Ectomesenchymal Chondromyxoid Tumor: A Series of Seven Cases and Review of the Literature

Abdulaziz Aldojain · Jumana Jaradat ·
Kurt Summersgill · Elizabeth A. Bilodeau

Received: 18 August 2014 / Accepted: 29 October 2014 / Published online: 18 November 2014
© Springer Science+Business Media New York 2014

Abstract Ectomesenchymal chondromyxoid tumors (ECT) are rare, benign, intraoral mesenchymal soft tissue tumors that can be diagnostically challenging. In this study the demographic, clinical, histopathologic, and immunohistochemical features of seven ECTs are examined. The differential diagnosis of this rare neoplasm is discussed and the literature is reviewed.

Keywords Ectomesenchymal chondromyxoid tumors · Tongue · Myoepithelial · Benign · Neoplasm

Introduction

Ectomesenchymal chondromyxoid tumors (ECTs) are rare, benign, intraoral mesenchymal soft tissue neoplasms. The entity was first described in 1995 by Smith et al. [1]. They described 19 tumors, all located on the anterior dorsal surface of the tongue. Despite the original description of ECT, the clinical, histopathologic and immunohistochemical features of this tumor have not been thoroughly defined, as these are rare tumors, with only 48 ECTs reported in the English language literature. Some authors attribute the low number of diagnosed cases to the possibility of confusion with other entities that may share some histopathological features, such as myoepithelioma, oral focal mucinosis, soft tissue myxoma, ossifying fibromyxoid tumor, chondroid choristoma, nerve sheath myxoma, pleomorphic adenoma, and mucocele [2, 3].

ECT appears clinically as a slow-growing, painless, well-circumscribed mass almost exclusively seen on the dorsum of the tongue. Two ECT cases have been reported on the hard palate; one of them was not verified with immunohistochemical staining [4, 5]. Only two documented cases have been reported in posterior tongue. The World Health Organization (WHO) named the lesion “ECT of the anterior tongue” indicating that it solely arises in this specific area [6].

Histopathologically, the tumor is unencapsulated but well-demarcated, with lesional cells proliferating in a lobular pattern and arranged in cords, strands, and sheets in a myxoid to chondromyxoid background. The cells are either round, oval, polygonal or spindled in morphology. They may have multilobulated nuclei and may occasionally show atypia [1–3].

In this article, we will be presenting the demographic, clinicopathologic, and immunohistochemical features of this rare entity and a review of the literature.

Materials and Methods

Data Collection

After institutional review board approval, five ECT glass slides and paraffin blocks were retrieved from archives at the University of Pittsburgh Medical Center from 1996 to 2013. An additional two cases were received from external pathology laboratories as ten unstained slides, along with their pathology reports and microphotographs of stained tissue on one case. Morphological features such as cellular pleomorphism, growth pattern, background, muscle entrapment, calcifications, giant cells, lobularity and

A. Aldojain (✉) · J. Jaradat · K. Summersgill · E. A. Bilodeau
Department of Diagnostic Sciences, School of Dental Medicine,
University of Pittsburgh, Pittsburgh, PA, USA
e-mail: aldojainaa@upmc.edu

Table 1 Antibodies used for immunohistochemistry

Antibody	Company	Clone	Dilution
S-100	Dako, Carpinteria	D5/16 B4	1:50
GFAP	Ventana	N/A	Prediluted
Calponin	Dako, Carpinteria	CALP	1:50
Smooth muscle actin	Cell Marque, Rocklin, CA	IA4	Prediluted
p63	Thermo, Fremont, CA	4A4	1:200
Pankeratin AE1/3	Dako, Carpinteria	AE1/AE3	1:100
CAM 5.2	BD	CAM 5.2	1:10
CD57	Ventana	NK-1	Prediluted
Synaptophysin	Cell Marque	N/A	Prediluted
SMMHC	Biogenex	MY-32	1:40
Desmin	Ventana	DE-R-11	Prediluted

cellular morphology were evaluated. Clinical parameters (size, sex, location) were recorded when available.

Methods

Hematoxylin and eosin stained (H&E) slides from all cases were reviewed, as well as available immunohistochemical (IHC) stains. Additional IHC stains were performed on selected cases based on the available material. The antibodies, manufacturer, dilution, and retrieval methods are listed in Table 1.

Results

The available clinical data are summarized in Table 2. Preliminary data for this study was presented at the annual meeting of the American Academy of Oral and Maxillo-facial Pathology [7]. The age of the affected patients ranged from 7 to 57 years, with a mean of 45.8 years. There was a slight male predominance with a ratio of 1.3:1. All tumors were located on the dorsal tongue. One case was on the posterior lateral tongue and three cases were on the right side of tongue. Three cases were described as asymptomatic. Tumor size ranged from 0.6 × 0.7 cm to 1.2 × 2.0 cm. The duration of tumors was only available on two cases and ranged from 6 months to several years. The clinical impression of one tumor was of a mucocele. Another case was described as exophytic with an ulcerated center, while a third case was described as yellow and rubbery. Histologically, the available differential diagnosis for three cases was myoepithelioma, nerve sheath myxoma, and cellular neurothekeoma.

Histopathologic and Immunohistological Features

The histological features are summarized in Table 3 and Fig. 1. Each case was evaluated for the following features:

Table 2 Clinical and demographic features

Features	Result
Mean age (range)	45.8 (7–57)
Gender ratio M:F	1.3:1
Location	Dorsal tongue 7/7 (100 %)
Tumor size range	0.6 × 0.7 cm to 1.2 × 2.0 cm
Tumor duration	6 months to several years

Table 3 Histopathologic features

Features	Result
Lobular proliferation of ovoid to round cells	6/7 (86 %)
Net-like growth pattern	7/7 (100 %)
Slit-like cystic spaces	7/7 (100 %)
Muscle entrapment	4/7 (57 %)
Fine calcification	4/7 (57 %)
Multinucleated giant cells	3/7 (43 %)
Chondroid stroma	3/7 (43 %)
Pleomorphism	7/7 (100 %)

general morphology, growth pattern, background, muscle entrapment, calcifications, giant cells, lobularity and cellular morphology. Histologically, six tumors exhibited a lobular proliferation of ovoid to round cells. There was no true fibrous capsule separating the tumor cells from normal tissue. The tumors demonstrated a net-like growth pattern with slit-like cystic spaces. Muscle entrapment was seen in four cases. However, there was no extensive invasion into the normal muscular and connective tissue. Fine calcifications were present in four cases, three of which contained multinucleated giant cells. At least focally, a myxoid background was present in all tumors, but four tumors lacked a chondroid component. All tumors were comprised of highly-cellular proliferations of small, round, oval,

Fig. 1 Histological features: lobular pattern $\times 20$ (**a**), myxoid stroma with slit-like spaces $\times 40$ (**b**), muscle entrapment $\times 100$ (**c**), net-like stroma with cellular pleomorphism $\times 200$ (**d**), calcification $\times 40$ (**e**), multinucleated giant cells $\times 400$ (**f**)

polygonal, or slightly elongated cells containing a scant to moderate amount of eosinophilic cytoplasm. The nucleus had vesicular chromatin with inconspicuous nucleoli. Nuclear atypia was present in all cases. No mitotic figures were seen.

The histochemical and immunohistochemical profile is summarized in Table 4 and Fig. 2. The tumors were consistently positive for S-100 (7/7, 100 %), glial fibrillary acidic protein (GFAP) (6/7, 86 %), focally-to diffusely-positive for smooth muscle actin (SMA) (5/6, 83 %), smooth muscle myosin heavy chain (SMMHC) (3/3, 100 %) and desmin (1/4, 25 %), with rare cells positive for P63 (3/6, 50 %). The extracellular myxoid material was

positive for mucicarmine (2/2, 100 %). Calponin showed rare weak positivity (1/5, 20 %). Some cases exhibited rare positivity for CD57 (4/5, 80 %), synaptophysin (1/5, 20 %), AE1/AE3 (1/4, 25 %) and focal positivity for CAM 5.2 (1/5, 20 %).

Discussion

Several hypotheses have been suggested for ECT histogenesis. Based on the tumor's immunohistochemical profile, histological presentation and location, it was thought to be derived from uncommitted ectomesenchymal cells

Table 4 Immunohistochemical stain results

IHC stain	Result
S-100	Diffusely positive (7/7, 100 %)
GFAP	Diffusely positive (6/7, 86 %)
SMA	Focal to diffusely positive (5/6, 83 %)
SMMHC	Focally positive (3/3, 100 %)
Desmin	Moderate diffuse positivity (1/4, 25 %)
P63	Rare positivity (3/6, 50 %)
Mucicarmine	Positive (2/2, 100 %).
Calponin	Rare positivity (1/5, 20 %).
CD57	Focal to diffusely positive (4/5, 80 %)
Synaptophysin	Rare positivity (1/5, 20 %)
AE1/AE3	Focally positive (1/4, 25 %)
CAM 5.2	Focally positive (1/5, 20 %)

that migrated from the neural crest, minor salivary gland, or from muscle fibers [1, 8–11]. The anterior dorsal tongue lacks minor salivary gland tissue and is known to develop from neural crest mesenchyme of the first branchial arch. Therefore, it is favored that ECT originates from pluripotent stem cells of ectomesenchyme. This also may explain the tendency of this tumor to develop on this particular area of the oral cavity. Yoshioka et al. [12] found that ECT-derived cells were morphologically similar to neuronal cells and might present characteristics similar to undifferentiated embryonic stem cells, with potential for multilineage differentiation.

Although ECT has a distinct clinical location on the anterior tongue that might help in establishing the diagnosis, its histopathological features (myxoid and/or chondroid stroma, pleomorphism, nuclear inclusions, and

Fig. 2 Histochemical and immunohistochemical profile: hematoxylin and eosin (a), S-100 (b), GFAP (c), SMA (d), p63 (e), CD57 (f), mucicarmine (g), calponin (h), AE1/AE3 (i), desmin (j), SMMHC (k), synaptophysin (l) (all $\times 200$)

Table 5 Accumulative data of all reported cases of ECT in the English literature^a [1, 3, 5, 6, 8–15, 18, 20–28]

<i>Demographic data</i>	
Age	7–78 years (mean = 37 years)
Gender	M:F 1.1:1 (29:26)
Race	75 % white (15/20), 15 % black (3/55), Asian 5 % (1/55), Indian 5 % (1/20)
<i>Clinical data</i>	
Location	93 % anterior dorsal tongue (51/55)
Size	Range from 3.5 × 2.2 cm to 0.3 cm in diameter
Duration	2 weeks—20 years; 42 % more than 1 year duration (16/38)
Clinical differential diagnosis	Granular cell tumor, mucocele, neurofibroma, benign mesenchymal tumor
<i>Histopathologic data</i>	
Histology differential diagnosis	Myoepithelioma, cellular neurothekeoma, pleomorphic adenoma
Lobular growth pattern	64 % (23/36)
Multinucleated cells	25 % (9/36)
Chondroid	81 % (45/55)
Myxoid stroma	100 % (36/36)
Net-like spaces	47 % (17/36)
Pseudocystic spaces	35 % (19/55)
Hyalinization	25 % (9/36)
Muscle entrapment	44 % (16/36)
Atypia	53 % (19/36)
Mitosis	22 % (8/36)
Mucosal ulceration	10 % (6/55)
<i>Immunohistochemical stain reactivity</i>	
GFAP	89 % (47/53)
S100	82 % (41/50)
CD57	74 % (20/27)
CK (cytokeratin)	41 % (17/41)
SMA	52 % (22/42)
Desmin	14 % (6/23)
Vimentin	100 % (22/22)
EMA	10 % (2/19)
p63	38 % (6/16)

^a In the articles where more than one case is reported, the generalized description of tumors was disregarded unless otherwise specified

amphophilic cytoplasm) can overlap with that seen in other soft tissue and minor salivary gland neoplasms. Clinically, ECT is relatively small, asymptomatic, well-demarcated, and has a history of long duration, suggesting a benign process and resembling other benign, indolent soft tissue tumors that may develop in the dorsal surface of tongue, such as peripheral nerve sheath tumors and granular cell tumor.

Our study shows that ECTs arise in a wide age range (7–57 years) with a slight tendency to affect males; however, literature review shows no sex preference [3]. In our series, six out of seven tumors were located on the anterior dorsal tongue, which is consistent with previously reported cases. One case was located on the posterior tongue, to be added to three previously reported ECT cases of posterior

tongue [8, 13, 14]. The single, well-documented case of ECT reported on the hard palate would argue against considering the dorsal tongue as an exclusive location for ECT [4].

Microscopic examination of our seven cases shows features similar to what have been described in the literature (Table 5) [1, 2]. Circumscription, lobular growth pattern and slit-like spaces were the most distinct feature seen in this entity. Cystic areas with papillary projection might also be seen, as we observed this in one case. Features such as muscle entrapment and/or calcification are not present in all cases, and it is not clear whether they are related to size, duration, or behavior of the tumor. The tumor that was present for several years did not demonstrate calcification; however, calcification was seen in the

Table 6 Differential diagnosis of ectomesenchymal chondromyxoid tumor [16–19]

Lesion	Microscopic morphology	Cellular features	Site	IHC
Myoepithelioma	Well-circumscribed. Lesional cells arranged in solid, sheet-like, myxoid, microcytic or reticular growth. No chondroid tissue	Plasmacytoid, epithelioid, clear or spindle cells. Absence of cellular atypia	Most frequently in parotid followed by palate and submandibular gland. It may occur in any areas where salivary glands are present	S100+ CK+ Vimentin+ p63+ Calponin+ GFAP+ SMA+ SMMHC+ Alcian blue Periodic acid-Schiff
Oral focal mucinosis	Well-localized, nonencapsulated, loose, myxomatous tissue	Ovoid, fusiform, or stellate-shaped	Gingiva, followed by hard palate	Vimentin+ Desmin+ CD34+/- S100+/-
Soft tissue myxoma	Less defined, surrounded by pseudocapsule. Infiltrating muscle fibers. No chondroid areas	Randomly, loosely distributed short, spindly and stellate-shaped cells within highly myxoid stromal matrix	No sites of predilection	S100+ Vimentin+ Desmin+ CD57+/- GFAP+/- SMA+/- CK+/-
Ossifying fibromyxoid tumor	Well defined, multiple lobules of lesional cells. 80 % rimmed by metaplastic bone. Cells arranged in nests and cords	Round to ovoid cells embedded in myxoid hyalinized stroma	Most often in extremities or trunk. Few cases reported in head and neck and oral cavity	
Chondroid choristoma	Multiple lobules of mature hyaline cartilage surrounded by connective tissue capsule	Mature chondrocytes with no atypia	Predilection for dorsal posterior tongue	
Nerve sheath myxoma	Coarse myxoid nodules composed of cords, and cluster of rounded or multipolar Schwann cells	Spindle, occasionally epithelioid in myxoid matrix	90 % on extremities. May occur in tongue	S100+ GFAP+ Vimentin+ NGFR+ NSE+ CD57+ MITF- NK1/C3- NK1/C3+ MITF+ S100- GFAP-
Neurothekeoma	Multinodular, lobular or plexiform growth pattern. Whorling pattern of lesional cells is often present. Myxoid stromal change frequently exists	Polygonal, or rarely plump and spindle-shaped, and arranged in a fascicular pattern	Head and neck, upper extremities and shoulder	
Pleomorphic adenoma	Encapsulated lesion contains epithelial, myoepithelial and mesenchymal component. Myxoid, chondroid and/or hyalinized areas are present	Spindle, plasmacytoid or clear cells arranged in sheets, cords or ductal structure	Areas where salivary glands are present. Most common site is parotid gland (~80 %). In minor salivary glands, it is seen in palate, lip, and buccal mucosa. Few cases reported in posterior tongue	S100+ CK+ Vimentin+ p63+ Calponin+ GFAP+ SMA+ SMM+
Mucocele	Granulation tissue surrounding pool of mucin	Mixed inflammatory cells and foamy histiocytes	Areas where salivary glands are present. Predilection for lower lip	CD68 will highlight histiocytes

+ Immunoreactivity present, – immunoreactivity not present

tumor of only 6 months' duration. Thus, duration of the lesion is not the sole factor for development of calcification. Multinucleated giant cells are only associated with cases that have calcification, which might explain their presence. Muscle entrapment apparently is not related to the size of the tumor, since the largest and smallest tumors did not show any muscular entrapment. A more exhaustive histopathologic evaluation may have identified additional muscular entrapment. No extensive infiltration of surrounding soft tissue was seen.

The histology of the tumor cells is interesting, as they show some worrisome features, such as pleomorphism and nuclear atypia and might be confused with other malignant processes. However, the absence of mitotic figures and other criteria of malignancy such as invasiveness or perineural and/or angiolymphatic invasion supports the benign nature of this entity. All the cases showed varying degrees of myxoid differentiation, ranging from <5 % up to 40 % of the tumor. Three cases showed chondroid differentiation. As opposed to our series, the majority of ECTs published in the literature showed chondroid tissue stroma (42/48, 87 %) [10, 13–15].

The immunohistochemical profile in our series is consistent with what has been described in the literature, showing diffuse and high reactivity to S-100, GFAP, and CD57, which suggest neural crest differentiation [2, 9]. However, synaptophysin, a neuroendocrine marker, was negative in most cases. While the majority of cases were positive for the smooth muscle markers SMA and SMMHC, staining pattern was variable and mostly focal. There was less reactivity for the skeletal muscle marker desmin, which stained only one case out of four. Cytokeratin antibodies showed low immunoreactivity with the lesional cells compared to what has been reported in the literature [1, 2]. Only one of our cases was focally positive for CAM 5.2 and AE1/3. Myoepithelial markers showed rare, weak positivity in a few cases, suggesting a non-salivary gland origin.

The differential diagnosis of ECT includes myoepithelioma, oral focal mucinosis, soft tissue myxoma, ossifying fibromyxoid tumor, chondroid choristoma, nerve sheath myxoma, neurothekeoma, pleomorphic adenoma, and mucocele (Table 6).

In conclusion, the findings of those seven new cases support the typical features of the previously-described ectomesenchymal chondromyxoid tumors. Neural markers are more consistent for this entity compared with the variable results obtained for muscle, cytokeratin, and myoepithelial markers. The tumor can arise in the posterior tongue, although few cases are reported. In addition to its lobular growth pattern and myxoid stroma, calcification, multinucleated giant cells and muscle entrapment may be seen.

Acknowledgments The authors would like to thank Dr. John M. Wright, Texas A&M University; and Jacinthe Chenevert, L'Hôtel-Dieu de Québec, for their contribution to this study.

References

1. Smith BC, Ellis GL, Meis-Kindblom JM, Williams SB. Ectomesenchymal chondromyxoid tumor of the anterior tongue. Nineteen cases of a new clinicopathologic entity. *Am J Surg Pathol*. 1995;19(5):519–30.
2. Allen CM. The ectomesenchymal chondromyxoid tumor: a review. *Oral Dis*. 2008;14(5):390–5. doi:10.1111/j.1601-0825.2008.01447.x.
3. Leeky M, Narayan T, Shenoy S, Jamadar S. Ectomesenchymal chondromyxoid tumor: review of literature and a report of a rare case. *J Oral Maxillofac Pathol*. 2011;15(1):74–9. doi:10.4103/0973-029X.80021.
4. Gouvea AF, Diaz KP, Leon JE, Vargas PA, de Almeida OP, Lopes MA. Nodular lesion in the anterior hard palate. *Oral Surg Oral Med Oral Pathol Oral Radiol*. 2012;114(2):154–9. doi:10.1016/j.oooo.2011.11.005.
5. Nigam S, Dhingra KK, Gulati A. Ectomesenchymal chondromyxoid tumor of the hard palate—a case report. *J Oral Pathol Med*. 2006;35(2):126–8. doi:10.1111/j.1600-0714.2006.00368.x.
6. van der Wal JE, van der Waal I. Ectomesenchymal chondromyxoid tumor of the anterior tongue. Report of a case. *J Oral Pathol Med*. 1996;25(8):456–8.
7. Aldojain AJ, Summersgill K, Bilodeau E. Ectomesenchymal chondromyxoid tumor: a series of 5 cases. *Oral Surg Oral Med Oral Pathol Oral Radiol*. 2013;116(6):e504–e5. doi:10.1016/j.oooo.2013.09.059.
8. Carlos R, Aguirre JM, Pineda V. Ectomesenchymal chondromyxoid tumor of the tongue. *Med Oral*. 1999;4(1):361–5.
9. de Visscher JG, Kibbelaar RE, van der Waal I. Ectomesenchymal chondromyxoid tumor of the anterior tongue. Report of two cases. *Oral Oncol*. 2003;39(1):83–6.
10. Goveas N, Ethunandan M, Cowlshaw D, Flood TR. Ectomesenchymal chondromyxoid tumour of the tongue: unlikely to originate from myoepithelial cells. *Oral Oncol*. 2006;42(10):1026–8. doi:10.1016/j.oraloncology.2006.06.004.
11. Woo VL, Angiero F, Fantasia JE. Myoepithelioma of the tongue. *Oral Surg Oral Med Oral Pathol Oral Radiol Endodontology*. 2005;99(5):581–9. doi:10.1016/j.tripleo.2004.12.016.
12. Yoshioka Y, Ogawa I, Tsunematsu T, Sakaue T, Yamasaki S, Fukui Y, et al. Ectomesenchymal chondromyxoid tumor of the tongue: insights on histogenesis. *Oral Surg Oral Med Oral Pathol Oral Radiol*. 2013;115(2):233–40. doi:10.1016/j.oooo.2012.11.008.
13. Seo SH, Shin DH, Kang HJ, Choi KU, Kim JY, Park do Y et al. Reticulated myxoid tumor of the tongue: 2 cases supporting an expanded clinical and immunophenotypic spectrum of ectomesenchymal chondromyxoid tumor of the tongue. *Am J Dermatopathol*. 2010;32(7):660–4. doi:10.1097/DAD.0b013e3181d7d3bf.
14. Cardin MJ, Fiset PO, Zeitouni AG, Caglar D. Ectomesenchymal chondromyxoid tumour of the posterior tongue. *Head Neck Pathol*. 2014;8(3):329–33. doi:10.1007/s12105-013-0500-x.
15. Palma Guzman JM, de Andrade BA, Rizo VH, Romanach MJ, Leon JE, de Almeida OP. Ectomesenchymal chondromyxoid tumor: histopathologic and immunohistochemical study of two cases without a chondroid component. *J Cutan Pathol*. 2012;39(8):781–6. doi:10.1111/j.1600-0560.2012.01910.x.
16. Barnes L. Surgical pathology of the head and neck. 3rd ed. New York: Informa Healthcare; 2009.

17. Goldblum JR, Folpe AL, Weiss SW. Enzinger and Weiss's soft tissue tumors. 6th ed. Philadelphia: PA Saunders/Elsevier; 2014.
18. Kannan R, Damm DD, White DK, Marsh W, Allen CM. Ectomesenchymal chondromyxoid tumor of the anterior tongue: a report of three cases. *Oral Surg Oral Med Oral Pathol Oral Radiol Endodontology*. 1996;82(4):417–22.
19. Neville BW, Damm DD, Allen CM, Bouquot JE. Oral and maxillofacial pathology. 3rd ed. St. Louis: Saunders/Elsevier; 2009.
20. Angiero F. Ectomesenchymal chondromyxoid tumour of the tongue. A review of histological and immunohistochemical features. *Anticancer Res*. 2010;30(11):4685–9.
21. Closmann JJ, Eliot CA, Foss RD. Ectomesenchymal chondromyxoid tumor: report of a case with description of histologic and immunohistochemical findings. *J Oral Maxillofac Surg*. 2013;71(3):545–9. doi:[10.1016/j.joms.2012.08.003](https://doi.org/10.1016/j.joms.2012.08.003).
22. Chopra R, Dhingra N, Handa U, Mohan H. Ectomesenchymal chondromyxoid tumor of the tongue masquerading as pleomorphic adenoma on fine needle aspiration cytology smears: a case report. *Acta Cytol*. 2010;54(1):82–4.
23. Ide F, Mishima K, Saito I. Ectomesenchymal chondromyxoid tumor of the anterior tongue with myxoglobulosislike change. *Virchows Arch*. 2003;442(3):302–3. doi:[10.1007/s00428-003-0781-7](https://doi.org/10.1007/s00428-003-0781-7).
24. Kaplan I, Anavi Y, Calderon S. Ectomesenchymal chondromyxoid tumour of the anterior tongue. *Int J Oral Maxillofac Surg*. 2004;33(4):404–7. doi:[10.1016/j.ijom.2003.07.003](https://doi.org/10.1016/j.ijom.2003.07.003).
25. Pires FR, Abrahao AC, Cabral MG, Azevedo RS, Horta MC, Martins CR, et al. Clinical, histological and immunohistochemical features of ectomesenchymal chondromyxoid tumor. *Oral Surg Oral Med Oral Pathol Oral Radiol Endodontology*. 2009;108(6):914–9. doi:[10.1016/j.tripleo.2009.07.007](https://doi.org/10.1016/j.tripleo.2009.07.007).
26. Portnof JE, Friedman JM, Reich R, Freedman PD, Behrman DA. Oral ectomesenchymal chondromyxoid tumor: case report and literature review. *Oral Surg Oral Med Oral Pathol Oral Radiol Endodontology*. 2009;108(4):e20–4. doi:[10.1016/j.tripleo.2009.05.040](https://doi.org/10.1016/j.tripleo.2009.05.040).
27. Seckin D, Demirkesen C, Gurbuz O. Ectomesenchymal chondromyxoid tumor of the anterior aspect of the tongue. *J Am Acad Dermatol*. 2008;59(2 Suppl 1):S23–4. doi:[10.1016/j.jaad.2007.09.033](https://doi.org/10.1016/j.jaad.2007.09.033).
28. Sengul D, Sengul I, Ozdol MU, Astarci MH, Ustun H. Ectomesenchymal chondromyxoid tumor of the anterior tongue: a rare case. *Kaohsiung J Med Sci*. 2011;27(5):203–5. doi:[10.1016/j.kjms.2010.07.004](https://doi.org/10.1016/j.kjms.2010.07.004).