ISSN 0973-2063 (online) 0973-8894 (print)

Bioinformation 22(10): 6704-6709 (2026)

©Biomedical Informatics (2026)

BIOINFORMATION
Discovery at the interface of physical and biological sciences

BIOMEDICAL INFORMATICS

www.bioinformation.net

Volume 22(10)

Research Article

Received October 1, 2026; Revised October 31, 2026; Accepted October 31, 2026, Published October 31, 2026

DOI: 10.6026/973206300226704

SJIF 2026 (Scientific Journal Impact Factor for 2026) = 8.478
2022 Impact Factor (2023 Clarivate Inc. release) is 1.9

Declaration on Publication Ethics:
The author's state that they adhere with COPE guidelines on publishing ethics as described elsewhere at https://publicationethics.org/. The authors also undertake that they are not associated with any other third party (governmental or non-governmental agencies) linking with any form of unethical issues connecting to this publication. The authors also declare that they are not withholding any information that is misleading to the publisher in regard to this article.

Declaration on official E-mail:
The corresponding author declares that lifetime official e-mail from their institution is not available for all authors

License statement:
This is an Open Access article which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly credited. This is distributed under the terms of the Creative Commons Attribution License

Comments from readers:
Articles published in BIOINFORMATION are open for relevant post publication comments and criticisms, which will be published immediately linking to the original article without open access charges. Comments should be concise, coherent and critical in less than 1000 words.

Disclaimer:
Bioinformation provides a platform for scholarly communication of data and information to create knowledge in the Biological/ Biomedical domain after adequate peer/editorial reviews and editing entertaining revisions where required. The views and opinions expressed are those of the author(s) and do not reflect the views or opinions of Bioinformation and (or) its publisher Biomedical Informatics. Biomedical Informatics remains neutral and allows authors to specify their address and affiliation details including territory where required.

Edited by Kaviya Gopinath
E-mail: kaviyagopinath@gmail.com
Citation: De *et al.* Bioinformation 22(10): 6704-6709 (2026)

A comparative evaluation of two treatment modalities for odontogenic keratocyst recurrence: A clinical study

Nayana De[1,*], Aritra Chatterjee[1], Ritoban Saha Bhowmick[2], Md. Arif Hossain[1], Pranay Tumsare[1] & Punan Dhabal[1]

[1]Department of Oral and Maxillofacial Surgery, Dr. R. Ahmed Dental College and Hospital, Kolkata, India; [2]Department of Oral and Maxillofacial Surgery, Manipal Hospitals, Dhakuria, India; *Corresponding author

Affiliation URL:
https://www.radch.edu.in/department/5
https://www.manipalhospitals.com/dhakuria/specialities/oral-maxillo-facial-surgery/

ISSN 0973-2063 (online) 0973-8894 (print)
Bioinformation 22(10): 6704-6709 (2026)
©Biomedical Informatics (2026)

Author contact:
Nayana De - E-mail: nayana.de2011@gmail.com
Aritra Chatterjee - E-mail: c.aritra@gmail.com
Ritoban Saha Bhowmick - E-mail: rsahabhowmick91@gmail.com
Md. Arif Hossain - E-mail: arif.hossain86@gmail.com
Pranay Tumsare - E-mail: pranaytumsare1302@gmail.com
Punan Dhabal - E-mail: drpunandhabalofficial@gmail.com

Abstract:
Odontogenic keratocysts (OKCs) are aggressive jaw lesions with a notoriously high recurrence rate between 12% and 62%. Therefore, it is of interest to evaluate the treatment efficacy of two distinct surgical interventions by randomly splitting 30 patients into two equal groups. Group-A received simple enucleation alone, whereas Group-B underwent enucleation supplemented with a 5-minute Carnoy's solution application. The sample showed a strong male preponderance, third-decade peak, and a 93.4% mandibular localization. Thus, both treatment modalities achieved 0% recurrence and uneventful bony healing over the 12-month follow-up.

Keywords: Odontogenic keratocyst (OKC), enucleation, Carnoy's solution, recurrence rate, chemical cauterization, mandible

Background:
The odontogenic keratocyst (OKC) is histopathologically and behaviorally a unique specific entity, first described in 1876 by Mikulicz **[1]** and named by Philipsen **[2]** in 1956. Reports describe a bimodal age distribution; OKC most commonly occurs in the 2nd decade of life but may occur as late as the 9th decade. The most common area of occurrence is in the mandible and occurs with greatest frequency in the molar-ramus area (42% to 52.2%) Radiologically, OKC is unilocular in most cases (83.2%) as reported by Zhao *et al.* **[3].** Overall recurrence of OKC ranges from 12% to 62%, para-keratinized variety showing more (66% to 94%) recurrence than ortho-keratinised ones. Various methods of palliative and curative treatments for OKC have been advocated, all with the purpose of complete excision and prevention of recurrence. Palliative (conservative) treatment generally includes simple enucleation with or without cauterization or marsupialization. Curative (aggressive) treatment generally includes peripheral ostectomy **[4],** chemical cauterization with Carnoy's solution and resection. Other treatment methods include combination of above-mentioned procedures or decompression followed by enucleation, decompression followed by marsupialization, liquid N2 cryotherapy along with enucleation. Therefore, it is of interest to evaluate the two different techniques *i.e.* enucleation alone and enucleation with chemical cauterisation with Carnoy's solution for the rationale treatment of OKC and was followed up for a period of 1 year to evaluate the rate of recurrence if any.

Materials and Methods:
Following proper clinical, radiological and histological evaluation, 30 patients diagnosed as "Odontogenic keratocyst" were selected for the present study, irrespective of age, sex, caste, creed and religion. Patients who were selected for the present study were asked to sign a printed consent form and the contents were also explained to the patients and accompanying person. In this present study, patients were divided randomly in Group-A (Received simple enucleation as the treatment modality) and Group-B (Underwent enucleation followed by treatment of the bony cavity with Carnoy's solution as the treatment modality).

Patient selection criteria:
Inclusion criteria:
[1] Patients who reported with cystic jaw lesions and diagnosed as OKC from the preliminary incisional biopsy.
[2] Radiological evaluation ascertained sufficient bony margin subsequent to enucleation.
[3] Patients with satisfactory general health with no systemic disease.
[4] Patients who could be readily available for periodic follow - up.
[5] Patients who were willing to participate in the study along with informed consent.

Exclusion criteria:
[1] Patient who were medically compromised.
[2] Radiological evaluation revealing inadequate bone height, or fracture of the jaws or involving the lower border of mandible or antrum.
[3] Cystic jaw-lesions with extra or intra-oral discharging sinuses.
Patients suffering from Basal Cell Nevus Syndrome, usually having multiple OKCs, were not included.

Surgical procedure:
Patients were treated either under General Anaesthesia or Local Anesthesia depending upon the site, size and extent of the lesion, the age of the patient and the duration of the surgical procedure. After standard surgical incision depending upon the site of the lesion, treatment consisted of enucleation (Group-A) or enucleation followed by treatment of the bony defect with Carnoy's solution (Group-B). The incision was sited well in front of and well behind the lesions in situations where bone was not destroyed by the cyst. A plane of cleavage between the soft tissue lining of the cyst and the enclosing bone was utilized to deliver the entire cyst in one piece wherever practicable. Any tooth or root involved in the cyst was then extracted as indicated

and the edges of the cavities were smoothed. A serious attempt was made in all cases to remove the cystic lining intact. In most cases, when the lesion was present particularly in the molar-ramus region, in both the groups' excision of the overlying mucosa in conjunction with enucleation of the cyst was carried out. For the patients who received enucleation followed by treatment of the bony defect with Carnoy's solution (Group-B) same protocol of enucleation was carried out. For the application of Carnoy's solution small gauze was soaked with Carnoy's solution and picked up with a mosquito forceps and kept there for 5 minutes. The clotted blood and necrotic material covering the bony defect were then scraped away and washed out using saline. When the nerve was exposed, a thin layer of petroleum jelly was applied over the nerve, when treating with the Carnoy's solution so as to avoid damage to the nerve **[5]**. In all cases ribbon gauze soaked with Whitehead's varnish solution, (composed of benzoin-3 gm, iodoform-3 gm, prepared storax-2 gm, balsam of tolu-1.5 gm, with solvent ether-24.8 ml) were used to pack the defect. These Whitehead's varnish packs were secured with stay sutures and kept for 7 days. These packs were changed every week until the defect had epithelized and become shallow enough to be cleaned by the patient him or herself. Patients were prescribed routine antibiotics and kept on soft diet for next 7 days. Rich food supplements and vitamins were also given for 7 days. Intraoral flushing with 0.2% Chlorhexidine gluconate and normal saline was done daily. Patients were encouraged to maintain oral hygiene and abstain from any deleterious oral habit.

Follow up:

Assessment of any postoperative complications like wound dehiscence, infection etc. were checked after 7 days and stay sutures were removed. Subsequent follow-up was done at 1 month, 3 months, 6 months, 12 months interval post operatively. During every follow - up, patients were assessed for any signs of recurrence by clinical and radiological means as used pre-operatively.

Post-operative findings:

Neither the patients of Group-A nor the patients of Group-B developed any recurrences as evaluated by the pre-operative clinical and radiological parameters in the follow up period of 1st, 3rd, 6th and 12th month respectively. In all the cases, bony healing was satisfactory and uneventful.

Results:

The age distribution of the 30 patients is shown in **Table 1**. A peak frequency of odontogenic keratocysts (OKCs) was observed in the third decade of life. In the present study which is shown in **Table 1** and Bar Diagram 1 odontogenic keratocysts (OKCs) revealed male preponderance. Out of 30 cases of odontogenic keratocyst (OKC) 2 (6.6%) were in the upper jaw and 28 (93.4%) were in the lower jaw **Table 2.** As shown in **Table 3** out of 30 cases of odontogenic keratocyst (OKC) 11 (36.66%) were in the posterior region only while 15 (50%) cases were involving both the anterior and posterior regions, 2 (6.66%) case were observed to be involving the anterior region only. Expansion of the bony cortical plates: In case of odontogenic Keratocyst (k) 9 (30%) cases revealed mild to less significant degree of expansion **Table 4.** Egg – shell crackling: Egg – shell crackling **(Table 5)** was present in 3 (10%) out of 30 cases of odontogenic keratocyst (OKC) **Table 5.** Outline of the cystic lesion: 22 cases of (73.33%) cysts revealed a regular outline, out of 30 cases of odontogenic keratocysts (OKCs) revealed a scalloped margin while 8 (26.67%) out of 11 cases of odontogenic keratocysts (OKCs) showed the same **Table 6.** Loculation: According to **Table 7** and Bar Diagram 2, 8 (26.67%) out of 30 cases of odontogenic keratocysts (OKCs) were multilocular while 22 (73.33%) were unilocular. Displacement of inferior dental canal: (3.33%) of the 30 cases of odontogenic keratocyst (OKC) showed downward displacement of the inferior dental canal **Table 8.** Impacted teeth: (6.66%) of the total number of 30 cases of odontogenic keratocysts (OKCs) **Table 9**. Root resorption: 11 (36.66%) of the 30 cases of odontogenic keratocysts (OKCs) showed root resorption on the radiograph **Table 10**. Cortical bone perforation: Cyst revealed perforation of the bone while 3 (10%) of the 30 cases of odontogenic keratocysts (OKCs) **Table 11.** Thickness of different cyst linings **Table 12.** Fragility of different cyst linings **Table 13.** Consistency of different cyst linings **Table 14.** Surface texture of different cyst linings **Table 15 Figure 1** odontogenic keratocysts (OKCs) revealed male preponderance, **Figure 2 8** (26.67%) out of 30 cases of odontogenic keratocysts (OKCs) were multilocular while 22 (73.33%) were unilocular. **Figure 3** thickness of different cyst linings, **Figure 4** fragility of different cyst linings, **Figure 5** consistency of different cyst linings, **Figure 6** surface texture of different cyst linings.

Table 1: Frequency of different age groups with sex

Age group	Odontogenic keratocyst	
(Years)	M	F
0-9	-	-
10–19	2	1
20-29	4	3
30-39	13	4
40-49	2	-
50-59	1	-
60 & above	-	-
TOTAL	22	8
Percentage (%)	73.33%	26.67%

Table 2: Distribution of cysts in upper and lower jaws

Jaw (u/l)	K(n=30)	
	Number	%
Upper jaw	2	6.6
Lower jaw	28	93

Table 3: Clinical site of cysts

	K (n = 30)	
	NUMBER	%
Anterior 3-1 1-3	2	6.66
3-1 1-3		
Anterior & Premolars	11	36.7
5-1 1-5		
5-1 1-5		
Anterior, Premolars & Molars	15	50
8-1 1-8		
8-1 1-8		
Molars & beyond	2	6.66
Molars		

Table 4: Expansion of the bony cortical plates

	K (n = 30)	
	Number	%
Present	9	30
Absent	21	70

Table 5: Egg – shell crackling

	K (n = 30)	
	Number	%
Present	3	10
Absent	27	90

Table 6: Radiological outline of cystic lesion

	K (n = 30)	
	Number	%
Regular	22	73.33
Scalloped	8	26.67

Table 7: Pattern of loculation in different cysts

	K (n = 30)	
	Number	%
Unilocular	22	73.33
Multilocular	8	26.67

Table 8: Displacement of inferior dental canal

	K(n = 30)	
	Number	%
Present	1	3.33
Absent	29	96.67

Table 9: Impacted teeth

	K(n = 30)	
	Number	%
Present	2	6.66%
Absent	28	93.44 %

Table 10: Radiological root resorption

	K(n=30)	
	Number	%
Present	11	36.66
Absent	19	63.44

Table 11: Cortical bone perforation

	K(n = 30)	
	Number	%
Present	3	10
Absent	27	90

Table 12: Thickness of different cyst linings

K (n = 30)	
Thick	3
Thin	19
Uneven	8

Table 13: Fragility of different cyst linings

K (n = 30)	
Fragile	19
Intact	11

Table 14: Consistency of different cyst linings

	K (n=30)
Firm	6
Soft	24

Table 15: Surface texture of different cyst linings

K (n = 30)	
Smooth	5
Nodular	3
Irregular	22

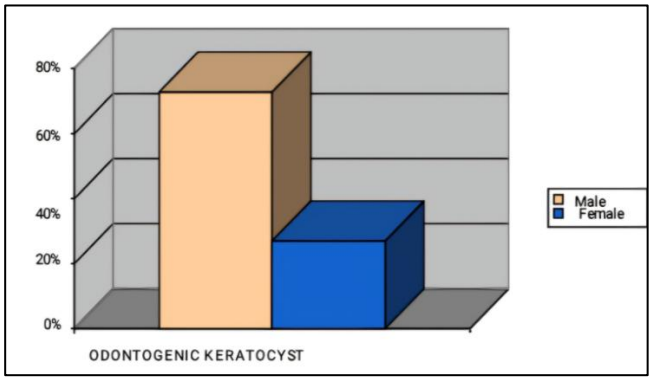


Figure 1: Odontogenic keratocysts (k) revealed male preponderance

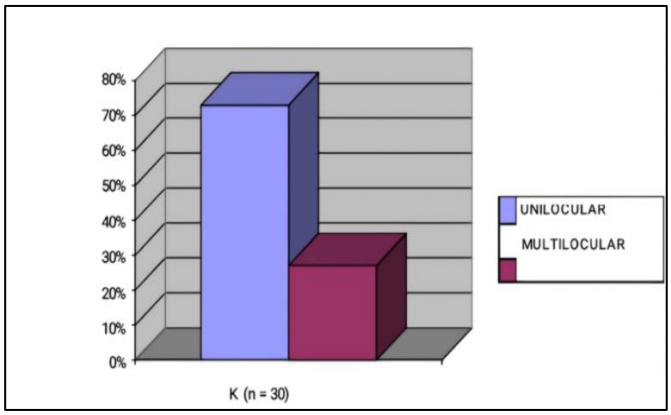


Figure 2: 8(26.67) out of 30 cases of odontogenic keratocysts (k) were multilocular while 22 (73.33%) were unilocular.

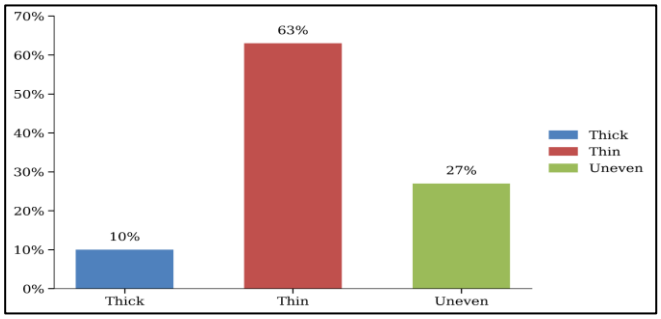


Figure 3: Thickness of different cyst linings

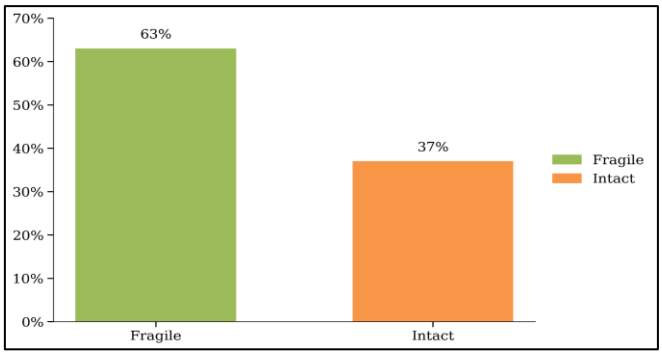


Figure 4: Fragility of different cyst linings

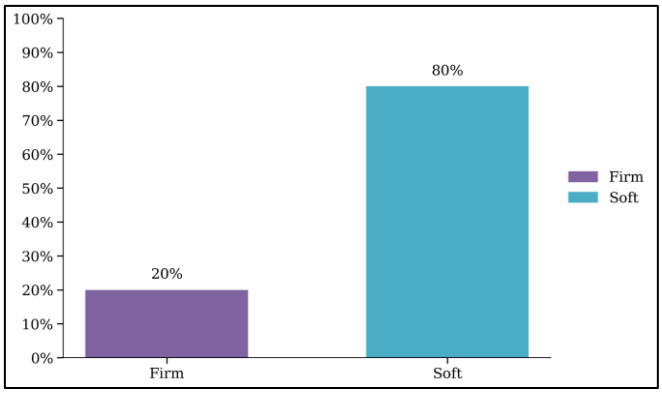


Figure 5: Consistency of different cyst linings

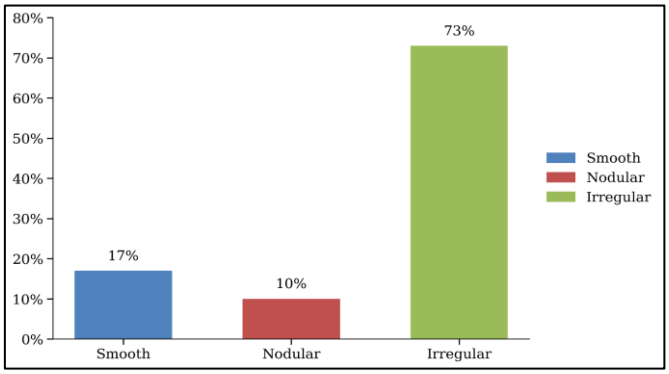


Figure 6: Surface texture of different cyst linings

Discussion:

Altogether 30 uninfected cases of histopathologically proven OKCs were selected for the study. This prospective study evaluated the recurrence rate of odontogenic keratocyst (OKC) after enucleation alone and enucleation with application of Carnoy's solution after enucleation. Treatment consisted of enucleation only (Group-A), enucleation followed by treatment of the bony defect with Carnoy's solution (Group-B). Formulation of Carnoy's solution is chloroform 3 ml, absolute alcohol 6 ml, glacial acetic acid 1 ml, ferric chloride 1 g and used as a sclerosing agent for the treatment of cysts and fistulae **[6].** In the present study a peak frequency of odontogenic keratocysts were observed in the third decade of life in accordance with the studies of Browne **[7],** Payne **[8],** Brannon **[9]** who stated OKCs occur over a wide age range. In most series there has been a pronounced peak frequency in the second and third decades, with figures ranging from 40% to 60% of patients being in this age group. Magnusson **[10]** in his study found a male preponderance with a sex ratio of 2.62:1 which was in accordance to our study. Forsell *et al.* **[11]** pointed out about half of all OKCs occur at the angle of the mandible extending to variable distances into the ascending ramus and anteriorly into the body as in the present study. Forsell *et al.* **[12]** suggested that as the odontogenic keratocysts enlarges it tend to track readily through the medullary bone and gets confined within the unyielding cortical bone involving the body, angle, ascending ramus, giving rise to "boot" or "L" shaped radiolucency. Forsell *et al.* **[11]** suggested that enucleation in one piece may be more difficult with cysts which have scalloped margins and this may explain the high rate of recurrence rather than those with a smoother margin. Shear **[12]** postulated that the scalloped margin suggests that unequal growth activity may be taking place in different parts of the cystic lining and this may be seen in occasional gross specimens which are removed intact. After standard surgical incision depending upon the site of the lesion, treatment consisted of enucleation (Group-A) and enucleation of the cyst was carried out and followed by treatment of the bony defect with Carnoy's solution (Group-B). For this purpose, small gauze was soaked with Carnoy's solution and picked up with a mosquito clamp and kept there for 5 minutes. The clotted blood and necrotic material covering the bony defect were then scraped away and washed out using saline. When the nerve was exposed, either it was lifted out from its bony canal or a thin layer of petroleum jelly was applied over the nerve, when treating with the Carnoy's solution to avoid damage to the nerve. The defects were packed open using ribbons soaked with Whitehead's varnish solution. This procedure was maintained as per guidelines specified by the work of Voorsmit *et al.* **[13],** Vedtofte and Praetorius **[14],** Forssell *et al.* **[11],** Stoelinga **[15].** In both Group A and Group B patients, the cysts were enucleated and the bony cavity of Group B patients were additionally treated with Carnoy's solution and were evaluated carefully following the previously discussed preoperative clinical and radiological parameters and followed-up in the 1st,3rd,6th,12th, months depending upon the initial reporting time. No recurrences were observed in either group during the 12-month follow-up and healing was uneventful. These findings are mostly corroborated by the study of Voorsmit & Stoelinga **[13],** Swanson *et al.* **[16],** Forssell *et al.* **[11]** and Stoelinga and Bronkhorst **[15].** From this study we can conclude that recurrence can be avoided not only by the definitive treatment procedure, but the meticulous performance of a particular treatment modality. Further multicenter studies with larger patient group and longer duration of follow-ups are recommended to corroborate the findings of the present study for their accurate application in clinical practice. Recent systematic reviews comparing adjunctive agents for OKC management report that recurrence and adverse effects vary by treatment modality, and they emphasize the need for longer follow-up and careful consideration of nerve-related complications **[15, 16].** The absence of recurrence in either group in the present 12-month study should therefore be interpreted cautiously.

Conclusion:

Recurrence of odontogenic keratocyst can be prevented not only by the definitive surgical modality chosen, but also by the meticulous and thorough performance of the procedure. Further multicenter studies featuring larger patient cohorts and longer

follow-up durations are recommended to validate these clinical observations.

References:

[1] Jacobs T *et al. J Oral Maxillofac Surg*. 2024 **82:**1433. [PMID: 39038594]
[2] https://www.scirp.org/reference/referencespapers?referenceid=1811033
[3] Zhao YF *et al. oral pathol oral radiol endod*. 2002 **94**:151 [PMID: 12221380]
[4] Eisenbud L *et al. J Oral Maxillofacial Surg*. 1988 **46**:376. [PMID: 3163371]
[5] Aarthi S *et al. Evid Based Dent*. 2025 **26:**151. [PMID: 40269316]
[6] Culter ECMD & Zollinger RMD. *Am J Surg*. 1933 **19**:411 [DOI: 10.1016/S0002-9610(33)90796-5]
[7] Browne RM. *British Dental Journal*. 1970 **128**:225 [PMID: 5270271]
[8] Payne TF. *Oral Surg*. 1972 **33**:538. [PMID: 4502229]
[9] Brannon RB. *Oral Surg*. 1976 **42**:54. [PMID: 1065842]
[10] Magnusson BC. *J Oral Pathology*. 1978 **7**:8. [PMID: 148497]
[11] Forsell K *et al. Int J Oral Maxillofac Surg*. 1988 **17**:25. [PMID: 3127485]
[12] Shear M. *Journal of Oral Pathology*. 1985 **14**:43. [PMID: 3918153]
[13] Voorsmit RA *et al. Journal of Maxillofacial Surgery*. 1981 9:228. [PMID: 6172530]
[14] Vedtofte P & Praetorius F. *Int. J. Oral Surg*. 1979 **8**:412. [PMID: 120338]
[15] Stoelinga PJW & Bronkhorst FB. *J Cranio-Max-Fac Surg*. 1988 **16**:184. [PMID: 3290262]
[16] Swanson KS *et al. Journal of Oral and Maxillofacial Surgery*. 1991 **49**:268. [PMID: 1995816]

Caveat Emptor is applicable among the literate community where required and possible. The publisher, its journal, editors and the internal/external reviewers take adequate steps to check, evaluate, correct, edit, revise and improve content where possible and required.