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Original Article

Pathology Section

Clinicopathological Evaluation of Mucocele and Associated Salivary Gland Changes: A Five-year Retrospective Study

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ABSTRACT

Introduction: Oral Mucoceles is a painless, asymptomatic swelling which results from the accumulation of mucin caused by either obstruction or severance of the duct of a minor salivary gland present in the oral cavity.

Aim: To evaluate the clinicopathological features of oral mucoceles and the associated histopathological changes in adjacent salivary gland tissue.

Materials and Methods: A cross-sectional study was conducted at the Department of Oral and Maxillofacial Pathology and Microbiology, Sri Aurobindo College of Dentistry, Indore, Madhya Pradesh, India from January 2020 to December 2024, comprising 43 histologically confirmed cases of Oral Mucoceles (OM). Clinical parameters, including age, gender, lesion site, history of trauma, and duration, were recorded. Histopathological evaluation included the type of mucocele (extravasation or retention), severity of inflammation (mild, moderate, severe), acinar type (serous/mucous), presence of necrosis, and glandular architectural changes. Data were analysed using the Statistical Package for the Social Sciences (SPSS) version 13.0, and associations between categorical variables were tested using the Chi-square test, with results presented in tables.

Results: Among the total 43 cases studied, OMs predominantly affected young male individuals, with 30 males (69.8%) and 13 females (30.2%). In the present study, OMs were observed among patients aged between 13 and 60 years, with a mean age of 27.9 years. The lower lip was the most common site, 37 cases (86%), and most lesions exhibited a pinkish-red hue, 38 cases (88%). A spontaneous onset was observed in 36 cases (83%), while a minority were associated with trauma. Extravasation-type mucoceles were overwhelmingly predominant, 42 cases (97%), and no recurrences were noted. The most frequent histopathological alterations in the associated salivary glands were ductal distension and acinar atrophy, 23 cases (53%).

Conclusion: OMs are frequently seen in young individuals and are usually associated with the extravasation phenomenon. Correlating clinical presentations with histological features may assist in clinicopathological interpretation and improve management strategies for OMs.

Keywords: Extravasation, Pseudocyst, Ranula, Retention, Saliva

INTRODUCTION

A mucocele is one of the most frequently encountered non neoplastic lesions of the salivary glands, characterised by a mucus-filled cavity that primarily originates from the minor salivary glands. Based on the pattern of mucus accumulation, mucoceles are broadly classified into extravasation and retention types [1].

The etiopathogenesis is mainly attributed to mechanical trauma or ductal obstruction. Habitual lip or cheek biting often causes rupture of the salivary duct, leading to extravasation of saliva into the subepithelial connective tissue. The pooled mucus elicits a chronic inflammatory reaction, ultimately resulting in the formation of a cyst-like cavity. In contrast, retention mucoceles occur more commonly in the major salivary glands and are associated with ductal dilatation secondary to obstruction. A distinct variant, known as a ranula, arises from the major salivary glands and is typically located on the floor of the mouth. Ranulas are further classified as oral ranulas, in which mucus accumulates above the mylohyoid muscle, and cervical (plunging) ranulas, where the mucus extends into the neck tissues [2,3].

The clinical diagnosis of mucoceles can be challenging because their presentation often mimics other oral lesions. Although most mucoceles appear as soft, fluctuant swellings with a bluish or translucent hue, variations in size, colour, and consistency may resemble fibromas, lipomas, vascular malformations, or even salivary gland neoplasms- especially when secondary infection or fibrosis modifies their typical features.

One of the major diagnostic challenges lies in correlating clinical presentation with histopathological findings. Clinically, mucoceles are frequently identified based on their characteristic appearance; however, histopathological examination remains essential to differentiate between extravasation and retention types. Misdiagnosis may occur when biopsy specimens fail to include the deeper portion of the lesion or adjacent salivary gland tissue [4].

In addition, mucoceles may induce secondary pathological alterations in the adjacent salivary gland tissue, such as chronic inflammation, acinar degeneration, necrosis, and architectural distortion [5]. Therefore, understanding the association between the clinical features of mucoceles and the histopathological changes in the adjacent salivary gland tissue is of considerable diagnostic and pathological significance. Hence, the present study aimed to evaluate the clinical features of mucoceles and the associated histopathological changes in the adjacent salivary gland tissue in relation to the duration and presentation of the lesion.

MATERIALS AND METHODS

A cross-sectional study was conducted in the Department of Oral Pathology and Microbiology from January 2020 to December 2024, including a total of 43 clinically and histopathologically confirmed cases of OM. Ethical approval was obtained from the Institutional Ethics Committee (SAIMS/IEC/65/24) before data collection.

Inclusion and Exclusion criteria: All mucocele cases with adjacent salivary gland tissue present in the histological sections were included. Cases lacking this feature were excluded from the study.

Study Procedure

Clinical data collected for each case included age, gender, lesion site, history of trauma, duration, clinical presentation (colour and fluctuation), and recurrence. Histopathological evaluation was performed on Haematoxylin and Eosin (H&E) stained slides, which were coded to eliminate observer bias. The assessment was conducted independently by two observers. The following parameters were evaluated:

- Type of mucocele- extravasation or retention;
- Degree of inflammation- mild, moderate, or severe;
- Type of acini- predominantly serous or mucous;
- Changes in adjacent salivary gland tissue- including ductal distension (interlobular and intralobular), acinar atrophy, proliferation of smaller ducts, and the degree of interstitial fibrosis.

STATISTICAL ANALYSIS

Findings from both observers were tabulated for analysis. Descriptive statistical analysis was performed using SPSS version 13.0. Associations between categorical variables were assessed using the Chi-square test, and results were presented in tabular form.

RESULTS

In the present study, OMs were observed among patients aged between 13 and 60 years, with a mean age of 27.9 years. The highest prevalence was recorded in the 21–30 years of age group, 19 cases (44.1%) [Table/Fig-1]. A male predominance was evident, with 30 males (69.8%) and 13 females (30.2%) affected [Table/Fig-2]. The lower lip was identified as the most common site of occurrence 37 cases (86%), followed by the buccal mucosa, 5 cases (11.6%) and the floor of the mouth, 1 case (2.3%) [Table/Fig-3]. With respect to mucosal colour, the majority of lesions appeared pinkish-red 38 cases (88.4%), while a bluish hue was seen in 5 cases (11.6%) [Table/Fig-4]. In terms of consistency, 39 lesions (90.7%) were soft, and 4 (9.3%) were firm [Table/Fig-5]. Likewise, 39 lesions (90.7%) were fluctuant, and 4 (9.3%) were non fluctuant [Table/Fig-6]. The duration of the lesion varied from one to six months. A majority of cases, 27 (62.8%), had a duration of one month, followed by 10 cases (23.3%) for two months, one case (2.3%) for three months, four cases (9.3%) for four months, and one case (2.3%) for six months [Table/Fig-7]. A history of spontaneous onset was reported in 36 cases (83.7%), whereas seven cases (16.3%) had a preceding history of trauma. Among these, three cases (7%) reported trauma one month before lesion appearance, two cases (4.7%) reported trauma two months prior, and one case (2.3%) each reported trauma three to four months prior [Table/Fig-8]. No recurrence was observed in any of the 43 cases during the study period. Histopathological analysis revealed that 42 cases (97.7%) were of the extravasation type, while 1 case (2.3%) was of the retention type [Table/Fig-9]. The degree of inflammation varied, with 16 cases (37.2%) showing mild, 17 cases (39.5%) showing moderate, and 10 cases (23.3%) showing severe inflammation [Table/Fig-10]. Regarding the type of salivary gland associated with the lesion, 38 cases (88.4%) involved mucous glands (acini), four cases (9.3%) involved mixed glands, and one case (2.3%) involved serous glands [Table/Fig-11]. No necrosis was observed in any specimen. Changes in the salivary gland tissue adjacent to the lesions included ductal distension, acinar atrophy, proliferation of smaller ducts, and interstitial fibrosis. Specifically, 23 cases (53.5%) demonstrated ductal distension with acinar atrophy, 13 cases (30.2%) showed ductal distension, acinar atrophy, and ductal proliferation, two cases (4.7%) exhibited only ductal distension, and five cases (11.6%) showed acinar atrophy alone [Table/Fig-12].

DISCUSSION

The OMs are relatively common, with a prevalence ranging from 0.4% to 0.9% in the general population. In some studies, they are reported to affect approximately 2.4 per 1,000 individuals and are recognised as the 17th most common oral lesion [6]. Ranulas are a less frequent subtype, occurring in about 0.2 per 1,000 people.

Age (in years)	n (%)
13-20	9 (20.9)
21-30	19 (44.1)
31-40	11 (25.5)
41-50	2 (4.65)
51-60	2 (4.65)
Total	**43 (100)**

[Table/Fig-1]: Age-wise distribution of oral mucocele cases.

Gender	n (%)
Male	30 (69.8)
Female	13 (30.2)
Total	**43 (100.0)**

[Table/Fig-2]: Gender distribution in oral mucocele cases.

Site	n (%)
Lower lip	37 (86.0)
Buccal mucosa	5 (11.6)
Floor of the mouth	1 (2.3)
Total	**43 (100.0)**

[Table/Fig-3]: Site distribution in oral mucocele cases.

Colour	n (%)
Pinkish red	38 (88.4)
Bluish	5 (11.6)
Total	**43 (100.0)**

[Table/Fig-4]: Colour in oral mucocele cases.

Consistency	n (%)
Soft	39 (90.7)
Firm	4 (9.3)
Total	**43 (100.0)**

[Table/Fig-5]: Consistency in oral mucocele cases.

Fluctuance	n (%)
Present	39 (90.7)
Absent	4 (9.3)
Total	**43 (100.0)**

[Table/Fig-6]: Fluctuance in oral mucocele cases.

Duration of lesion	n (%)
1 month	27 (62.8)
2 months	10 (23.3)
3 months	1 (2.3)
4 months	4 (9.3)
6 months	1 (2.3)
Total	**43 (100.0)**

[Table/Fig-7]: Duration of lesion in oral mucocele cases.

History of trauma	n (%)
Spontaneous development	36 (83.7)
1 month	3 (7.0)
2 months	2 (4.7)
3 months	1 (2.3)
4 months	1 (2.3)
Total	**43 (100.0)**

[Table/Fig-8]: History of trauma in oral mucocele cases.

Histological presentation	n (%)
Extravasation	42 (97.7)
Retention	1 (2.3)
Total	**43 (100.0)**

[Table/Fig-9]: Histological presentation of oral mucocele cases.

Type of inflammation	n (%)
Mild	16 (37.2)
Moderate	17 (39.5)
Severe	10 (23.3)
Total	**43 (100.0)**

[Table/Fig-10]: Type of inflammation in oral mucocele cases.

Type of acini	n (%)
Serous acini	1 (2.3)
Mucous acini	38 (88.4)
Mixed acini	4 (9.3)
Total	**43 (100.0)**

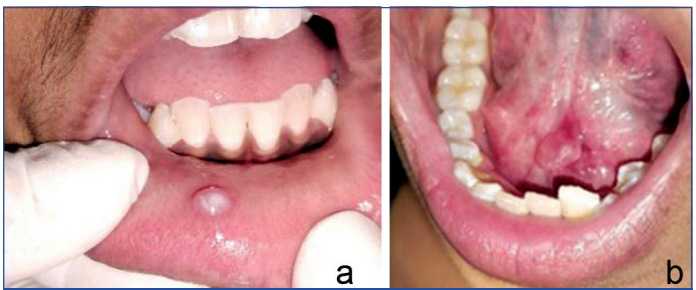
[Table/Fig-11]: Type of acini in oral mucocele cases.

Alteration in salivary gland tissue	n (%)
Ductal distension, atrophic changes of acinar elements	23 (53.5)
Ductal distension, atrophic changes of acinar elements and proliferation of duct	13 (30.2)
Ductal distension	2 (4.7)
Atrophic changes of acinar elements	5 (11.6)
Total	**43 (100.0)**

[Table/Fig-12]: Alteration in salivary gland tissue of oral mucocele cases.

Similar to mucoceles, both are more commonly observed in teenagers and young adults [7].

Clinically, superficial mucoceles manifest as small, elevated, vesicle-like swellings with a bluish translucent hue, typically ranging from a few millimetres to several centimetres in diameter. In contrast, deeper mucoceles present as diffuse, firm, and non tender swellings covered by mucosa of normal colouration. These deeper variants are often asymptomatic and may go unnoticed [8]. Ranulas typically present as bluish, cup-shaped, fluctuant swellings located on the base of the mouth. They are generally larger than mucoceles found at other intraoral sites, often reaching several centimetres in diameter, while usually painless, large lesions may impair speech, swallowing or tongue mobility [9] [Table/Fig-13].



[Table/Fig-13]: Clinical picture of oral mucocele- a) (lower lip) and b) (floor of mouth).

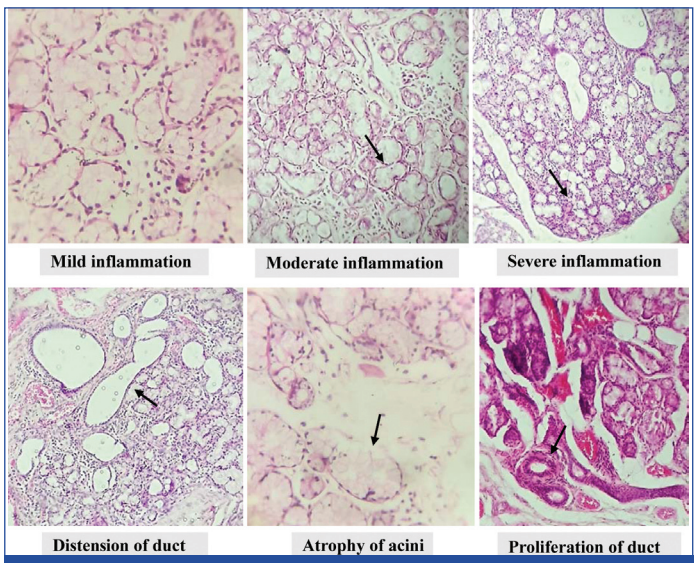
The pathogenesis of mucous extravasation occurs when a minor or major salivary duct ruptures because of trauma. No matter the cause, this rupture causes saliva (mucin) to leak into the surrounding tissues. This leakage triggers an inflammatory response in the area. As a result, granulation tissue forms around the leaked mucin, eventually enclosing it and creating a pseudocyst (a cyst-like structure without an epithelial lining) [10].

The mucous retention phenomenon happens when a salivary duct gets blocked by a stone (sialolith) or a narrowing (stricture). This blockage prevents saliva from flowing from the gland into the mouth, causing it to build up inside the duct. As saliva continues to be produced, pressure increases, gradually stretching the duct to hold the excess saliva. This collected saliva, surrounded by the stretched duct walls, resembles a cyst with an epithelial lining (true cyst). The increased pressure can also inflame the salivary gland, leading to episodes of acute or chronic sialadenitis (inflammation of the salivary gland) [11].

The main cause of ranulas is trauma to the major salivary duct. Less common causes include ductal obstruction (e.g., sialoliths, mucus plugs), chronic inflammation (e.g., sarcoidosis, Sjogren's syndrome), infections (e.g., HIV), or developmental anomalies (e.g., ductal hypoplasia, agenesis, or neoplasia). Anatomical differences, like the duct of the sublingual gland (Bartholin duct) emptying into the duct of the submandibular gland (Wharton duct), can raise the risk of developing a ranula [12,13].

Histopathologically, mucoceles, particularly of the extravasation type, are seen as a collection of mucins within the connective tissue stroma, notably lacking an epithelial lining. The pooled mucin is typically surrounded by compressed fibrous connective tissue or granulation tissue. The adjacent stroma exhibits a dense chronic inflammatory infiltrate composed of foamy histiocytes (macrophages), polymorphonuclear neutrophils, eosinophils, and a prominent population of lymphocytes. In some cases, remnants of ruptured salivary gland ducts may be identified in proximity to the lesion.

The extravasation mucocele is believed to evolve through a triphasic process- initial spillage of mucus, formation of a granulation tissue wall, and subsequent cyst formation [Table/Fig-14]. In the first stage, mucus leaks out from the salivary duct into the nearby tissues. At this point, some white blood cells (leucocytes) and tissue cells called histiocytes are present around the spilled mucus. In the second stage, a granuloma (a small area of inflammation) forms. This happens because of the reaction from histiocytes, macrophages, and large multinucleated giant cells as a response to the spilled mucus acting like a foreign body. In the third stage, a tissue lining called a pseudo capsule develops around the area. This capsule is made up of connective tissue cells and does not have an epithelial lining [14].



[Table/Fig-14]: Histopathological alteration in salivary gland tissue of oral mucocele cases shown by arrow (in black). Mild inflammation (H&E, 40x); Moderate inflammation (H&E, 10x); Severe inflammation (H&E,10x); Distention of duct (H&E,10x); Atrophy of acini (H&E,40x); Proliferation of duct (H&E,10x). (Images from left to right).

Mucous retention cyst presents a small cystic cavity, which is filled with mucous and is lined by flattened cuboidal or columnar epithelial cells of the salivary gland duct. Sometimes, the cyst can be lined by an atrophic stratified squamous epithelium; moreover, in a few

cases, the cystic epithelium exhibits papillary folding, which often projects into the cystic lumen. The mucocele almost always has a minor salivary gland in its vicinity [15].

In the present study, OMs were most prevalent in the second and third decades of life (44.1%) and predominantly affected the lower lip (86%), similar to Hayashida AM et al., who reported 49.4% cases in the second decade and 78% affecting the lower lip [16].

A male predominance was observed (69.8%), similar to findings by with Jani DR et al., (63.9%), Rashid A et al., (57.1%), and Tegginamani AS et al., (M: F ratio 19:6.) [17-19], though Hayashida AM et al., reported a higher prevalence in females (60.1%) [16].

The extravasation type was predominant (97.7%), similar to findings by Jani DR et al. (83.3%), Narendran MR et al., (98.1%), and Bagán Sebastián JV et al., (95%) [17,20,21].

Most lesions had a history of spontaneous onset (83.7%), similar to Rashid A et al., where 71.4% of cases were spontaneous, followed by trauma-related or habit-associated lesions [18].

The colour of lesions in the current study was pinkish-red, indicating that they were not in proximity to the mucosal surface.

In the current study, majority of mucocele cases show moderate inflammation with predominant mucous acini. The most common altered feature seen in adjacent salivary gland tissue was Ductal distension, followed by atrophic changes in acinar elements and proliferation of smaller ducts [Table/Fig-14].

Uncommon histopathological features of OMs include myxoglobulosis, characterised by globular non epithelial structures containing eosinophilic lamellar or fibrillary material, with spherules observed within the lumen or surrounding connective tissue. Papillary synovial metaplasia-like changes demonstrate villous and folded membranous projections partially replacing the granulation tissue at the site of mucin extravasation. Superficial mucoceles are located close to the epithelial surface and may exhibit atypical clinical and histopathological presentations. A rare variant includes the presence of clear cells within the mucosal lesion. In addition, early separation of collagen fibres following mucin extravasation may result in cavity formation, occasionally leading to spontaneous resolution of the lesion [22].

OMs are commonly seen as fluctuant swellings with a soft to firm consistency, easily appreciated upon palpation. Fluctuation is a distinguishing clinical feature that aids in differentiating mucoceles, cysts, abscesses, and haemangiomas from non fluctuant lesions such as lipomas or minor salivary gland tumours [23]. Advanced cross-sectional imaging modalities, including ultrasonography, computed tomography, and magnetic resonance imaging, are instrumental in evaluating deep-seated lesions. Fine-needle aspiration offers a simple yet effective diagnostic tool, particularly useful in excluding vascular lesions from the differential diagnosis. Analysis of the mucocele's aspirated fluid reveals elevated levels of amylase and proteins [24]. However, histopathological examination via biopsy remains the definitive standard for accurate diagnosis.

Differential diagnosis of OMs:

- Lesions with similar clinical appearance: lipoma, haemangioma, traumatic fibroma, oral varicosities [25].
- Superficial mucoceles may resemble: bullous variant of oral lichen planus, mucous membrane pemphigoid, other vesiculobullous disorders [26]

Treatment is determined by the lesion's size and anatomical location. Standard management includes complete surgical excision in which an elliptical incision is commonly used to minimise mucosal tissue loss, reduce the risk of fibrous scar formation, and prevent leakage of cystic contents, which may otherwise lead to recurrence [27]. Complete excision should extend down to the muscle layer and include adjacent glandular acini to minimise recurrence. Care must be taken during suturing to avoid injury to the neighbouring gland or its duct [28]. Marsupialisation, in which a small window is created to facilitate continuous drainage. Micromarsupialisation is an effective alternative in paediatric patients, offering a simple, minimally painful approach with a lower recurrence rate. Several minimally invasive alternatives, such as cryosurgery, provide a non surgical option for OM management [29]. Diode laser ablation is initiated at the central portion of the lesion and extended outward to ensure complete evacuation of its contents [30,31]. Electrocautery and intralesional corticosteroid injections have also shown therapeutic success. The prognosis is generally favourable, with a low recurrence rate following appropriate management [32].

There is a notable paucity of literature addressing the correlation between mucoceles and their impact on adjacent salivary gland tissue; the current study findings will help contribute valuable insights into the impact of the formation of mucoceles on adjacent salivary gland tissue.

Limitation(s)

The sample size (n=43), although sufficient for descriptive analysis, may not be large enough to generalise the findings to the wider population. The study was conducted in a single Institution, which may limit the applicability of the results to other populations with different demographic or clinical characteristics. The assessment of histopathological parameters was based on routine H&E staining; the use of additional histochemical or immunohistochemical markers might have provided deeper insights into glandular alterations and inflammatory responses. Observer bias, though minimised by coding and independent evaluation, cannot be completely excluded in qualitative histopathological interpretation.

CONCLUSION(S)

The present study provides descriptive insights into the clinicopathological characteristics and histological changes associated with OMs, with the highest incidence observed in individuals aged 21-30 years. A clear male predilection was noted, and the lower lip emerged as the most frequently affected site, with predominant extravasation-type mucoceles. Clinically, most lesions presented as soft, fluctuant, pinkish-red swellings, and a majority reported a history of spontaneous development without identifiable trauma. Histopathologically, the extravasation type was overwhelmingly predominant, and associated glandular changes such as ductal distension, acinar atrophy, and interstitial fibrosis were frequently observed. Inflammation was present in varying degrees, but no cases exhibited necrosis or recurrence following treatment. These findings suggest the importance of early recognition, appropriate clinical evaluation, and complete surgical excision, including the involved minor salivary glands, to minimise recurrence. Furthermore, a thorough histopathological examination remains essential for confirming the diagnosis and understanding the underlying tissue changes associated with mucoceles.

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