.3310/hta24300.
17. Chávez-Rimache LK, Rodríguez-Vargas MC, Castro-Rodríguez Y, Chumpitaz-Cerrate VM. Anti-inflammatory effect of dexamethasone and B vitamins in third molar surgery. Randomized clinical trial. Rev Esp Oral Maxillofac Surg. 2020;42(2):69-75. https://dx.doi.org/10.20986/recom.2020.1035/2019
18. Santos BF, Costa FO, Júnior AA, Araújo AV, Cyrino RM, Cota LO. Postoperative pain and edema control following different protocols of preemptive analgesia in the surgical removal of impacted third molars: A triple-blind parallel randomized placebo-controlled clinical trial. J Cranio-Maxillofac Surg. 2021 Aug 1;49(8):694-704. doi: 10.1016/j.jcms.2021.01.002. Epub 2021 Jan 11.
19. Miroshnychenko A, Azab M, Ibrahim S, Roldan Y, Martinez JP, Tamilselvan D, et al. Corticosteroids for managing acute pain subsequent to surgical extraction of mandibular third molars: A systematic review and meta-analysis. J Am Dent Assoc. 2023 Aug 1;154(8):727-741. doi: 10.1016/j.adaj.2023.04.018.
20. Canellas JVDS, Ritto FG, Tiwana P. Comparative efficacy and safety of different corticosteroids to reduce inflammatory complications after mandibular third molar surgery: a systematic review and network meta-analysis. Br J Oral Maxillofac Surg. 2022 Oct;60(8):1035-1043. doi: 10.1016/j.bjoms.2022.05.003.
21. Wang X, Chen Y, Jia D, Teng Y, Pan H. The role of adjuvant systemic corticosteroid in pediatric retropharyngeal and parapharyngeal abscess. Am J Otolaryngol. 2024 Mar 1;45(2):104117. doi: 10.1016/j.amjoto.2023.104117.
22. Alqahtani S, Alsharidi TRI, Alelaiwi MA, Albelowi LM, Alserhani AS, Alhosan ZA, et al. Efficacy of corticosteroids for sore throat management in adults: a systematic review and meta-analysis of randomized trials. Cureus. 2024 Aug 25;16(8):e67740. doi: 10.7759/cureus.67740.
23. Mahran H, Hassanein AG, Rizq M. Trends and Outcome of Aggressive Fascial Space Infections. Surg Infect. 2023 Jun;24(5):475-481. doi: 10.1089/sur.2023.079.
24. Galdino-Santos L, da Luz-Silva G, Pires AL, Cademartori MG, Pereira-Cenci T. Perioperative therapies to reduce edema after orthognathic surgery: a systematic review and meta-analysis. Oral Surg Oral Med Oral Pathol Oral Radiol. 2023 Feb 1;135(2):211-235. doi: 10.1016/j.oooo.2022.06.017.
25. Selvido DI, Bhattarai BP, Niyomtham N, Riddhabhaya A, Vongsawan K, Pairuchvej V, et al. Review of dexamethasone administration for management of complications in postoperative third molar surgery. J Korean Assoc Oral Maxillofac Surg. 2021 Oct 31;47(5):341-350. doi: 10.5125/jkaoms.2021.47.5.341.