

# Cone Beam Computed Tomographic with Conventional Type of Inspection and Comparison of Resorption (External): Observation Study

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**Abstract— Aim:** To determine whether there is difference in radiographic signs of external cervical resorption (ECR) by using two devices.

**Methodology:** This study included twenty ECR lesions on routine radiographs collected from diagnostic department data of College of Dentistry / Hawler Medical University. The radiographic clues (periapical [PA] and then cone beam computed tomography [CBCT]) had been recorded and later assessed. Statistical analysis was done on specific evaluation form to determine if there were differences in the presentation between the two devices to this condition (ECR) by specific parameters.

**Results:** Single defects were detected in 90% of samples (18 in no.) in radiographs while multiple defects were detected in 50% of cases (10 in no.) by CBCT; however, only 10% of samples were detected with multiple defects by radiographs (2 in no.).

Patel 2A was the most frequently detected type of ECR (50% of cases), and 3B was reported the least frequent (5%); destructive was higher than reparative type in percentage (80%).

**Conclusion:** When the ECR was evaluated by CBCT, most lesions were sub crestal relation in height and extended circumferentially.

**Index Terms—** CBCT, External cervical resorption, Radiographic features.

## I. INTRODUCTION

Resorption (of External type that present mostly at cervix of the teeth) (ECR) usually presents in the cervical 1/3. The periodontal ligament deficiency may lead to initiation of ECR in addition to that defect in the subepithelial cementum as protective layer might cause this lesion. This process is considered dynamic and involves dentin, periodontium, and pulpal soft tissues<sup>1</sup>. Because a pairing of improved inspection of conventional method with CBCT leads to understanding best of etiological factors<sup>2</sup>. The use of CBCT is more applicable for pairing conventional PA the presence of ECR, with lesion nature (corono-apical and circumferential). This lesson is crucial to decide the active managing ECR, and acts as evaluation as a baseline for untreated cases progression<sup>1</sup>. Heithersay wrote the first review on ECR, evaluating 257 cases for the radiographic presentations' prevalence that different<sup>3</sup>. Irinakis and his colleagues and Mavridou evaluated 98 and 313 cases of ECR in row<sup>1,4</sup>. Both showed the radiographic appearance and decided the ECR diagnosis provisionally. The

CBCT use in endodontic therapy has focused on the less noticed results, the size of those lesions was misdiagnosed and might considered as under-estimation specially when inspected with PA<sup>2</sup>. Precise inspection can only be executed with PA when ECR is limited to the proximal side of a tooth. The buccal or palatal/lingual surface lesions cannot be accurately inspected. Little information about the difference between two devices for assessing the ECR; therefore, the objective of the paper was to explore signs and features of ECR by those two techniques.

## II. MATERIALS & METHODS

The collected previous radiographs that diagnosed as ECR lesions were confirmed by two experienced specialist endodontists and prior to study data analysis, the examiners were simulated using radiographic data for 10 ECR cases which were rule out of experimental data. The evaluators accepted diagnosis confirmation, variables and factors were reached a correlation to decide the extent of the ECR and its nature. Moreover, Patel classification was discussed, and agreement also was confirmed about the results about those ten ECR cases. Classification of Patel (3D) based on the CBCT and PA and findings was used to discuss the nature of that lesion (Patel et al., 2018). Digital system was used for PAs by paralleling maneuver and beam-aiming tool (Rinn sensor holder XCP-DS; Dentsply Corporate). The X-ray machine (digital CCD sensors at 60kV, 7.5mA, 0.13-0.2 s) was executed the record.

For confirmation purposes, all PAs were recorded acceptable from diagnosis point of view. A small volume CBCT scanner was executed (3D Accuitomo 80; J Morita Manufacturing) with a 4×4cm field of view, 0.08mm of voxel size and 0.640mm slice thickness set at 90kV (tube voltage), 4-5mA, and an exposure time of 17.5s. CBCT scans were reformatted (0.125mm slice intervals and 1.5mm slice thickness).

The CBCT & PAs of twenty cases (One-Volume Viewer, J Morita) were reviewed using high-resolution monitors (Radforce; Eizo) in a condition of dimmed lighting room that considered as quit circumstances to inspect images. Statistical analysis was executed to determine the percentage of each variable. Statistical analysis was done using percentages, tables and bar charts as descriptive types of statistics<sup>4</sup>.

III. RESULTS

The percentage of detected ECR as single and multiple defects in both radiographs & CBCT was presented in Table 1. The Patel (3D) classification was used as evaluation parameters and shown in Figure 1.

TABLE I  
PERCENTAGE OF ECR DETECTED IN ALL CASES

	No. of ECR defects	Radiographic detection	%	CBCT detection	%
All ECR defects	33	20	100%	20	100%
Single defect	10	18	90%	10	50%
Multiple defects	23	2	10%	10	50%

- Patel classification
- 1: At cemento-enamel junction level or supracrestal
  - 2: Extends into coronal-third of the root subcrestal
  - 3: Extends into middle third of the root
  - 4: Extends into apical-third of the root
- A:  $\leq 90^\circ$   
 B:  $> 90^\circ$  to  $\leq 180^\circ$   
 C:  $> 180^\circ$  to  $\leq 270^\circ$   
 D:  $> 270^\circ$
- Limited to dentine or (probable) pulp involvement
- Type
- Destructive
  - Reparative

Fig. 1. The Patel (3D) classification<sup>5</sup>

Features of ECR were detected according to Patel classification and the percentage of each feature was shown in Table 2.

TABLE II  
ECR FEATURES PERCENTAGES

Class	No. of ECR defects	%	Type of ECR (No.)	%	%
2A	16	50	Destructive	100	Destructive
2B	7	20	Destructive	100	80%
1A	4	12.5	Reparative	100	Reparative
3A	4	12.5	Destructive	100	20%
3B	2	5	Destructive	100	

The most frequent showing was Patel 2Ap (50%, n=16), while the least one was Patel 3Bp (5%, n=2). Stage of ECR was inspected in the resorptive (destructive) and reparative phases in 80% and 20% of the cases in row. See Figures 2-5.

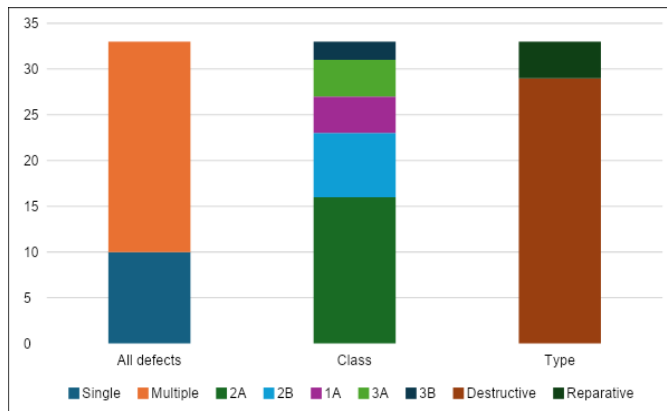


Fig. 2. Statistical description

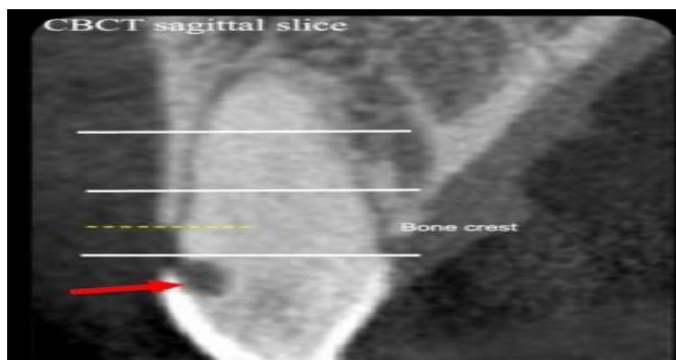


Fig. 3. 1A

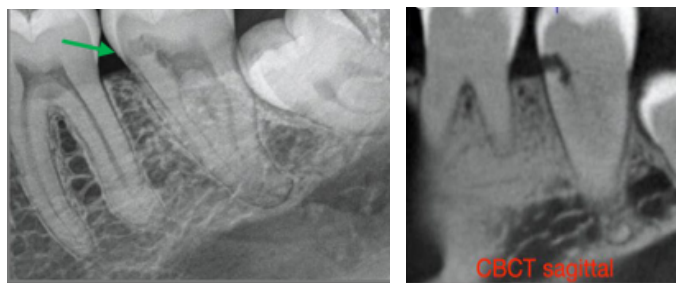


Fig. 4. 2B



Fig. 5. 3B

#### IV. DISCUSSION

Till now, there is little literature information assessing the difference between the presentation of ECR in conventional method (PA) and CBCT. From the author's point of view, it might be considered as the first study to analyze the presenting signs of radiographic findings of ECR. Previous research (the clinical ones) has just consisted of an analysis partially of symptoms of the patient's, clinical and radiographic findings<sup>1,4,6</sup>. It is doubtful to compare the results in this study with the presenting old observational reports have not extensively assessed the details of presenting signs. This might be attributed that these studies having objectives those might be not complement with present aim, inspecting potential affecting factors, distributing teeth and/or traditional signs<sup>4,7,8</sup>. The sample size in this study might gave an idea about reliability that was simplified and ultimately the importance of the results; 50% (n=10) of cases had one ECR or more lesion and those detected by CBCT alone since the radiographs revealed only 10% of cases had multiple lesions. Previous research in literature, especially studies of observation type concluded the incidence of lesions of multiple design ranged from 11.2% (32 of 284 cases) to 12.7% (15 of 118 cases)<sup>9,10</sup>. Diagnosis and/or management through CBCT is only acceptable when the resorption is doubted beyond examination clinically and traditional maneuver<sup>11</sup>. In this study, many of those lesions were detected as accidental findings by x-ray with being inspected firstly on PA, and a further being decided with CBCT. 'hidden' lesions might be shown on CBCT and/ or confirm the inspection of multiple resorption which might be considered misdiagnosed or undertaken<sup>10</sup>.

Vaz de Souza and his colleagues simulated different sized ECR defects in human dry jaws and found that images of CB were more precise in diagnosing resorption than periapical one<sup>12</sup>. In a study evaluating 115 teeth clinically with resorption; the overall precision of traditional maneuver was significantly less than CB, thus it was of lower inspection and less advantage of planning for management of resorption with traditional method<sup>13</sup>.

The classification of Heithersay was executed to be used with traditional maneuver only and in one research to inspect its accuracy was concluded to be 48.5% precise<sup>12</sup>. Three evaluators calibrated in other study independently and inspected 168 resorption lesions. They found that there was poor justification among them when classifying the resorption lesion with conventional maneuver using the classification of Heithersay<sup>8</sup>. Therefore, the classification was not applied in this study as the two-dimensional design does not reveal predictably the maneuver of resorption on the non-proximal walls or lesion depth - these properties can only be executed with CB<sup>2,14</sup>.

Classification of Patel was applied in this study as it showed a more precise inspection of descriptive design of resorption. It is expected that Patel one will show an objective evaluation of the outcome of treatment and complying to the three-dimensional nature of resorption<sup>11</sup>.

In the present study, resorption affects four walls of the tooth that to be single-rooted teeth. This might be to root sides

circumference that was lower to resorption ratio in relation to the bigger surfaces. CB confirmed that resorption mostly acts on the buccal or lingual sides of the root. Stresses occlusally transferred to the buccal/labial walls might lead to the features and/or composition of the cementum in this area changes<sup>1</sup>. Matny and his colleagues showed that 65% of patients they inspected had less than 180 degrees spread all around the root<sup>8</sup>. The lower tendency of teeth with 3 and 4 sides influenced may be partly because they were symptomatic beyond events and therefore being extracted and/or treated because of the fine prognosis of advanced resorption<sup>1</sup>.

The height of most lesions (70%) was limited to sub crestal root, comparable findings by Irinakis et al. were found (51%) and Matny et al. (46%)<sup>4,8</sup>. This might be attributed to the critical nature (self-limiting), detection early of resorption or advanced untreatable cases may have become extracted since they were symptomatic<sup>4,8</sup>.

Although many resorptions being in proximity to the root canal or resorptive (destructive) (80%) in design, many lesions had no clinical signs or asymptomatic; they were commonly discovered as an accidental traditional sign. The findings comply with those concluded by Irinakis et al. and Nosrat and his colleagues<sup>4,6</sup>. The maneuver of resorption may be due to the slow resorption progression relatively, delay symptoms of pulp canal by signals from the resorptive side, the Peri-canal resorption, pulp stones formation and calcifications or deposition of pre-dentine preventing that increased<sup>15</sup>.

A radiolucent lesion was considered as 'resorptive' (destructive), and 'reparative' if it was radiopaque or at least cloudy on both techniques<sup>5</sup>. Most of the cases (80%) being resorptive (destructive) may review that the lesions were inspected earlier relatively, that is, prior they could repair themselves with bonelike (reparative) tissue or that the phase reparation is not common. The two evaluators were experienced clinicians' academics with +20 years' skill between them and executed panel to assess the conventional data. Both had skills in the interpretation of both techniques and executing clinical study in both resorption and CB particularly viewed and focused with resorption as the diagnosis is relevant on the lesion nature in vision.

Future focus required to evaluate the treated and untreated teeth output that are being checked on watchful waiting and to inspect if there is relationship between the maneuver of resorption on initial inspection and treatment prognosis options.

#### CONCLUSION

The study presented the resorption (ECR), radiographically and by CBCT varied; many cases of multiple lesions were not detected unless the use of CT. Most lesions were resorptive (destructive) in nature. When assessed with the Patel classification most lesions were sub crestal relation in height and extended circumferentially.

## REFERENCES

1. Mavridou, A.M., Rubbers, E., Schryvers, A., Maes, A., Linssen, M., Barendregt, D.S. et al. A clinical approach strategy for the diagnosis, treatment and evaluation of external cervical resorption. *International Endodontic Journal* 2022, 55, 347–373.
2. Mazón, M.G., Garcia-Font, M., Doria, G., Durán-Sindreu, F. & Abella, F. Influence of cone-beam computed tomography in clinical decision-making among different specialists in external cervical resorption lesions: a before-after study. *Journal of Endodontics* 2022, 48(9), 1121–1128.
3. Heithersay, G.S. Invasive cervical resorption: an analysis of potential predisposing factors. *Quintessence International* 1999, 30, 83–95.
4. Irinakis, E., Aleksejuniene, J., Shen, Y. & Haapasalo, M. External cervical resorption: a retrospective case-control study. *Journal of Endodontics* 2020, 46, 1420–1427.
5. Patel, S., Foschi, F., Mannocci, F. & Patel, K. External cervical resorption: a three-dimensional classification. *International Endodontic Journal* 2018, 51, 206–214.
6. Nosrat, A., Dianat, O., Verma, P., Levin, M.D., Price, J.B., Aminoshariae, A. et al. External cervical resorption: a volumetric analysis on evolution of defects over time. *Journal of Endodontics* 2022, 49, 36–44.
7. Jeng, P.Y., Lin, L.D., Chang, S.H., Lee, Y.L., Wang, C.Y., Jeng, J.H. et al. Invasive cervical resorption-distribution, potential predisposing factors, and clinical characteristics. *Journal of Endodontics* 2020, 46, 475–482.
8. Matny, L.E., Ruparel, N.B., Levin, M.D., Noujeim, M. & Diogenes, A. A volumetric assessment of external cervical resorption cases and their correlation to classification, treatment planning, and expected prognosis. *Journal of Endodontics* 2020, 46, 1052–1058.
9. DeLuca, S., Choi, A., Pagni, S. & Alon, E. External cervical resorption: relationships between classification, treatment, and 1-year outcome with evaluation of the Heithersay and Patel classification systems. *Journal of Endodontics*, 49, 467–477. *European Society of Endodontology*. (2018) *European Society of Endodontology position statement: external cervical resorption*. *International Endodontic Journal* 2023, 51, 1323–1326.
10. Mavridou, A.M., Bergmans, L., Barendregt, D. & Lambrechts, P. Descriptive analysis of factors associated with external cervical resorption. *Journal of Endodontics* 2017, 43, 1602–1610.
11. Patel, S., Krastl, G., Weiger, R., Lambrechts, P., Tjäderhane, L., Gambarini, G. et al. ESE position statement on root resorption. *International Endodontic Journal* 2023, 56, 792–801.
12. Vaz de Souza, D., Schirru, E., Mannocci, F., Foschi, F. & Patel, S. External cervical resorption: a comparison of the diagnostic efficacy using 2 different cone-beam computed tomographic units and periapical radiographs. *Journal of Endodontics* 2017, 43, 121–125.
13. Patel, K., Mannocci, F. & Patel, S. The assessment and management of external cervical resorption with periapical radiographs and cone-beam computed tomography: a clinical study. *Journal of Endodontics* 2016, 42, 1435–1440.
14. Ferreira, M.D., Barros-Costa, M., Costa, F.F. & Freitas, D.Q. The prevalence and characteristics of external cervical resorption based on cone-beam computed tomographic imaging: a cross-sectional study. *Restorative Dentistry and Endodontics*. 2022, 47, 1–12. Available from: <https://doi.org/10.5395/rde.2022.47.e39>
15. Mavridou, A.M., Hauben, E., Wevers, M., Schepers, E., Bergmans, L. & Lambrechts, P. Understanding external cervical resorption in vital teeth. *Journal of Endodontics* 2016, 42, 1737–1751.