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Original Research Article

Noise reduction effect on evaluation of apical root resorption in digital radiography: An in vitro study

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Abstract: The purpose of the current study was to evaluate noise reduction effect on apical root resorption evaluation in digital radiography. In the present experimental study, 60 extracted lower premolars with sound roots were used. The teeth were fixed in a dry human mandible for radiographic evaluation. Digital radiographs were taken before and after artificial external root resorption on the mesial side of the apical third by a #¼ round bur and transferred to SCANORA software. Then all the radiographs were examined by one radiologist twice, with and without the option of noise reduction, with a one-week interval between the readings. The radiographs were scored in two groups: 0 and 1, without and with root resorption, respectively. Resorptions were measured by Williams probe and considered as the gold standard. Data collected from the digital radiographs were processed and the gold standard values were analyzed by SPSS 23 using McNemar and Cochran tests ($\alpha = 0.05$). There were significant differences in frequencies of detection of root resorption between the three groups (standard, processed with the noise reduction option and processed without the noise reduction option) (p value < 0.001). There were no significant differences between the group processed with the noise reduction option and the group processed without the noise reduction option (p value = 0.774).Based on the results of this study application of noise reduction option in SCANORA software has no effect on the diagnosis of periapical lesions.
Keywords: Digital radiography, Image processing, Noise, Root resorption

INTRODUCTION:

In order to do an appropriate root canal therapy (RCT) it is necessary to be familiar with root canals anatomy. Dental radiography in the most important way to evaluate root canals. One of obstacles in RCT is external root resorption (ERR) in which osteoclasts resorb external root surface. Osteoclasts demand appropriate blood supply to resorb root surface, so external root resorption usually occurs where root surface is in contact with soft tissue [1]. Etiology of ERR is still unknown but peri-apical infection, trauma and orthodontic movements are considered to be some of ERR reasons [2].

Digital radiography has revolutionized dental radiology systems. Many reasons like processing errors, conventional lead sheets and the ability of transferring data without reduced quality and less exposure time for patient has led us to digital systems.

Digital radiography has countable benefits like fast processing, reduced exposure time and less noise than conventional radiography [1]. Digital images are easily modifiable with alteration their contrast and density in order to identify any lesion in hard or soft tissue easier [1]. Corrected digital images are made with alteration of contrast of images and tube angle in software programs and have higher quality than non-corrected digital images [3].

Digital plates have pixels or light-sensitive portions instead of silver halide parts, these pixels are made of several gray scales based on amount of exposure [4]. An opaque layer on image and fogginess of the image is called image noise which interferes with accurate diagnose from image [1].

Various software programs are available to process dental image, Scanora (Soredex, Finland) is considered to enhance image quality [5, 6]. Goudarzipour *et al.;* compared software programs in determining working length of root canal in which Trophy and Cygnus media software programs showed higher efficacy than standard type [7].

Schmitd *et al.;* declared that modifying contrast and resolution elevates diagnosing ability [8]. Mehdizadeh and Dolatyar evaluated “Adaptive

histogram equalization" tool on quality of peri-apical region images, which showed that using this tool can elevate image quality and reveal more data for the dentist [9]. Purpose of this article is to study the effect of noise reduction on apical root resorption evaluation in digital radiography with Scanora software in digital radiography.

METHODS AND MATERIALS

This in-vitro experimental study was performed in Torabinejad research center in Isfahan University of medical science. 60 human extracted pre molars without any ERR were used. Teeth were kept in thymol (Goldaru, Isfahan, Iran). Teeth with any filling, RCTs, fractures or horizontal resorption in root surface were excluded from the study.

CCD sensor (Cygusmedia, Finland) was fixed to the lingual surface of a dried human mandible, and each sample was exposed with Planmecca device(Planmecca, Finland) for 0.03 second with 63 kVp and 10 mA. Then artificial root resorption was made on samples without one, on their apical third with $^1/_4$round bur (Teezkavan, Tabriz, Iran), and another radiography was taken from them with same exposure details.

Images were processed with Scanora software and were evaluated by a dental radiologist 2 times with one week in between with and without noise reduction and they were coded. Presence or absence of ERR was evaluated with digital ruler(Guanglu, China) (sensitive for 0.01 mm) and they were coded "0" for " no resorption and "1" for presence of resorption.

Amount of ERR was measured with a Williams probe (Williams, Hu fridey, USA) and was recorded as gold standard. Then measured ERR from Scanora software with and without noise reduction was compared to the gold standard and all data were analyzed with SPSS 23 (SPSS Inc., Chicago, USA) using Cochran an McNemar tests (α=0.05). Measure of Agreement Kappa was used to evaluate radiologist's evaluating situation within a week.

RESULTS:

Cochran test showed a significant statistical difference in diagnosing ERR between all three groups(Standard (a), processed with noise reduction sensor(b) and processed without noise reduction sensor(c)) (p value < 0.001). McNemar test also showed a significant statistical difference between group a and c.(p value <0.001)(figure 1).

There was also a significant difference between group a and b.(p value <0.001)(figure 2).

But there was no significant difference between group b and c.(pvalue=0.774)(figure 3)

Kappa was measured =0.640 with p value less than 0.001 for agreement between noise reduction group and no-reduction group. Kappa was measured =0.762 with p value less than 0.001 for agreement between specialists analyze within a week.

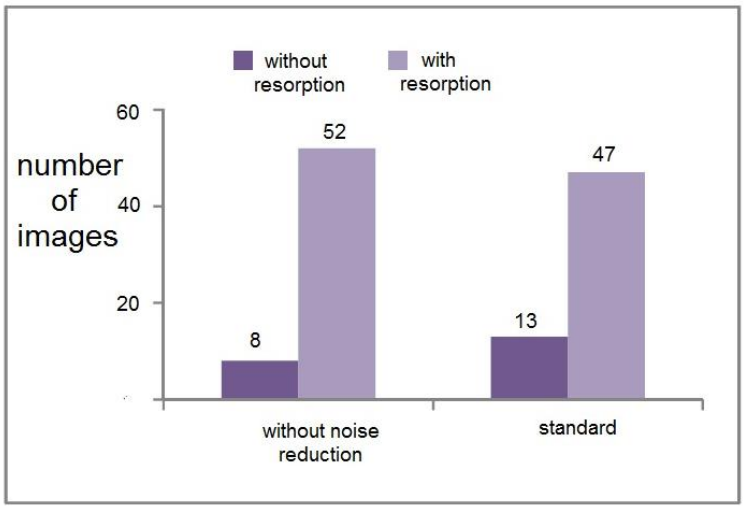

Fig 1: Comparison of diagnosing ability between groups a and c

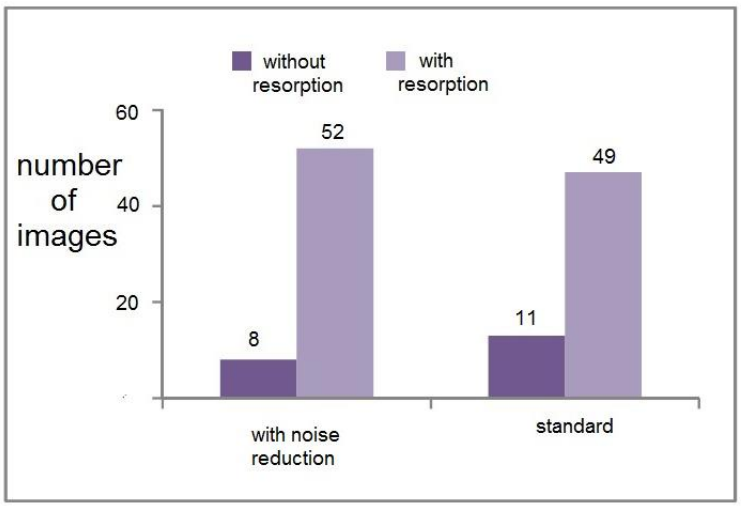

Fig 2: comparison of diagnosing ability between groups a and b

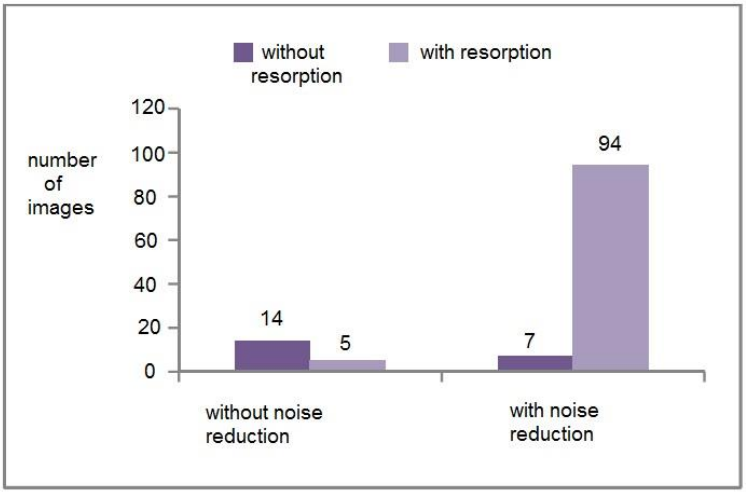

Fig 3: comparison of diagnosing ability between groups b and c

DISCUSSION:

Mehdizade *et al.;* study is one of the studies which has evaluated digital radiography accuracy, algorithms and diagnostic ability for various lesions [10]. This study was performed to evaluate digital radiography's diagnostic accuracy for internal root resorption in lower pre molars. This study showed that corrected digital images enhance the ability to diagnose internal root resorption. According to this study [10] using software tools enhanced diagnostic ability for internal root resorption while data from current study showed no significant enhancement for diagnosing external root resorption.

Lofthang-Hansen *et al.;* [11] evaluated marginal bone level around human mandibular dental implants and declared that Scanora software has facilitated studying marginal bone level around implants. Also differences between observers between digital images in Scanora software and conventional peri apical images were significant.

Hintze [12] couldn't find any significant differences between various digital software programs in detecting dental caries. But in current study differences for external root resorption between using "noise reduction" tool and not using it comparing to standard method were significant(p value<0.001). This difference may be influenced by using different systems in current study.

Poornima and Subba Reddy [13] declared that detecting lateral canals is more accurate in this order:1- decalcification 2- histological sections and 3- digital radiography. In current study some samples which had no ERR showed resorption in Scanora software with noise reduction tool. This may be biased by high sensitivity of this tool which leads to false positive results.

Processing digital images with different algorithms relies on operator's knowledge and technique which can lead to inconsistency of results between different articles. Measure of Agreement Kappa was measured 0.762 which shows agreement

between operator's opinion about images with and without noise reduction within a week.

CONCLUSION:

Based on data from current study accuracy of diagnosing external root resorption with and without noise reduction tool comparing to standard method shows significant difference (p value<0.001). So using noise reduction tool in Scanora software for diagnosing peri-apical lesions is not accurate enough. Performing studies with advanced softwares in future is recommended.

REFERENCES

1. White SC, Pharoah MJ; Oral radiology: principles and interpretation. 5th ed. St Louis: Mosby; 2004; 224-5, 356-60.
2. Hintze H, Wenzel A, Andreasen FM, Swerin I; Digital subtraction radiography for assessment of simulated root resorption cavities. Performance of conventional and reverse contrast modes. Endod Dent Traumatol 1992; 8(4): 149-54.
3. Mehdizadeh M, Karami M, Zamani H; Comparative Study of Conventional and Digital Radiography in Diagnosis of Periapical Lesions in Dry Human Mandible. J Dent Shiraz Univ Med Sci 2008; 9(2): 163-9.
4. Van der Stelt PF; Modern radiographic methods in the diagnosis of periodontal disease. Adv Dent Res 1993; 7(2): 158-62.
5. Mosayyebi AR; Camparative study of diagnostic accuracy of periapical radiography between eyes and indirect digital radiography in determination of working length [Thesis]. Isfahan, Iran: School of Dentistry, Isfahan University of Medical Sciences; 2004.
6. Bushong SC; Radiologic science for technologists. 8th ed. Philadelphia, PA: Elsevier Mosby; 2004.
7. Goodarzi Pour D, Razmi H, Jabedar Maralani S, Zeighami S. New software: comparison between three software programs for root canal length measurement. Dentomaxillofac Radiol 2008; 37(4): 228-31.
8. Schmitd LB, Lima Tde C, Chinellato LE, Bramante CM, Garcia RB, de Moraes IG, *et al.;* Comparison of radiographic measurements obtained with conventional and indirect digital imaging during endodontic treatment. J Appl Oral Sci 2008; 16(2): 167-70.
9. Mehdizadeh M, Dolatyar S; Study of Effect of Adaptive Histogram Equalization on Image Quality in Digital Preapical Image in Pre Apex Area. Research Journal of Biological Sciences 2009; 4(8): 922-4.
10. Mehdizadeh M, Zojaji Nejad Z, Torabinia N; Evaluation of digital radiography in the diagnosis of internal resorption of mandibular premolars with the help of software programs. J Isfahan Dent Sch 2011. [Special Issue].
11. Lofthag-Hansen S, Lindh C, Petersson A; Radiographic assessment of the marginal bone level after implant treatment: a comparison of periapical and Scanora detailed narrow beam radiography. Dentomaxillofac Radiol 2003; 32(2): 97-103.
12. Hintze H; Diagnostic accuracy of two software modalities for detection of caries lesions in digital radiographs from four dental systems. Dentomaxillofac Radiol 2006; 35(2): 78-82.
13. Poornima P, Subba Reddy VV; Comparison of digital radiography, decalcification, and histologic sectioning in the detection of accessory canals in furcation areas of human primary molars. J Indian Soc Pedod Prev Dent 2008; 26(2): 49-52.