The Effect of Decompression on Histologic Diagnoses of Cystic Jaw Lesions

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AIM: The aim of this study is to investigate if and how decompression alters histopathologic diagnoses of cystic jaw lesions.
METHODS: A retrospective study was conducted on patients with a histologic diagnosis of an odontogenic cystic lesion that was surgically treated with decompression followed by a definitive surgery. The correlation between variables including age, gender, location of the lesion, decompression time and the change in histopathologic diagnosis following decompression was analyzed.
RESULTS: Thirty-nine patients were included in the study. The mean decompression time was 7.87 ± 3.43 months. Post-decompression histologic examination at time of definitive surgery was consistent with the initial biopsy diagnosis in 83.33% (5 of 6) of odontogenic keratocysts (OKCs), 94.11% (16 of 17) of radicular cysts, 100% of dentigerous cysts, and 100% of residual cysts. The change in histopathologic diagnosis of the cystic lesions was not found to be statistically correlated with the study variables.
CONCLUSIONS: Histopathologic diagnoses of odontogenic cystic lesions predominantly remain unchanged after decompression. A treatment protocol based on the initial diagnosis may be appropriate for odontogenic cystic lesions that are considered for decompression before definitive surgery.

Keywords: biopsy; diagnosis; keratocysts; odontogenic cysts; oral pathology; surgical decompression

Introduction

Jaw lesions of cystic nature are commonly treated surgically using enucleation and peripheral ostectomy when indicated by the histopathologic diagnosis [1]. This approach allows for immediate definitive treatment and requires less patient compliance. However, it is associated with increased morbidity and larger bony defects in affected portions of the jaws [2]. Therefore, techniques that target maintaining reduced intralesional pressure and thereby, shrinkage in lesion volume are also widely practiced in effort to reduce post-surgical defects and the potential to injure neighboring anatomical structures [3].

Decompression and marsupialization, both share the same principle that resides on reduced pressure on adjacent bone and promotion of bone formation that gradually replaces the space previously occupied by the lesion. They are carried out by means of a window created on the lumen of the cystic lesion and suturing edges forming an "open pocket" (marsupialization) or suturing a device in place (decompression) to allow irrigation [4].

The term "decompression" is commonly used to describe the specific procedure of inserting some type of tube, drain, or prosthesis into a cystic cavity to maintain a patent opening into the oral cavity [5, 6, 7]. Decompression typically requires a smaller window and is associated with less morbidity [8]. Both techniques allow for an incisional biopsy if indicated and provide continuous reduced intralesional pressure.

Decompression is routinely practiced and reported for the management of cystic jaw lesions owing to its benefits in achieving a less morbid definitive surgery [9]. However, it is also associated with certain downsides including longer treatment time and the need for patient compliance. Moreover, the technique itself may fail due to displacement of the decompression device resulting in interrupted bony deposition on the periphery of the lesion and reduction in lesion size. However, it is widely regarded as a safe and predictable treatment modality, if performed properly and for the right indications [8].

Decompression of cystic jaw lesions typically extend over several months depending on the nature of the lesion and patient's healing response. It is followed by a definitive surgery once the desired reduction in lesion size is achieved. The time required for reduction in size and the iatrogeni-

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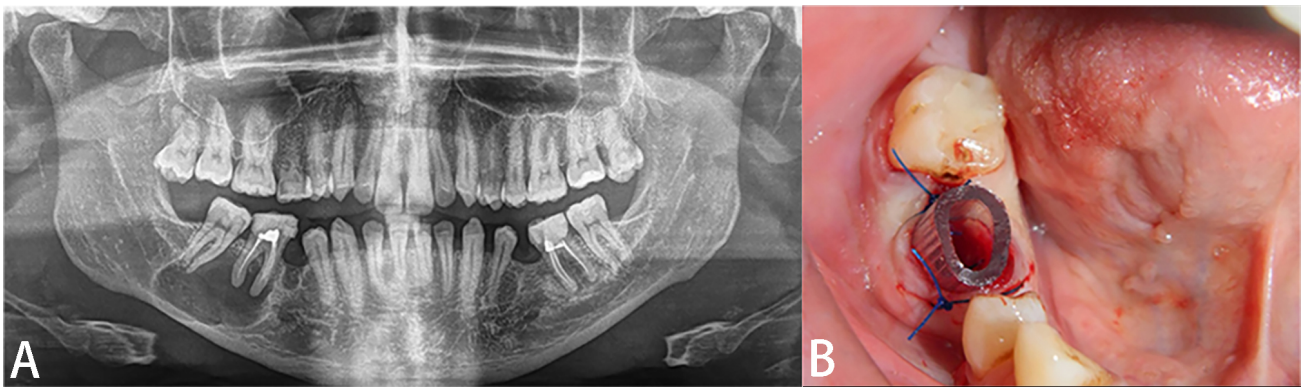

Fig. 1. Decompression procedure of a radicular cyst. (A) Decompression procedure of a radicular cyst. (B) A tube drain is placed and secured in the extraction socket.

cally induced change in nature of the lesion have remained subjects of debate, with some studies reporting change in histologic character over time [10, 11]. This condition may be a concern, specifically if the change is in a direction that requires more complicated treatment protocols.

As with any other treatment, effective and predictable management of cystic jaw lesions require clear understanding of treatment outcomes. In this regard, it is of utmost importance to better understand if and how decompression alters histopathologic character of a lesion in a case, where it is regarded as a treatment option. Therefore, the aim of this study is to understand the effects of decompression of cystic jaw lesions by means of comparing pre- and post-decompression histologic findings.

Material and Methods

The study included patients with a histologic diagnosis of an odontogenic cystic lesion, that was surgically treated with decompression followed by a definitive surgery. The study was carried out retrospectively by means of evaluating records, surgical and histologic reports of patients who were treated at Akdeniz University, Department of Oral and Maxillofacial Surgery between January 2015 and December 2018. To be included in the study, all patients must have had an initial diagnosis of an odontogenic cystic jaw lesion confirmed with an incisional biopsy. Furthermore, the patients must have undergone decompression and, enucleation or enucleation and peripheral ostectomy after decompression period. Previously treated patients, the patients with missing information in medical and/or dental records, and the ones who did not adhere to follow-up protocol were excluded from the study. All patients, and, when applicable, their families or legal guardians, included in the study were informed about treatment and gave their verbal and written consent for clinical and radiological data acquisition as well as for surgical procedures. The Declaration of Helsinki on medical protocol and ethics was followed and Clinical Research Ethics Committee of the Akdeniz University, Antalya, Turkiye approved the study (Approval Number: 70904504/553). This manuscript was prepared according to the STROBE guidelines [12].

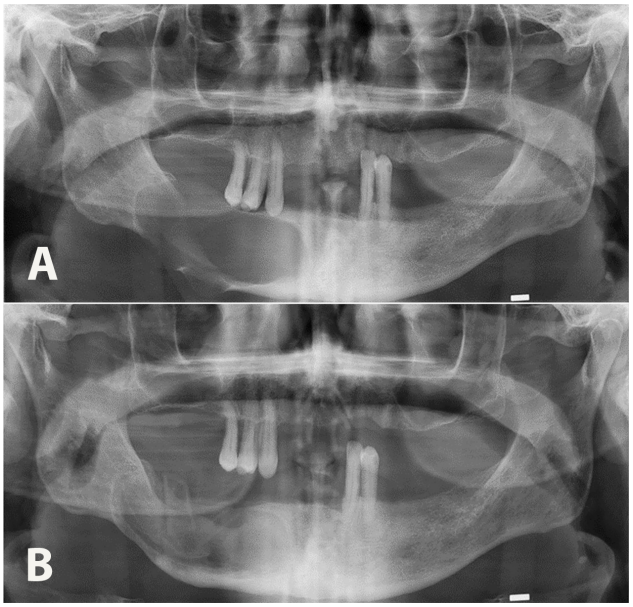

Fig. 2. Definitive surgery is performed after considerable reduction in lesion size and/or distancing from anatomical structures is achieved. (A) Pre-decompression orthopantomogram (OPG) of a cystic lesion extending to the inferior border of the mandible. (B) OPG following 14-month of decompression. A significant reduction in lesion size is observed.

Surgical Procedure

Cystic jaw lesions were initially managed with decompression performed immediately after incisional biopsy. Under local anesthesia, a small bony window was prepared into the lesion after reflection of a mucoperiosteal flap or through the extraction socket of the related tooth and a sample was obtained. A tube drain or multiple drains, if required, were placed into the cavity, and secured to surrounding soft tissues using polypropylene or silk sutures (Fig. 1).

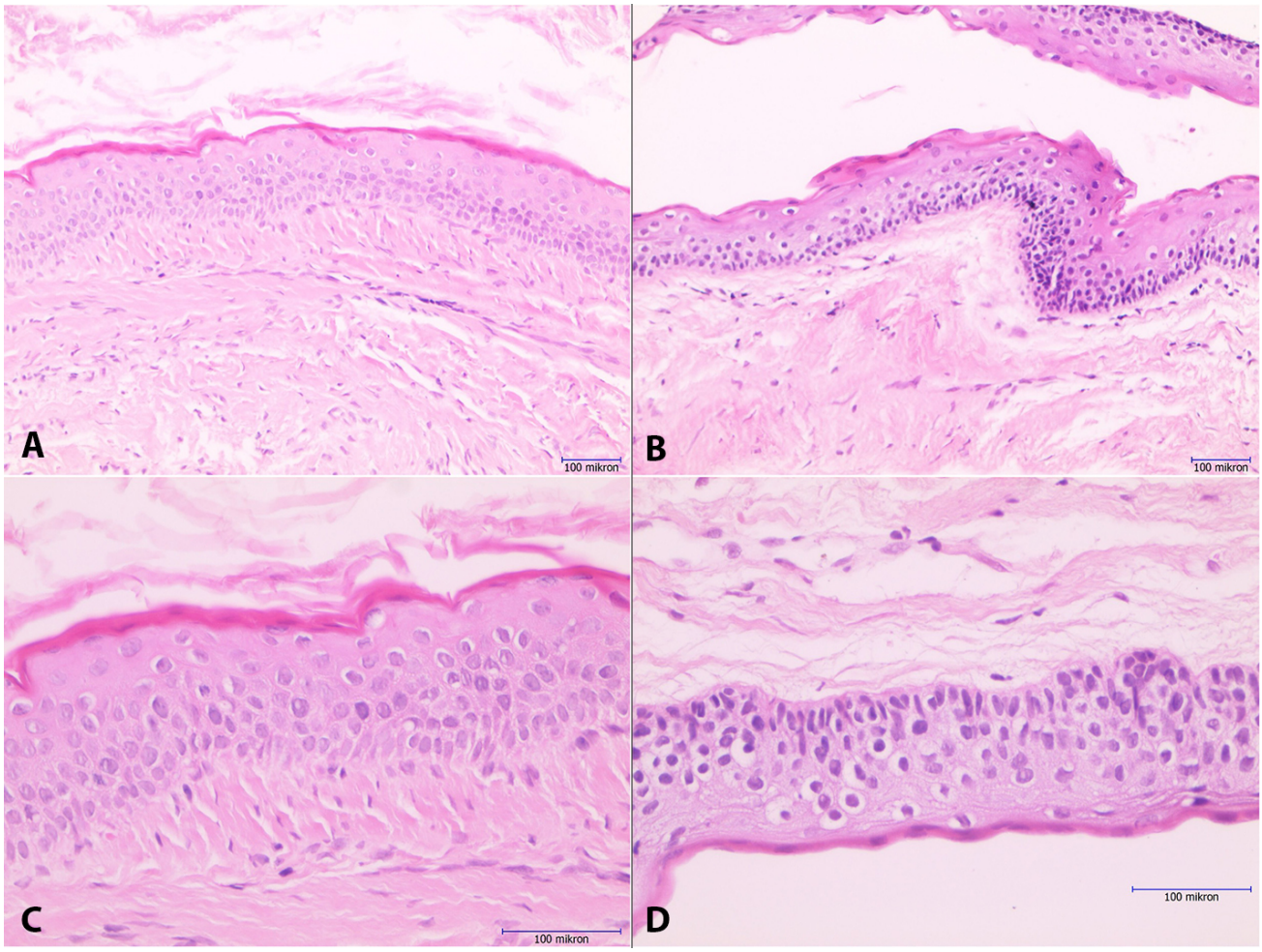

Fig. 3. Histopathologic images of an odontogenic keratocyst of which the pre-and post-decompression diagnoses were consistent. (A,C) Pre-decompression histopathologic evaluation reveals thin and wavy parakeratinized surface, basal cell palisading and mild hyperplasia. (B,D) Post-decompression histopathologic evaluation similarly reveals odontogenic keratocyst epithelium and mild chronic lymphocytic infiltration in the cystic wall. Hematoxylin and Eosin (H&E), (A,B) 200×, (C,D) 400×, scale bar = 100 µm.

Patients were instructed to irrigate the cavity through the tube with sterile saline twice daily during decompression phase of the treatment. The tube drains were adjusted to fit the cystic lesion over time as it decreased in size. The efficacy of decompression was confirmed and the decision to perform the final surgery was made by the same surgeon for all patients, looking at reduction in lesion size and distancing from anatomical structures (inferior alveolar canal, maxillary sinus, nasal cavity) (Fig. 2).

The extent of definitive surgery was determined by looking at reports of initial histologic evaluation and ranged from simple enucleation (dentigerous, radicular, and residual cysts) to enucleation and peripheral ostectomy (odontogenic keratocysts). All specimens obtained after final surgery were sent for histopathologic evaluation and were evaluated by the same pathologist, who also examined initial biopsy samples. Pre- and post-decompression histologic findings were compared in effort to understand if decompression leads to alteration in histologic character and change in diagnoses of lesions.

Statistical Analysis

All data on age, gender, location of the lesion, primary and definitive diagnoses were collected and analyzed using IBM SPSS Statistics for Macintosh, Version 23.0. (IBM Corp., Armonk, NY, USA. Released 2014). Descriptive statistics, including mean, standard deviation, and percentage distributions were used to analyze the data. The data was organized in 2 × 2 contingency tables and tested using Fisher's exact test to investigate the potential relation between variables including age (<50 vs ≥ 50 years) [7], gender, location (maxilla vs mandible), decompression time (<6 vs ≥ 6 months) [13, 14] and the change in initial histopathologic diagnosis following decompression (changed vs unchanged). Differences were considered significant at $p < 0.05$.

Results

The study included 39 patients, 11 (28.2%) females and 28 (71.8 %) males, of average age 40.05 ± 17.10 years

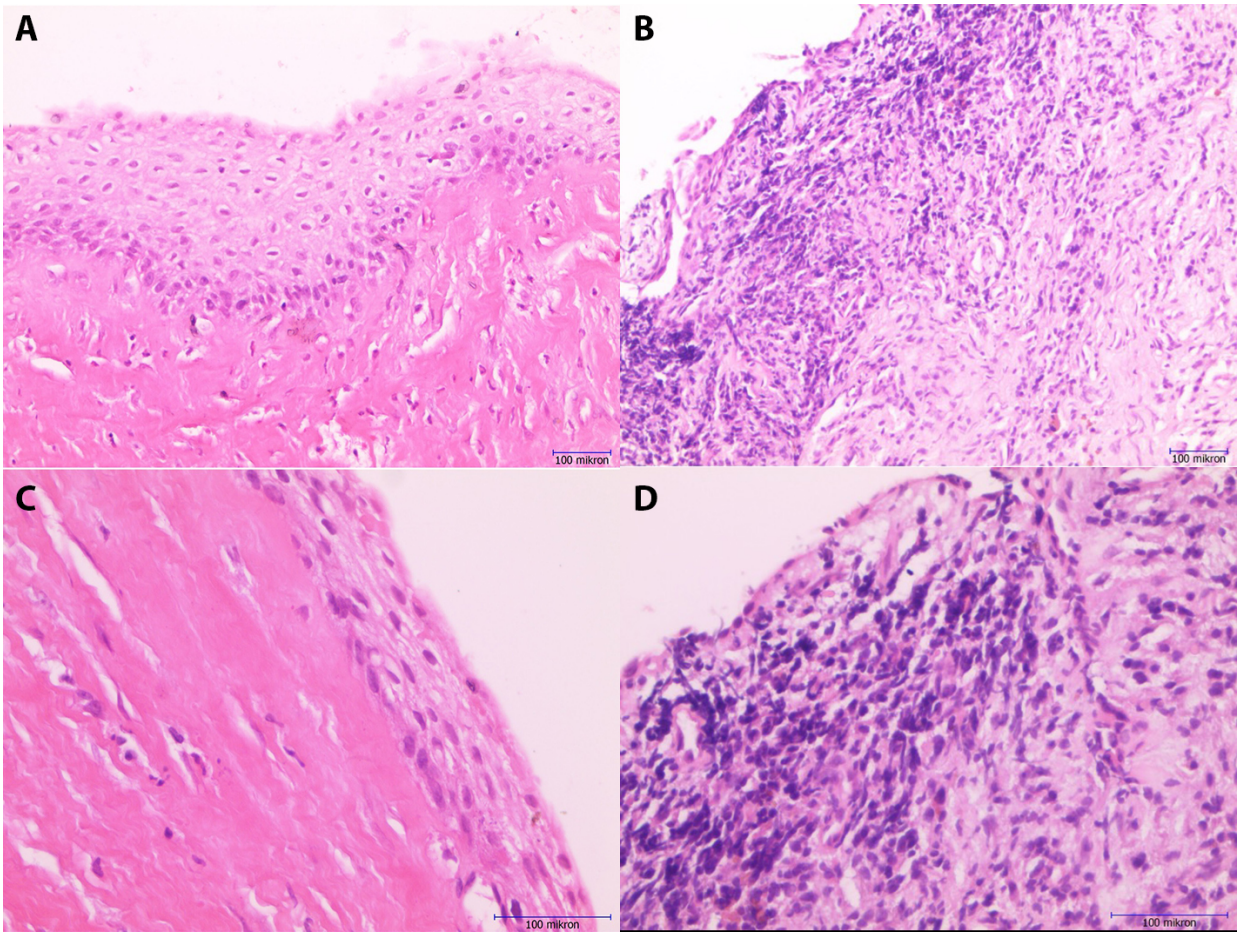

Fig. 4. Histopathologic images of a radicular cyst of which the pre-and post-decompression diagnoses were different. (A,C) Pre-decompression histopathologic evaluation reveals nonspecific squamous epithelial lined cyst with inflammatory cell infiltrates. (B,D) Final histopathologic evaluation after enucleation reveals subepithelial chronic inflammation and normal squamous epithelium. H&E, (A,B) 200×, (C,D) 400×, scale bar = 100 μm.

(range 12–81 years). Lesions were located in the mandible in 66.7% of cases (26 of 39) and the maxilla in 33.3% of cases (13 of 39). The initial diagnoses of the lesions consisted of 13 dentigerous cysts (33.3%), 17 radicular cysts (43.6%), 3 residual cysts (7.7%), and 6 odontogenic keratocysts (OKCs) (15.4%).

All patients tolerated the decompression period well and there were no cases of nerve disturbance, pathologic fracture, or infection. Following a decompression period ranging between 2 and 15 months (mean 7.87 ± 3.43 months), the definitive surgery (enucleation or enucleation and peripheral ostectomy) was performed. Post-decompression histologic examination at time of definitive surgery was consistent with the initial biopsy diagnosis in 83.33% (5 of 6) of OKCs, 94.11% (16 of 17) of radicular cysts, 100% of dentigerous cysts, and 100% of residual cysts (Fig. 3).

Of the 2 lesions, that were not compatible with the initial diagnosis, one was a 17-year-old male patient with an initial diagnosis of radicular cyst and a final histopathologic diagnosis of granulation tissue without the presence of cyst epithelium after 11 months of decompression (Fig. 4).

The second was an OKC in the mandible, which was finally reported as *granulation tissue characterized by chronic lymphoplasmacytic inflammation* following a decompression period of 9 months (Fig. 5).

The change in histopathological diagnosis of the cystic lesions was not found to be statistically correlated with the variables including age, gender, location of the lesion, and decompression time (Table 1). No recurrence was observed during the follow-up period ranging between 5 and 8 years.

Discussion

Decompression is a well-established and predictable treatment modality for various odontogenic cystic lesions with several benefits including preservation of vital structures and tooth vitality, reduction of the risk of jaw fracture and surgically induced morbidity [15]. Despite its safety and efficacy, questions have recently been raised concerning the change in histopathologic features of the cystic lesions following decompression. In this regard, several studies focusing on the histopathological change in OKCs have been performed [16, 17, 18]. However, there is still insuffi-

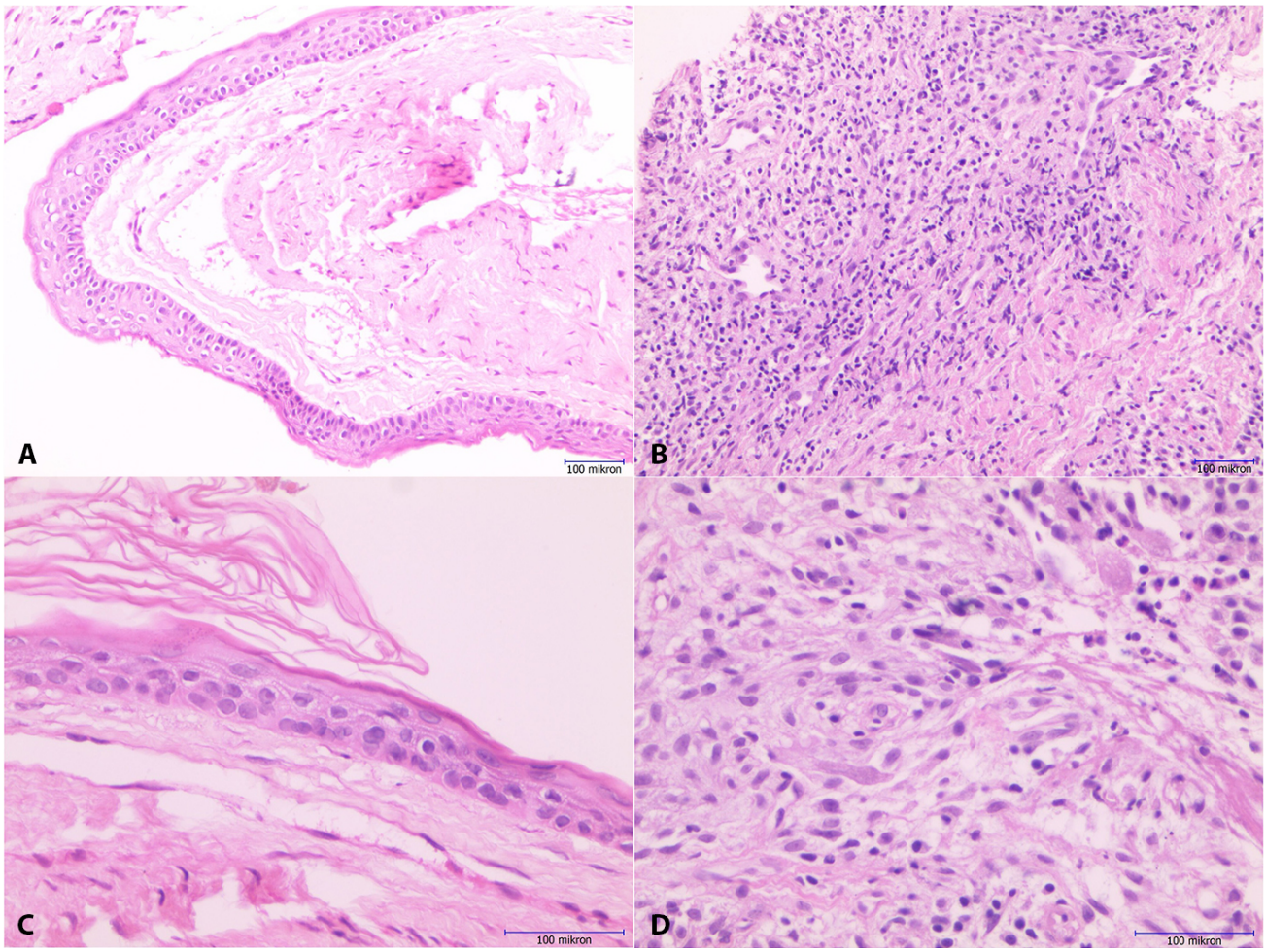

Fig. 5. Histopathologic images of an odontogenic keratocyst of which the pre-and post-decompression diagnoses were different. (A,C) Pre-decompression histopathologic evaluation reveals thin and wavy keratinized epithelium, basal cell palisading and keratin lamellae on surface. (B,D) Final histopathologic evaluation after enucleation reveals chronic inflammation showing lymphoplasmacytic infiltration with acute attacks. Surface epithelium is not visible due to the ulceration. H&E, (A,B) 200×, (C,D) 400×, scale bar = 100 μm.

cient data for other odontogenic lesions of cystic nature. Therefore, the present study was designed to investigate and compare the initial and post-decompression histopathologic findings of various odontogenic cystic lesions and thereby, to determine if decompression leads to a change in diagnosis. The potential association between variables including age, gender, location of the lesion, decompression time and the change in diagnoses were also investigated. The authors of the study are in the belief that a clearer understanding of if and how decompression alters histologic character of cystic jaw lesions may not only contribute to their effective management but also to predictable treatment outcomes.

The present study revealed that 94.87% of the odontogenic cystic lesions were consistent with the initial biopsy diagnosis at time of definitive surgery, after a mean decompression period of 7.87 months. Only 2 cystic lesions (1 OKC and 1 radicular cyst) were found to have changed to prominent subepithelial chronic inflammation following decompression for 9 and 11 months, respectively. These findings support the conclusions of Schlieve *et al.* [7], who found that the histologic diagnoses at time of definitive treatment by enucleation and curettage were predominantly consistent with the pre-decompression diagnoses. In their study, 3 of 25 cystic lesions (a keratocyst, a glandular odontogenic cyst and a dentigerous cyst) were found to have changed after decompression. Similar to the present study, they reported that the change in histologic diagnosis at the time of final surgery were not significantly associated with age and gender. In contrast to our findings, they found significant association between location of the lesion and change in histologic diagnosis in favor of the maxilla. However, in their study, the change was attributed to sampling errors by the authors, making it difficult to draw comparative conclusions.

In their study evaluating the effectiveness of decompression as the initial treatment of various odontogenic lesions, Anavi *et al.* [5] reported that 3 of 28 dentigerous cysts, 15 of 22 OKCs, 14 of 17 radicular cysts and 1 of 2 glan-

Table 1. Correlation between change in histopathologic diagnoses of odontogenic cystic lesions and variables following decompression treatment.

		Histopathological diagnosis		Total	*p*
		Unchanged	Changed		
Gender	Female	11	0	11	1.00
	Male	26	2	28	
Age	<50	24	2	26	0.54
	≥50	13	0	13	
Location	Maxilla	12	1	13	1.00
	Mandible	25	1	26	
Decompression time	<6 months	11	0	11	1.00
	≥6 months	26	2	28	

dular odontogenic cysts did not show same histopathologic features at the time of final enucleation surgery. The authors also reported that 25 cysts were treated by decompression alone and 48 underwent final enucleation surgery. However, these authors did not specifically report on which lesions were treated by decompression alone and which were found to have transformed into scar tissue in the final histopathologic examination. Therefore, a comparison of their findings with those of the current study was not possible.

Another study by Mustansir-Ul-Hassnain *et al*. [19], examined 10 odontogenic cystic lesions including radicular cysts, dentigerous cysts, sialo-odontogenic cyst and OKCs histopathologically and immunohistochemically. The authors reported that the proliferative activity evaluated by Ki-67 marker was significantly greater in pre-decompression epithelial lining compared to post-decompression.

Some findings of the present study also accord with earlier studies conducted within the context of OKCs. In their study, August *et al*. [10] reported that epithelial dedifferentiation and loss of cytokeratin-10 production occurred in 64% of OKCs after decompression for at least 9 months. This finding is in accordance with our results, which indicate a change histopathologic character of an OKC after 9 months of decompression (the longest of all OKCs), while remaining were decompressed for 3 to 7 months.

A more recent study was performed by Castro-Núñez *et al*. [17], to investigate the change in histopathologic diagnoses of OKCs after a 4-week active decompression followed by enucleation and curettage. Five out of 6 OKC lesions were consistent with the initial diagnosis, however, in 1 patient (16.77%), post-enucleation histopathological examination showed marked subepithelial chronic inflammation and normal squamous epithelium. Despite differences in decompression methodology (passive decompression and longer time), a similar histopathological change was observed in the present study in 1 of 6 OKC lesions, of which the final histopathological diagnosis was increased inflammation with non-keratinized squamous epithelium. In accordance with the findings of the current study, Park *et al*. [18] reported that no evidence was found that decompression treatment reduced potentially aggressive behavior of OKC indicating no change in the biological behavior of the epithelial cyst lining or the recurrence rate. Furthermore, in a prospective recent study on 10 OKC lesions initially treated with decompression, all follow-up sections reconfirmed the initial diagnoses and it was concluded that decompression was considered to be the least invasive treatment of choice for OKC [20].

Common remarks regarding the explanation of histological alterations following decompression of odontogenic cystic lesions are increased inflammatory response and reduced intra-lesional pressure [21]. It has been reported that both conditions may predispose epithelial modulation including metaplastic changes with subsequent thickening, which may lead to a realignment in biologic behaviour of the odontogenic cystic lesions [22, 23]. In a study by Zhang *et al*. [24], three patients with OKCs, which had been treated by decompression and subsequently transformed into primary intraosseous squamous cell carcinoma (PIOSCC) were presented. The authors concluded that long-standing chronic inflammation might play an important role in the pathogenesis of PIOSCC ex-OKC.

Certain limitations of the present study need to be taken into consideration when interpreting its outcomes. Among these are, the lack of standardization of decompression duration, differences in histopathological characters and diagnoses of lesions and the limited sample size. Therefore, further research with larger sample size including various jaw lesions of cystic nature and long-term follow-up is warranted to understand the exact mechanism of histologic alteration as well as clinical prognosis following decompression of cystic jaw lesions.

Conclusions

The findings obtained from the current study suggest that histologic diagnoses of odontogenic cystic lesions predominantly remain unchanged after decompression. The change in histologic character after decompression, if any, was benign in character and did not necessitate treatment further than initially planned. Therefore, a treatment protocol based on the initial diagnosis may be appropriate for

odontogenic cystic lesions that are considered for decompression before definitive surgery. Consequently, it can be concluded that decompression, owing to its previously mentioned benefits, can safely and predictably be practiced within the context of change in histologic character of odontogenic cystic jaw lesions. However, in the light of previous literature, proper follow up during and after decompression is still indicated to avoid complications.

Availability of Data and Materials

The datasets used and analyzed during the current study are available from the corresponding author upon reasonable request.

Author Contributions

MAA designed and coordinated the study; MAA, ÖÖ, AS and DK performed the surgical interventions; İHÖ, DK, and ÖÖ acquired and analyzed data; MAA, AS, and ÖÖ interpreted the data; DK, ÖÖ and MAA have been involved in drafting the manuscript and all authors have been involved in revising it critically for important intellectual content. All authors give final approval of the version to be published. All authors have participated sufficiently in the work to take public responsibility for appropriate portions of the content and agreed to be accountable for all aspects of the work in ensuring that questions related to its accuracy or integrity.

Ethics Approval and Consent to Participate

This retrospective study was approved by the Clinical Research Ethics Committee of the Akdeniz University, Antalya, Turkiye (Approval Number: 70904504/553) and The Declaration of Helsinki on medical protocol and ethics was followed. This manuscript was prepared according to the STROBE guidelines. All patients included in the study were informed about treatment and gave their verbal and written consent for clinical and radiological data acquisition as well as for surgical procedures.

Acknowledgment

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Conflict of Interest

The authors declare no conflict of interest.

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