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ORAL CYSTICERCOSIS AS A CHALLENGE FACED BY DENTISTS: A REVIEW

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ABSTRACT

Oral Cysticercosis is a rare condition poorly documented in literature, however usually reported in endemic regions for the taeniasis-cysticercosis complex, such as developing countries, comprising areas with poor sanitation and population with bad hygiene practices. It happens when viable *Cysticercus cellulosae*, which is the larval form of the cestode*Taenia solium*, affects tissues of the oral cavity. Its clinical presentation often mimicks other common oral lesions, being therefore, frequently misdiagnosed by dentists. This study aims to make a literature review on Oral Cysticercosis and emphasize the important role of dentists in making the correct diagnosis when *Cysticercus cellulosae* affects oral tissues. An active bibliographic search on the subject was performed in electronic scientific databases. The selection criteria adopted consisted in articles from open access sources, dating from 2000 to 2020 with the keywords. Hence, 40 articles were considered, of which 32 were case reports on intraoral cysticercosis, containing 69 patients in total. The lack of knowledge about parasitic infections and their oral manifestations is a contributory factor to the misdiagnosis of Oral Cysticercosis and consists in a crucial point in endemic areas, like Brazil, where parasitic infections of the mouth are deficiently discussed during the formation of dentists in universities.

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INTRODUCTION

The taeniasis-cysticercosis complex are neglected parasitic infectious diseases that represent a public health burden in many developing countries, especially in parts ofLatin America, Sub-Saharan Africa, Southeast Asia, India, and China, regions where poor sanitation, lack of measures for health control, bad hygiene habits amongst the population, and non-strict meat inspection propitiate the viability of the parasitic cycle of *Taenia solium,* popularly called "pork tapeworm". Besides, because of the intense immigration from endemic areas, it also has become a 'global problem' even in developed nations with well-instructed population (Fernández *et al*., 2016; Gripper andWellburn, 2017; Zou *et al*. 2019). Taeniasis is a disease caused by the adult form of *Taenia solium,* an hermaphrodite cestode inhabiting the human intestine, morphologically characterized by a ribbon-shaped body that can reach up many meters in lenght and is divided in 3 anatomical parts: scolex (containing four suckers and a double crown of rostellarhooklets), neck and strobilus, that last one constituted by several proglottids (Gupta *et al*., 2017b; Singh *et al*., 2018). To develop taeniasis the individual has to consume raw or inadequately cooked pork that has been infected with viable cysticerci, which consist in the larval encysted form of *T. solium* called *Cysticercus cellulosae*, morphologically described as a scolex and neck structure (the same cranial parts found in *T.solium*) invaginated in a vesicle form (Gripper andWellburn, 2017; Singh *et al*., 2018). The cysticerci infest various tissues of the intermediate host (pork) or abnormal/accidental host (human), and represents one of the mostly frequent larval infections in humans originated by cestodes, with more than 50 million individuals estimated to be infected all over the world (Fernández *et al*., 2016.; Gupta *et al*., 2017b). To acquire cysticercosis humans must ingest viable eggs of *Taenia solium* that might be present in fecal contaminated food, vegetables, water, or even in the fingers of

contaminated food handlers with poor hand washing practices; additionally it can happen through self-contamination, by reflux of the gravid proglottid from the intestine into the stomach. It is remarkable to mention that every proglottid contains at about 80.000 eggs; however only a half are actually infective and can stay viable for a long time in the enviromnet (Hosur, 2015; Kalladka *et al*., 2018). Therefore, once humans swallow such eggs, they become intermediate hosts, which is a role normally played by the pigs. The ingested eggs suffer the action of the intestinal and gastric juices releasing the oncospheres (activated embryos) that vigorously penetrate the bowel wall of the host. Subsequently, through vascular and lymphatic circulation the mentioned embryos reach many destinations in organs and tissues where, after around 10 weeks, the larvae stage develops into cysticerci that can survive for many years infecting locations such as skeletal muscles, subcutaneous and ocular tissues and, preferably, the central nervous system, generating a clinical disorder named neurocysticercosis (NCC), which is considered the most common cause of seizures and acquired epilepsy in developing countries (Freitas *et al*., 2005; Santos *et al*., 2012; Delgado-Azañero *et al*., 2018; Zou *et al*., 2019).

Even though the involvement of oral cavity by cysticercosisis considered to a rare situation, it can represent a diagnostic dilemma by mimicking other benign oral lesions, reason why dental clinicians and dentist must be aware of that phenomenon, especially in endemic areas (Kalladka *et al*., 2018; Momanyi, 2015; Singh *et al*., 2018). Thus, this study aims to make a literature review on Oral Cysticercosis and emphasize the important role of dentists and dental clinicians in making the correct diagnosis when cysticercus affects oral tissues.

MATERIALS AND METHODS

An active bibliographic search was performed from July to September of 2020 in the following electronic scientific databases: SciELO (Scientific Electronic Library Online), PUBMED (US Library of Medicine), BVS (Biblioteca Virtual emSaúde) and Google Scholar using the keywords: oral, human cysticercosis, buccal, *Cysticercus cellulosae, Taenia solium*. Publications from 2000 to 2020 in english, portuguese and spanish language from open access sources were included, totalizing 40 articles.

RESULTS AND DISCUSSION

The orofacial presentation of cysticercosis is poorly documented in the literature (Hosur *et al*., 2015). In the present research 40 articles on the subject were considered, dating from 2000 to 2019. Of those, 32 were case reports on oral cysticercosis. Although oral cavity involvement of cysticercosis in humans is considered to be rare (3.5% out of 769 cases of cysticercosis in other locations of the body, according to the scientific data) possibly in consequence of the higher muscular activity and increased metabolic rate of oral tissues, which act disturbing the lodgement and development of the larvae, it's a clinical condition usually reported in developing countries (Chand *et al*., 2016; Singh *et al*., 2017a; Prajapat *et al*., 2019; Sah *et al*., 2019). A search in the English and Spanish literature conducted by Delgado-Azañero *et al*. in 2007 noticed about 97 cases of oral cysticercosis reported up to the mentioned year. The most common locations were tongue (44 cases), followed by buccal mucosa (24 cases), lower lip (19 cases), and upper lip (8 cases). Another review made by Krishnamoorty *et al*. in 2012 found 65 cases of oral cysticercosis documented in the English language literature. Up to the year 2018, 24 more cases were added to the literature according to Singh *et al* (2018). Considering that total of cases, the main chosen lesion locations were: Tongue (50%), lips (27%) and buccal mucosa (19,1%), however it's known that any region of the oral cavity can be affected (Hosur *et al*., 2015). There is almost equal distribution between the genders, affecting mostly the ages from third to fourth decade (Pichare, *et al*. 2014), showing a much lower number of pediatric cases as compared to adults (Fernández, *et al*. 2016). The present research revealed 69 individuals with oral cysticercosis distributed in 32 case report articles published from 2000 to 2019 (as seen in Table 1). The main origins were Indian (35) and Brazilian (11); the preferred intraoral location was the tongue (32), followed by buccal mucosa (22), lips (13) and labial mucosa (9). The lesions were mostly clinically diagnosed as common benign oral lesions just as mucoceles, fibromas and lipomas.

The misdiagnosis of oral cysticercosis is highly frequent due to its clinical presentation that can mimic several other oral lesions, normally mucoceles and benign tumors of mesenchymal origin, as well as because of its rare occurence (Sah *et al*., 2019). This condition can also be a component of the disseminated form of cysticercosis, having the patient as well multiple nodules all over the body, as described by Gupta *et al*. (2017a). Even though oral cysticercosis can indicate a disseminated infestation, systemic complications are not frequent in most of the individuals presenting such lesions. This could be due to the fact that generally disseminated cysticercus are located in deep tissues, where they may remain alive without showing clinical manifestations (Kunal *et al*., 2019). The oral cysticercotic lesions are often characterized as a solitary well circumscribed and smooth, submucosal nodular swelling, ranging from 0.5cm to 2cm in diameter, showing firm consistency on palpation, with an intact and healthy overlying mucosa. The swelling can be symptomatic once being tender, or non-symptomatic, when non tender, depending upon the inflammation started by the larvae, especially when it suffers colloid degeneration, although pain has only been reported in secondarily infected cases (Hosur, *et al*. 2015; Fernández, *et al*. 2016, Goenka, *et al*. 2016). The main complaint of patients with oral cysticercosis is a slowly growing painless swelling, which can, depending on the placement, interfere with the movement of the tongue and lips, creating discomfort during eating and speaking (Pichare, *et al*. 2014). Sometimes the lesion can be posteriorly infected by other patogens or traumatized by the movements of mastication, causing painful reports. Dube *et al*. (2019) described a situation in which the lesion occasioned a painful clinical condition in consequence of a secondary inflammation.

Once the larval nodule is located on buccal mucosa, labial mucosa and lips the main oral lesions cysticercosis is mistaken for are fibroma, lipoma, mucocele, hemangioma, pyogenic granuloma or pleomorphic adenoma. When the lesion happens to be on the tongue, it is often misdiagnosed as pyogenic granuloma, fibroma, granular cell tumour, or rhabdomyoma (Singh *et al*., 2018; Dube *et al*., 2019). However, a careful and strict clinical examination can help in differentiating this condition from other similarly presenting lesions.

Table 1. Main features of the case reports (from 2000 to 2019)

Study	Total of Patients	Origin	Intraoral Locations	Clinical Diagnosis
1. De Souza, et al., 2000	7	Brazil	Tongue: 3 Lip: 3 Mouth floor: 1 Retromolar region: 1	Benign oral lesions
2. Mazhari et al., 2001	8	India	Buccal mucosa: 4 Lip: 2 Tongue: 1 Gingiva: 1	Cysticercosisclinicaly unsuspected
3. Elias et al., 2005	1	Brazil	Tongue: 1	Benign neoplasm of neural origin
4. Martelli-Junior et al., 2006	1	Brazil	Buccal mucosa	Mucocele, fibroma, lipoma, or pleomorphic adenoma
5. Delgado-Azañero et al., 2007	16	Guatemala: 7 Peru: 7 Mexico: 2	Tongue: 11 Lip: 6 Buccal mucosa: 4	Cysticercosis: 8; Mucocele: 7; Adenoma: 2;Neurilemoma: 2; Cyst: 1; Lipoma: 1
6. Lee et al., 2009	1	Unites States of America	Multiple in labial mucosa	Mucoceles
7. Gadbail et al., 2010	2	India	Buccal mucosa: 1 Labial mucosa: 1	Lipoma, fibroma or mucocele
8. Sathe et al., 2011	1	India	Labial mucosa	Mucocele
9. Deshmukh et al., 2011	1	India	Lip	Fibroma
10. Santos et al., 2012	1	Brazil	Tongue	Lipoma
11. Krishnamoorthy et al., 2012	1	India	Labial mucosa	Mucocele, lipoma or fibroma
12. Venkatraman et al., 2013	1	India	Tongue	Mucocele, sialocyst, lymphangioma or minor salivary gland tumour
13. Chunduri et al., 2013	1	India	Labial mucosa	Mucocele
14. Ferreira Filho et al., 2013	1	Brazil	Tongue	Lingual papilloma
15. Wanjari et al., 2013	2	India	Labial mucosa Buccal mucosa	Mucoceles
16. Joshi et al., 2014	1	India	Buccal mucosa	Mucocele, lymphangioma or minor salivary gland tumor
17. Pichare et al., 2014	1	India	Tongue	Mucocele or orofacial mucinosis
18. Bhatia et al., 2014	1	India	Buccal mucosa	Mucocele
19. Hosur et al., 2015	1	India	Buccal mucosa	Lipoma
20. Kulkarni et al., 2015	1	India	Buccal sulcus	Mucocele
21. Devulapalli et al., 2015	1	India	Labial mucosa	Fibroma
22. Chand et al., 2016	1	India	Buccal mucosa	Fibroma, neurofibroma, focal fibrous hyperplasia or mucocele
23. Fernández et al., 2016	6	Mexico	Tongue: 4 Lip: 1 Buccal mucosa: 1	Mucocele: 5 Lipoma: 1
24. Goenka et al., 2016	1	India	Tongue	Mucocele or benign tumors of mesenchymal origin
25. Gupta et al., 2017	1	India	Tongue: 3 Labial mucosa: 2	Cysticercosis
26. Sharma and Kaur, 2017	1	India	Buccal mucosa	Fibroma
27. Singh et al., 2017b	1	India	Tongue	Soft tissue abscess
28. Pujani et al., 2017	1	India	Tongue	Fibroma or mucocele
29. Singh et al., 2018	3	India	Buccal mucosa: 2 Tongue: 1	Lipoma or minor gland salivary tumor
30. Riju et al., 2018	1	India	Buccal mucosa	Lymphadenitis, parotid sialotithiasis, cysticercosis, soft tissue abscess or mesenchymal tumor
31. Dube et al., 2019	1	India	Buccal mucosa	mucocele, fibroma, neurofibroma or epidermal cyst
32. Sah et al., 2019	1	India	Tongue	Fibroma, mucocele, ranula or leymioma

Because of their intraluminal pressure, oral cysticerci are firm nodules on palpation; consequently, neither lipoma nor hemangioma should be taken as clinical possibilities, especially for that hemangioma usually has a purple or bluish-red color, and lipoma is soft and divided into lobules by fibrous tissues. Nevertheless, a granular cell tumor, for example, which is normally a slow growing, painless and smooth mucous swelling, can be clinically manifested in a very similar form as a cysticercotic lesion. That explains why the histopathological examination is needed to confirm the condition and is considered the gold standard for the diagnosis of oral cysticercosis (Delgado-Azañero *et al*., 2007; Singh *et al*., 2017a; Prajapat *et al*., 2019). The histopatologic findings of cysticercosis after an excisional biopsy of the lesion normally consist in a cystic lumen, outlined by a delicate triple-layered membrane, containing a *Taenia solium* in larval stage, whose cephalic end reveals an invaginatedscolex with rostellum, whereas caudal end shows a duct like invagination lined by a homogenous membrane (Kunal, 2019; Lee, 2009). When the larvae is under degenerative stage, histologic findings exhibit the presence of granular mineralization surrounded by much intense inflammatory infiltrate, especially in abundance of eosinophils, neutrophils, lymphocytes and plasma cells (Fernández, *et al*., 2016; Riju, 2018). Fine Needle Aspiration Citology (FNAC) as well as multiple laboratory techniques and modern radiological methods like Computer Tomography (CT), Magnet Resonance Imaging (MRI) and High-Resolution Ultrasonography (USG), are some other tools that can actually help in the suggestive pre-operative diagnosis of oral cysticercosis (Momanyi *et al*., 2015). FNAC has gained acceptance as a reliable method for an accurate diagnosis, since it is a widely approved and easy to perform in dental clinics, for example. It is also valuable to stress that in a palpable intramuscular or subcutaneous nodule the aspiration

of clear fluid raises a strong possibility of a parasitic cyst, although this technique is subject to sampling error and may fail to give a confirmatory diagnosis (Devulapalli, 2015; Sharma *et al*., 2017; Pujani *et al*., 2017;Prajapat *et al*., 2019).
The cytological features of cysticercosis may vary depending on the nature of lesion. Fluid is always aspired from viable cysts, containing fragments of bladder wall against an acellular clear background without inflammatory response. While the aspirates from necrotic and degenerated lesions can reveal pieces of bladder wall, invaginated segments, including calcareous corpuscles and single detached hooklets, and in calcified cysts calcareous corpuscles can be the only recognizable elements (Pujani, *et al*., 2018). Mazhari *et al*. (2001) observed larval fragments of *Cysticercus cellulosae* with inflamatory background in cytologic smears of every 8 cases reported. Devulapalli *et al*., (2015) successfully diagnosed pre-operatively a case of cysticercosis in the labial mucosa using USG and MRI techniques, observing an oval well-defined hypoechoic cystic lesion with smooth walls and eccentric hyperechoic nidus, presumed to be the scolex within. The scolexcan be better visualized in USG other than MRI in muscular lesions. Even though MRI has been frequently used in the diagnosis of Neurocysticercosis, it is considered an expensive method in developing countries and sometimes it may be unable to delineate the nature of the lesion, which can be accomplished by the histopathological examination (Arshad *et al*., 2020).

The lodgement of cysticerci in masticatory human muscles is even more infrequent, but it has been reported in 4 studies collected in this research. The studies by Chaurasia *et al*. (2013), Chander *et al*. (2013) and Prajapat *et al*. (2019) approaching the masseteric location, the last one described a case misdiagnosed as unilateral temporomandibular joint ankylosis, and Kalladka *et al*. (2018), who reported a manifestation of cysticercosis in the lateral pterigoyd muscle, mimicking a temporomandibular disorder, causing limitation of mouth opening and orofacial pain. In all mentioned situations, techniques of USG or MRI were adopted in order to make a presumptive diagnosis. Excluding Chaurasia *et al*. (2013), who opted for surgical excision, the other referred cases were managed conservatively using oral anthelmintic medication. The chosen treatment for oral cysticercosis depends on the site where the larvae is located. In accessible places such as subcutaneous tissues, it can be surgically excised with an excellent prognosis (Singh *et al*., 2018). However, a conservative management can also be approached by using oral anthelminthic medication such as Albendazole (15mg/kg/day in 3 doses for 28 days) and Praziquantel (50mg/kg/day in 3 doses for 15 days), one that has no effect on calcified cysticerci. Since both of the mentioned drugs provoke strong inflammatory responses there should be simultaneous administration of corticosteroids (Devulapalli, 2015; Dube *et al*., 2019). According to the exposed information, the majority of cases in the reports collected by this research were surgically treated and histopathologically diagnosed. In spite of living in endemic regions, it has been observed, however, that most of the clinicians or dentists failed to give a correct clinical diagnosis, or even consider oral cysticercosis as a probability, as showed in table 1.

CONCLUSION

The diagnosis of oral cysticercosis is a challenge to dentists and dental clinicians, once that it has a rare occurrence and clinical manifestation can mimic many other oral lesions. Therefore, it is important to emphasize the need of correct investigation, which includes not neglecting to take the medical history and personal information of every single patient, for that they can reveal valuable details. Noticing if the patients are from endemic areas, have good hygiene habits, how is their daily diet, as well as taking notes on the general systemic condition, which is something often ignored by dentists, are relevant and easy tools to help in the diagnosis. Besides, the inadequate and lack of knowledge of parasitic infections and their oral expressions also contribute to the misdiagnosis, thing that is a crucial point especially in endemic areas, like Brazil, where parasitic infections of the mouth are poorly discussed during the formation of dentists in universities. In that manner, another remarkable fact is the requirement of multidisciplinary efforts to manage most of the cases including dentists, physicians and pathologists, for example. Finally, it is significant to emphasize the role of the dentists in contributing to the treatment and early identification of this condition, once that it can also happen to tissues of the Central Nervous System, causing neurocysticercosis, which is the fatal manifestation of this disease. Consequently, after every suspicion of oral cysticercosis, sending the patient to a physician and undergoing other examinations in order to investigate more placements of cysticerci is mandatory.

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