

Systematic Review

Intralesional corticosteroid injections in single-system Langerhans cell histiocytosis with maxillomandibular involvement: a systematic review

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Abstract

Single-system Langerhans cell histiocytosis (LCH) involving the maxillomandibular complex is rare, and optimal management remains controversial. Intralesional corticosteroid injections have been proposed as a minimally invasive alternative to surgery, radiotherapy, or systemic therapy. The aim of this study is to systematically evaluate the effectiveness and safety of intralesional corticosteroid injections for treating LCH of the maxilla or the mandible. A systematic review was conducted according to the PRISMA guidelines, in which PubMed, Embase and Scopus were searched. Eligible studies included English language case reports and case series describing LCH of the mandible and/or maxilla that had been confirmed by biopsy and treated with intralesional corticosteroid injections. Outcomes assessed included the resolution of symptoms, regression of lesions confirmed by radiography, recurrence, and adverse effects. Fifteen studies comprising 28 patients were included. Thirteen patients were treated with triamcinolone acetonide, 13 with methylprednisolone, and two with dexamethasone. Lesions were predominantly unifocal and located in the body or ramus of the mandible. Intralesional corticosteroid therapy was effective in 27 patients. Recurrence was reported in one case 12 months post treatment. Adverse effects were limited to one localised abscess that resolved without sequelae. Intralesional corticosteroid injections are associated with high rates of clinical and radiological improvement in mandibular and maxillary LCH, with minimal morbidity. While the current evidence is limited to low level studies, this approach represents a promising conservative treatment option. Prospective studies with standardised protocols are needed to define its long-term efficacy and role within treatment algorithms.

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Introduction

Langerhans cell histiocytosis (LCH) is a heterogeneous disease, which is characterised by the accumulation of dendritic Langerhans cells that form granulomatous lesions in various organs. Any organ can be affected, but those most frequently

involved are the skeleton and the skin. LCH can manifest as a single-system disease affecting only one organ system, or present with multisystem involvement.^{1,2}

The clinical course varies by the extent of organ involvement, and ranges from a self-limiting disease to a rapidly progressive condition that may culminate in irreversible sequelae or death.¹ The estimated overall annual incidence of LCH across all age groups is approximately 11 to 12 cases per million individuals. Children younger than 15 years account for almost half of the affected cases.³

Maxillomandibular involvement occurs in approximately 20–30% of patients with LCH and is commonly associated with localised pain, swelling, trismus, gingival ulceration, and tooth mobility. Radiographic imaging typically demonstrates osteolytic lesions, often producing the characteristic

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‘floating teeth’ appearance.⁴ Lesions involving the mandible and maxilla are of particular clinical relevance due to their potential impact on dental development, facial growth, mastication, and facial aesthetics, especially in growing patients. Treatment options vary considerably depending on the extent of disease involvement and the severity at initial presentation. In case of single-system LCH affecting the maxillo-mandibular complex, possible therapeutic approaches include watchful waiting, intralesional corticosteroid injection, simple curettage, segmental resection with subsequent reconstruction, as well as low-dose radiotherapy or chemotherapy.⁵ There is currently no consensus on the optimal management of single-system maxillomandibular LCH. Surgical interventions may result in functional and aesthetic deformities, while radiotherapy and systemic chemotherapy are associated with significant short- and long-term adverse effects, potentially compromising quality of life. Overtreatment carries a risk of unnecessary long-term morbidity, whereas undertreatment may lead to persistence, progression, or recurrence of the disease. In recent years, several studies have reported intralesional corticosteroid injections as an effective, minimally invasive therapeutic option for localised LCH, with favourable clinical outcomes and low morbidity. Nevertheless, these individual reports remain insufficient to establish definitive evidence regarding the efficacy of this therapeutic approach. The objective of the present systematic review was to critically evaluate the effectiveness of corticosteroid injections in the treatment of single system maxillomandibular LCH.

Methods

Protocol and search strategy

The search strategy was structured according to the PICO framework. The population consisted of adult and paediatric patients diagnosed with single system LCH involving the mandible or the maxilla, or both. The intervention of interest was intralesional corticosteroid injection. As no established gold standard treatment for LCH exists, no formal comparator was applied. The primary outcome parameter was the effectiveness of the treatment, which is defined as the resolution of clinical symptoms and regression of the lesion size assessed on radiological imaging (orthopantomography (OPG), or cone-beam computed tomography (CBCT)). The secondary outcome parameter was the occurrence of adverse events.

This systematic review was registered with PROSPERO (CRD42024570171) and conducted in accordance with PRISMA 2020 guidelines.⁶ Literature searches were performed in PubMed, Embase, and Scopus, and the search was completed in August 2025. The search strategy combined controlled vocabulary terms from MeSH and Emtree with free text terms searched in titles and abstracts. While the terms ‘eosinophilic granuloma’ and ‘histiocytosis X’ are considered outdated in contemporary literature, they were included in the search query to ensure maximal retrieval of

relevant articles. An additional search was done based on backward citation searching. The complete search strategy is provided in Supplemental Appendix A (online only).

Study selection

Study selection and data extraction were performed independently by two reviewers, with disagreements resolved by consensus. Only full-length articles published in English were considered eligible. Inclusion criteria comprised studies with histopathological confirmation of LCH by biopsy, use of intralesional corticosteroid therapy, and lesions located in the mandible or maxilla (both unifocal and multifocal single system LCH). Exclusion criteria included multi-system LCH, studies lacking clearly reported corticosteroid type or dose, studies reporting lesions without jaw involvement, studies with other concomitant treatment, patients with multi-system disease and studies lacking follow-up data.

Initially, titles and abstracts were screened, and duplicate records were removed. Subsequently, full text articles were reviewed in detail, and studies meeting the predefined eligibility criteria were included.

Data extraction

A standardised data extraction checklist was used to ensure consistency across included studies. Extracted variables included author and year of publication, patient age and gender, location of the lesion, presenting symptoms, type and dose of corticosteroid used, number of injections, reported adverse events, duration of follow up, treatment effectiveness, time to ossification of the lesion, and recurrence.

Risk of bias

Two authors assessed the risk of bias separately using the methodological quality assessment tool for case reports and case series proposed by Murad et al.⁷ No systematic reviews, randomised controlled trials, cohort studies, or case-control studies addressing this topic were identified.

Results

Study selection and study characteristics

The literature search identified 76 records, including 13 from PubMed, 12 from Embase, and 51 from Scopus. After removal of duplicates, 60 articles were screened based on title and abstract. Of these, 31 articles underwent full text review, resulting in the inclusion of 13 studies: Li et al,⁸ Putters et al,⁹ Watzke et al,¹⁰ Jones et al,¹¹ Almuzayyen et al,¹² Moralis et al,¹³ Esen et al,¹⁴ Lee et al.,¹⁵ Robertsson et al,¹⁶ Kon et al,¹⁷ Guiglia et al,¹⁸ Nakagawa et al¹⁹ and Sood et al.²⁰

Two additional studies were identified through backward citation searching, namely Cohen et al.²¹ and Tauro et al.²² All included studies were case reports or case series. The

study selection process is illustrated in the PRISMA flow diagram shown in Fig. 1.

Results of individual studies

All extracted data from the included studies are summarised in the data extraction table (Table 1). In total, 28 patients were included, with a predominance of paediatric cases ($n = 19$, ages 1–18) compared to adults ($n = 9$, ages 21–48). The overall mean (SD) age was 17.1 (14.8) years. Most lesions were located in the mandibular body and ramus ($n = 26$), while five cases involved the maxilla and the mandibular condylar region was affected in one case only. Nineteen patients presented with unilocular lesions, which were limited to the mandible or maxilla. Seven patients had multiple lesions within the maxillomandibular complex, and two cases exhibited multifocal involvement extending beyond the facial skeleton (multifocal single-system LCH). The most frequently presenting symptoms were swelling ($n = 22$) and pain ($n = 17$), followed by tooth mobility ($n = 8$), mucogingival ulceration ($n = 3$), and trismus ($n = 3$). Less common presentations included pathological

fracture ($n = 2$) and fever ($n = 1$). Thirteen patients were treated with triamcinolone acetonide (TA), thirteen with methylprednisolone (MP), and two with dexamethasone (DEX) as intralesional corticosteroid therapy. Treatment protocols demonstrated substantial heterogeneity, with cumulative doses ranging from 10 to 360 mg for TA and MP, and from 33 to 36 mg for DEX. The number of injections varied widely, from a single administration to a maximum of 12. Treatment efficacy was the primary outcome measure and was defined as clinical improvement of symptoms accompanied by a reduction in lesion size on radiological imaging. Intralesional corticosteroid therapy was effective in 27 of the 28 included cases. Improvement of symptoms typically occurred within days to weeks, suggesting a rapid anti-inflammatory and analgesic effect of the intralesional therapy. Paediatric patients often experienced resolution of their symptoms with fewer injections, which was frequently a single administration; they also demonstrated a potentially more rapid regenerative response with ossification occurring between 3 and 24 months, compared to 5 to 32 months in adults. The adult group showed slightly more variable outcomes, including one ineffective case and one recurrence.^{8,20}

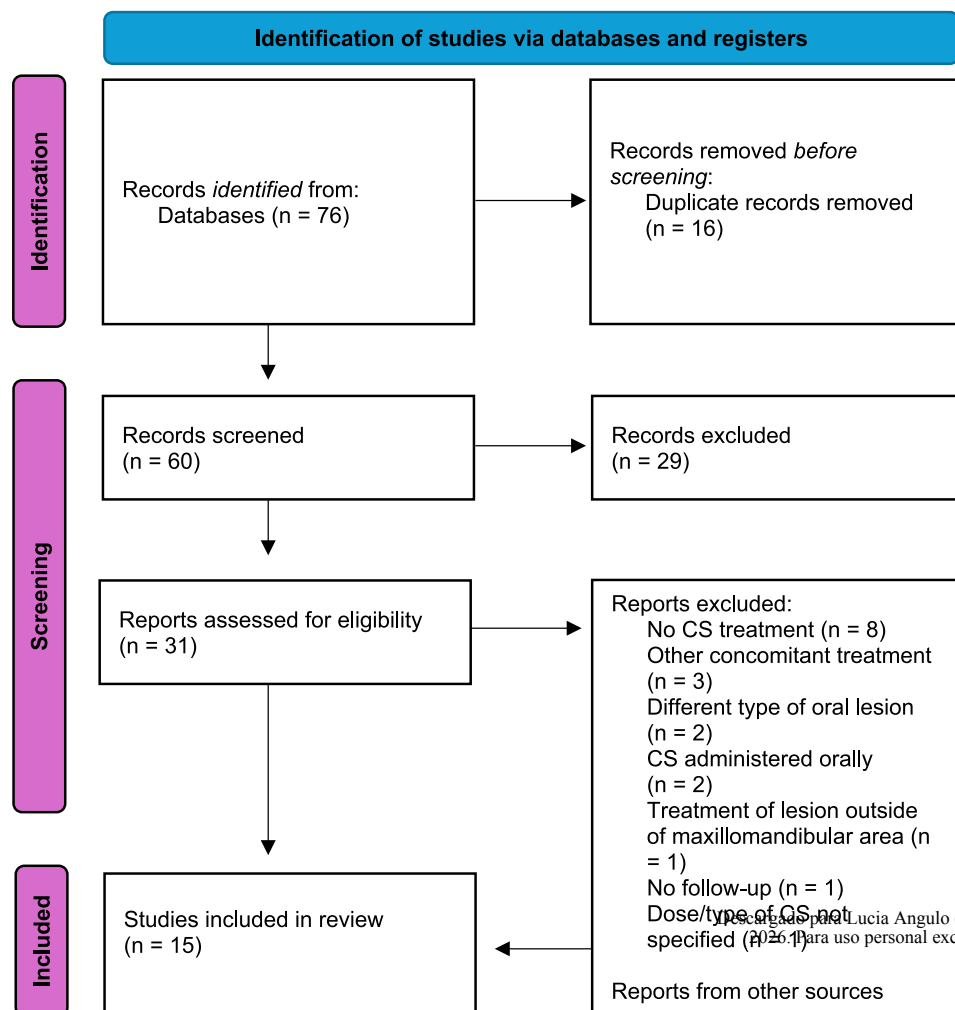


Fig. 1. PRISMA flowchart of the selection process.

Table 1
Data extraction table.

First author, year and reference	Patient	Sex	Age (years)	Location of neoplasm	Primary symptom	Initial dosage (mg) + corticosteroid type	Accumulative dosage (mg)	Number of injections (times)	Treatment effectiveness	Time needed for ossification of lesion (months)	Follow-up time (months)
Li, 2025 ⁸	1	Male	2	Right mandible	Swelling of the right mandibular region	40 TA	80	2	Effective	6	9
Li, 2025 ⁸	2	Male	21	Left maxilla and bilateral mandible	Gradual loosening of multiple teeth	80 TA	280	6	Effective	14	38
Li, 2025 ⁸	3	Female	1	Bilateral maxilla and mandible	Gradual loosening of deciduous teeth and oral ulcers	10 TA	40	3	Effective	6	6
Li, 2025 ⁸	4	Male	43	Bilateral mandible	Pain and loosening of multiple teeth	40 TA	160	4	Effective	32	32
Li, 2025 ⁸	5	Male	5	Left mandible	Pain and swelling of the left mandibular region	40 TA	40	1	Effective	12	49
Li, 2025 ⁸	6	Female	26	Right maxilla	Pain and swelling of the right maxillary region	40 TA	80	2	Effective	20	23
Li, 2025 ⁸	7	Male	46	Bilateral mandible	Loosening of bilateral mandibular posterior teeth	40 TA	240	6	Ineffective	/	13
Li, 2025 ⁸	8	Male	3	Left mandible	Swelling of the left mandibular region	15 TA	15	1	Effective	6	6
Li, 2025 ⁸	9	Female	3	Bilateral mandible	Swelling of the left mandibular region	10 TA	50	3	Effective	9	15
Li, 2025 ⁸	10	Male	3	Left mandible	Swelling and pain of the left mandibular region	10 TA	30	2	Effective	12	15
Putter, 2005 ⁹	11	Female	2	Right side body mandible	Pain oedema	80 MP	80	1	Effective	6	30
Putter, 2005 ⁹	12	Male	9	Left side body mandible	Oedema and fracture	40 MP	40	1	Effective	3	36
Putter, 2005 ⁹	13	Male	15	Left side body mandible	Painful oedema	80 MP	80	1	Effective	6	108
Watzke, 2000 ¹⁰	14	Male	39	Right and left side mandible	Swelling, loosening of bilateral mandibular posterior teeth	2x 50 TA	2x 300	6	Effective*	15	108
Jones, 1989 ¹¹	15	Female	10	Right mandible	Pain oedema	165 MP	165	1	Effective	8	84
Almuzayyen, 2019 ¹²	16	Male	10	Right body and ramus of the mandible	Swelling	120 TA	360	4	Effective	18	18
Moralis, 2008 ¹³	17	Male	10	Left mandibular angle	Progressive, pressure-sensitive swelling	200 MP	200	1	Effective	17	17
Essen, 2010 ¹⁴	18	Male	25	Anterior and right side of mandible	Pain, swelling, fracture and loosening anterior teeth	80 MP	220	3	Effective	14	36
Lee, 2013 ¹⁵	19	Female	11	Left mandibular angle	Pain and swelling	120 MP	120	1	Effective	6	35
Lee, 2013 ¹⁵	20	Female	3	Left side mandibular angle	Pain and swelling	120 MP	120	1	Effective*	7	15
Robertsson, 2021 ¹⁶	21	Male	6	Right side mandibular angle	Swelling and pain	60 MP	60	1	Effective	24	36
Robertsson, 2021 ¹⁶	22	Male	9	Right side mandibular angle	Swelling, pain and trismus	80 MP	80	1	Effective	24	24
Kon, 2018 ¹⁷	23	Male	47	Right body and mandible body	Swelling	3.3 DM	33	10	Effective	5	7
Guiglia, 2009 ¹⁸	24	Male	13	Left mandibular body	Pain severe mobility of posterior teeth and ulceration	40 MP	80	2	Effective	12	12
Nakagawa, 2007 ¹⁹	25	Male	23	Right maxilla	Pain and ulceration mucosa	4 DM	36	12	Effective	8	33

Sood, 2025 ²⁰	26	Male	48	Mandibular body and right posterior maxilla	Swelling, pain and tooth mobility	40 MP	40	1	Effective ⁺	6	12
Cohen, 1980 ²¹	27	Female	5	Right mandible	Swelling, pain and fever	150 MP	300	2	Effective	11	11
Tauro, 2011 ²²	28	Female	18	Left condylar region and ramus	Swelling, pain and trismus	40 TA	240	6	Effective	12	12

* : chemotherapy/radiotherapy before corticosteroid injection; +: recurrence after 12 months; DM = dexamethasone; MP = methylprednisolone; TA = triamcinolone acetonide.

Recurrence was reported at the 12-month follow up in a patient with multifocal disease. Local corticosteroid injection was repeated however the outcome was not reported due to insufficient follow-up time.²⁰ No apparent differences in outcomes were observed among the three types of corticosteroids used. Follow up ranged from 6 to 108 months (mean (SD) 30.7 (27.8), median 23.5 months), with a small number of patients followed for ≥ 84 months. The secondary outcome was the assessment of adverse effects. Overall, intralesional corticosteroid therapy was well tolerated. One study reported a localised abscess occurring one week after treatment, which resolved without further complications.¹¹

Risk of bias assessment

Overall risk of bias was considered moderate to high, primarily due to limitations in the domain of causality. These included the absence of control groups, lack of rechallenge or dose response evaluation, and insufficient exclusion of alternative explanations. More recent studies demonstrated improved reporting quality, as summarised in Supplemental Appendix B (online only).

Discussion

Mechanism of action

Langerhans cell histiocytosis is currently understood as a clonal neoplastic disorder rather than a purely inflammatory condition.^{23,24} The majority of LCH lesions originate from myeloid dendritic cell precursors that acquire somatic mutations in the MAPK/ERK signalling pathway, most commonly the BRAF V600E mutation. These alterations result in uncontrolled cellular proliferation, impaired apoptosis, and prolonged survival of pathological Langerhans-like cells. In addition, the neoplastic clones secrete cytokines such as TNF- α , IL-1 β , and IL-17, as well as chemokines that recruit and activate immune cells, thereby generating a secondary inflammatory microenvironment that contributes to tissue destruction and osteolysis.²³ Corticosteroids counteract these processes by suppressing inflammatory cell infiltration and downregulating the production of pro-inflammatory cytokines. They bind to glucocorticoid receptors, which leads to the inhibition of transcription factors such as NF- κ B and AP-1, which in turn reduces the expression of inflammatory genes. This mechanism diminishes local inflammation, oedema, and osteoclast activation, which allows the affected bone to heal.²⁵ Local injection ensures that high drug concentrations are delivered directly into the lesion, reducing systemic exposure. This localised approach is particularly well suited to maxillomandibular LCH, which often presents as a solitary or localised lesion rather than diffuse systemic involvement.

Choice of corticosteroid and dosing considerations

Both particulate steroids such as MP and TA and non-particulate agents such as DEX were used in the included

studies. Particulate corticosteroids are poorly water soluble and may form a local depot, potentially prolonging drug release and therapeutic effect.^{26,27} Although this theoretical advantage is attractive, no comparative evidence currently demonstrates superior outcomes with particulate formulations in LCH bone lesions. Moreover, safety considerations must be considered, including the risk of embolisation when injections are performed near to vascular structures.^{26,27} Overall, several glucocorticoid preparations, particulate and non-particulate, have been used successfully with high local control rates and minimal toxicity. The choice of steroid should be guided by the anatomy of the lesion, its proximity to vascular structures, the anticipated duration of the desired effect, availability of the formulations, and familiarity of the operator rather than any proven superiority of the particulate agents. Formal dose recommendations have not been established to date. Dosing regimens varied widely across studies in terms of concentration, injection volume, and number of sessions, which underscores the need for standardised protocols.^{8–22}

Comparison with alternative treatment modalities

Traditional management of mandibular and maxillary LCH has often relied on surgical curettage. While effective, surgery is associated with potential complications that include damage to developing tooth buds, alveolar nerve injury, growth impairment, and facial deformities.^{9,13,19} Moreover, incomplete resection can lead to recurrence. Recurrence rates varying from 16–25%²⁸ and up to 70%²⁹ have been reported in the literature. Lesion location (such as anatomically complex regions or proximity to vital structures) may negatively influence surgical completeness and thereby increase the risk of recurrence.

Spontaneous regression of osseous LCH has been described, and diagnostic biopsy may occasionally be sufficient to initiate the healing process.²⁵ Despite these observations, biopsy followed by observation alone is not universally recommended as a definitive treatment strategy. Reported healing times vary widely from 1.5 to 18 months. During this prolonged healing phase, patients may experience substantial pain and discomfort and remain at risk of pathological fractures in cases of mandibular involvement.^{16,25}

Systemic chemotherapy remains the standard of care for multisystem or refractory LCH, but its use in isolated craniofacial lesions may constitute overtreatment.^{1,30}

Radiotherapy, although proven effective for treating LCH bone lesions, can lead to dysphagia, dry mouth, mucositis, and fibrosis.³⁰ Long-term adverse effects, including damage to endochondral ossification centres and the development of secondary malignancies, have been reported and are of particular concern in the paediatric population.³¹

In contrast, intralesional corticosteroid infiltrations offer a less invasive alternative with lesion regression rates ranging from 75% to 96% in unifocal bone lesions.^{8–22,32} Although occasional cases of the exacerbation of symptoms or insufficient response to the treatment have been reported,^{8,33} the

overall complication profile remains favourable. Reported adverse events are rare and include one case of the formation of a post-injection abscess.¹¹ One notable case report described clinical deterioration after the injection of a corticosteroid into the lesion, with worsening pain, increased lesion size on CBCT one month after treatment, and disruption of the cortical bone; which ultimately necessitated radical surgical intervention with subsequent resolution of the disease. However, this study was not included in several analyses because the corticosteroid type and dosage were not specified, which limited its generalisability.³⁴ In addition to its biological and clinical benefits, intralesional corticosteroid therapy may also offer meaningful cost-effectiveness advantages. The procedure can typically be performed in an outpatient setting, it requires no operating room time, and avoids hospitalisation, general anaesthesia, and the substantial costs associated with systemic chemotherapy or radiotherapy. Follow-up imaging and clinical monitoring remain necessary, but the overall utilisation of resources is markedly lower compared with more invasive or systemic treatment modalities.

Follow up

Although intralesional corticosteroid therapy demonstrated high rates of lesion regression in our review, the unpredictable nature of LCH necessitates careful, structured, and prolonged follow up. LCH may reactivate or progress locally or systemically, even after apparent initial resolution, and relapse has been reported several years after diagnosis in both unifocal and multifocal presentations. In our series, one patient with multifocal single-system disease experienced recurrence at 12 months, which highlights the potential for treatment-refractory lesions. The literature suggests that follow up should include both clinical and radiological assessment, with more frequent evaluations (such as every 3–6 months) in the first 2–3 years and annual monitoring thereafter.^{35,36} Imaging at 6-month intervals may be warranted if symptoms recur or progress. Such structured surveillance allows early identification of persistent disease, recurrences, or progression to multisystem involvement, which may necessitate escalation to systemic therapy. Extended follow up is particularly important in patients with multifocal lesions, incomplete initial response, or lesions located in anatomically complex regions, to ensure timely intervention and optimise long-term outcomes.¹

Evidence quality and methodological limitations

Despite encouraging results, the overall quality of evidence supporting intralesional corticosteroid therapy remains limited. All included studies were case reports or case series, which are inherently subject to selection bias and were lacking control groups. Sample sizes were small and insufficient to allow meaningful subgroup analyses based on age, lesion size, lesion location, or disease extent. Considerable heterogeneity existed in corticosteroid type, dose, and frequency of

injections, which precluded the determination of an optimal regimen of treatment. Follow-up periods were varied and often relatively short, which limited the assessment of long-term durability and late recurrence. Because LCH has an unpredictable natural course, spontaneous regression cannot be ruled out as a confounding factor. In osseous LCH, where spontaneous regression is well documented yet variable, it is therefore difficult to conclusively attribute the resolution of the lesion solely to intralesional corticosteroid therapy, particularly in the absence of control groups. Publication bias also represents a concern, as favourable outcomes are more likely to be reported than unsuccessful or equivocal cases. Furthermore, outcome measures were not standardised across studies, with most reports relying on qualitative clinical and radiographic assessments rather than validated metrics.

Future research directions

Further prospective, multicentre studies are needed to better define the role of intralesional corticosteroid therapy in maxillo-mandibular LCH. Although randomised controlled trials may be challenging in a rare disease, standardised prospective registries could provide valuable insights. Future research should focus on defining optimal corticosteroid type, concentration, injection protocol, and follow-up strategy. Long-term outcomes, including recurrence rates, dental development, and effects on craniofacial growth, should be systematically evaluated, and patient reported outcome measures should be incorporated to assess quality of life (pain scores, functional outcome, and cosmetic satisfaction).

Conclusion

Intralesional corticosteroid injections represent a promising, minimally invasive treatment option for mandibular and maxillary LCH. Existing studies report high rates of lesion regression, symptom resolution, and bone regeneration, with a low incidence of adverse effects. Compared with surgical or systemic therapies, this approach offers a favourable balance between efficacy and safety, particularly for localised disease in paediatric patients. In this population, avoiding surgical trauma, radiation exposure, and systemic chemotherapy is especially important given their potential impact on craniofacial growth, tooth eruption, and long-term quality of life.

Although intralesional therapy may be considered as a first line or adjunctive treatment in carefully selected cases, long-term efficacy and recurrence rates remain incompletely defined, which necessitates cautious implementation within multidisciplinary care pathways.

Conflict of interest

None.

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Ethics statement/confirmation of patient permission

Not applicable

Appendix A and B. Supplementary material

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.bjoms.2026.05.006>.

References

1. Haupt R, Minkov M, Astigarraga I, et al. Langerhans cell histiocytosis (LCH): guidelines for diagnosis, clinical work up, and treatment for patients up to the age of 18 years. *Pediatr Blood Cancer* 2013;**60**:175–184.
2. Stålemark H, Laurencikas E, Karis J, et al. Incidence of Langerhans cell histiocytosis in children: a population-based study. *Pediatr Blood Cancer* 2008;**51**:76–81.
3. Liu H, Stiller CA, Crooks CJ, et al. Incidence, prevalence and survival in patients with Langerhans cell histiocytosis: a national registry study from England, 2013–2019. *Br J Haematol* 2022;**199**:728–738.
4. Faustino IS, Fernandes PM, Pontes HA, et al. Langerhans cell histiocytosis in the oral and maxillofacial region: An update. *J Oral Pathol Med* 2021;**50**:565–571.
5. Fiorini P, Galesio C, Longoni V, et al. Eosinophilic granuloma of the mandible: is a conservative treatment sufficient for local disease control? *J Craniofac Surg* 2016;**27**:e255–e257.
6. Page MJ, McKenzie JE, Bossuyt PM, Boutron I, Hoffmann TC, Mulrow CD, et al. The PRISMA 2020 statement: An updated guideline for reporting systematic reviews. *BMJ* 2021;**372**:n71. <https://doi.org/10.1136/bmj.n71>.
7. Murad MH, Sultan S, Haffar S, et al. Methodological quality and synthesis of case series and case reports. *BMJ Evid Based Med* 2018;**23**:60–63.
8. Li J, Alaoui H, Lu H, et al. Craniofacial Langerhans cell histiocytosis successfully treated through intralesional injection of triamcinolone acetonide: a retrospective study. *J Craniofac Surg* 2025;**36**:e551–e555.
9. Putters TF, de Visscher JG, Van Veen A, et al. Intralesional infiltration of corticosteroids in the treatment of localised Langerhans' cell histiocytosis of the mandible: report of known cases and three new cases. *Int J Oral Maxill Surg* 2005;**34**:571–575.
10. Watzke IM, Millesi W, Kermer C, et al. Multifocal eosinophilic granuloma of the jaw long term follow-up of a novel intraosseous corticoid treatment for recalcitrant lesions. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod* 2000;**90**:317–322.
11. Jones LR, Toth BB, Cangir A. Treatment for solitary eosinophilic granuloma of the mandible by steroid injection report of a case. *J Oral Maxill Surg* 1989;**47**:841–843.
12. Almuzayyen A, Elhassan W, Alabbadi M. Intralesional triamcinolone for treating mandibular Langerhans cell histiocytosis: a case report and literature review. *Saudi J Med Med Sci* 2019;**7**:47–50.
13. Moralis A, Kunkel M, Kleinsasser N, et al. Intralesional corticosteroid therapy for mandibular Langerhans cell histiocytosis preserving the intralesional tooth germ. *Oral Maxill Surg* 2008;**12**:105–111.
14. Esen A, Dolanmaz D, Kalayci A, et al. Treatment of localized Langerhans' cell histiocytosis of the mandible with intralesional steroid injection: report of a case. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod* 2010;**109**:e53–e58.

15. Lee SH, Yoon HJ. Intralesional infiltration of corticosteroids in the treatment of localized Langerhans cell histiocytosis of the mandible: report of two cases. *Oral Surg Oral Med Oral Pathol Oral Radiol* 2013;**116**:e255–e260.
16. Robertsson C, Swartling JA, Rasmusson L, et al. Intralesional corticosteroid injection for intraosseous mandibular Langerhans cell histiocytosis: a report of two cases. *J Oral Maxillofac Surg Med Pathol* 2021;**33**:599–604.
17. Kon T, Nakagawa Y, Kubota K, et al. A case of Langerhans cell histiocytosis of the mandible treated by intralesional injection of dexamethasone. *J Oral Maxillofac Sug Med Pathol* 2018;**30**:528–532.
18. Lajolo C, Campisi G, Deli G, et al. Langerhans's cell histiocytosis in old subjects two rare case reports and literature review. *Gerodontology* 2012;**29**:e1207–e1214.
19. Nakagawa Y, Idesaki S, Matsumoto K, et al. Treatment for localized Langerhans' cell histiocytosis of the maxilla by corticosteroid injection: a case report. *Oral Sci Int* 2007;**4**:59–62.
20. Sood RV, Tiwari RR, Weihsin H, et al. Langerhans cell histiocytosis involving the maxilla and mandible – A case report. *Ann Maxillofac Surg*. 2025;**15**:102–105.
21. Cohen M, Zornoza J, Cangir A, et al. Direct injection of methylprednisolone sodium succinate in the treatment of solitary eosinophilic granuloma of bone a report of 9 cases. *Radiology* 1980;**136**:289–293.
22. Tauro DP, Agarwal S, Kamath R, et al. Resolution of eosinophilic granuloma of the mandibular ramus and condylar neck following minimal intervention – report of a case and review of literature. *Asian J Oral Maxill Surg* 2011;**23**:138–142.
23. Allen CE, Merad M, McClain KL. Langerhans cell histiocytosis. *The New England J Med* 2018;**379**:856–868.
24. Gulati N, Allen CE. Langerhans cell histiocytosis: version 2021. *Hematol Oncol* 2021;**39**(Suppl 1):15–23.
25. Chang CY, Guimares JB, Joseph G, et al. Percutaneous CT-guided corticosteroid injection for the treatment of osseous Langerhans cell histiocytosis: a three institution retrospective analysis. *Skeletal Radiol* 2022;**51**:1037–1046.
26. Dietrich TJ, Sutter R, Froehlich JM, et al. Particulate versus non particulate steroids for lumbar transforaminal or interlaminar epidural steroid injections an update. *Skeletal Radiol* 2015;**44**:149–155.
27. Egeler R, Thompson Jr RC, Voûte PA, et al. Intralesional infiltration of corticosteroids in localized Langerhans cell histiocytosis. *J Paediatr Orthop* 1992;**12**:811–884.
28. Lagha J, Adatia P, Cain E. Langerhans cell histiocytosis a rare diagnosis in a patient with chronic periodontitis. *Int J Oral Maxillofac Surg* 2024;**173**(Suppl 2):P084.
29. Martinez Perez D, Mulliken JB, Arceci RJ. Langerhans cell histiocytosis: an uncommon disease commonly manifesting in the craniofacial skeleton. *Plast Reconstr Surg* 1996;**98**:211–226.
30. Laird J, Ma J, Chau K, et al. Outcome after radiation therapy for Langerhans cell histiocytosis is dependent on site of involvement. *Int J Radiat Oncol Biol Phys*. 2018;**100**:670–678.
31. Willis B, Ablin A, Weinberg V, et al. Disease course and late sequelae of Langerhans' cell histiocytosis: 25-year experience at the university of California, San Francisco. *J Clin Oncol* 1996;**14**:2073–2082.
32. Baptista AM, Camargo AF, de Camargo OP, et al. Does adjunctive chemotherapy reduce remission rates compared to cortisone alone in unifocal or multifocal histiocytosis of bone? *Clin Orthop Relat Res* 2011;**470**:663–669.
33. Li J, Wu H, Wang Z, et al. Langerhans cell histiocytosis of the jaw: clinical analysis of 68 cases. *Orphanet J Rare Dis* 2025;**20**:191.
34. Izzetti R, De Marco E, Caramella D. Cone Beam CT study of a case of eosinophilic granuloma of the mandible in a young patient. *BMJ Case Rep* 2019;**12** e228455.
35. Goyal G, Tazi A, Go RS, et al. International expert consensus recommendations for the diagnosis and treatment of Langerhans cell histiocytosis in adults. *Blood* 2022;**139**:2601–2621.
36. Krooks J, Minkov M, Weatherall A. Langerhans cell histiocytosis in children: diagnosis, differential diagnosis, treatment, sequelae, and standardized follow-up. *J Am Acad Dermatol* 2018;**78**:1047–1056.