A COMPARATIVE EVALUATION OF VISTASCAN AND ULTRASOUND IMAGING IN THE DIAGNOSIS OF PERIAPICAL LESIONS OF ENDODONTIC ORIGIN – AN IN VIVO STUDY.

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Abstract

Aims and objectives*: To carry out an in vivo comparative study to evaluate the potential of Vistascan and Ultrasound imaging technique with color Doppler to diagnose the periapical lesions of endodontic origin.*

Methods*: Ten patients diagnosed with periapical lesions using conventional radiographic findings were selected and consented for the study. They were subjected to vistascan and ultrasound imaging with Color Doppler. The reports of radiologist and echographist was compared and evaluated and a provisional diagnosis was made as to whether the lesion is cyst or granuloma. Endodontic surgery was performed including curettage of the apical tissues to enable histopathological investigation, which provided the gold standard diagnosis.*

Results*: The Ultrasound with Color Doppler revealed the lesions within the bone in three dimensions and their contents, that is, fluids or tissues or blood vessels. Out of 10 cases examined, Vistascan and Ultrasound report for 9 cases were similar except in one case it was differed. Ultrasound diagnosis agreed with the hisyopathological gold standard in all the 10 cases.*

Conclusion*: Ultrasound with Color Doppler is a very simple, non invasive technique with an immediate diagnostic report. Conventional and digital radiography enable diagnosis of periapical diseases, but not their nature, whereas ultrasound provides accurate information on the pathologic nature of the lesion which is of importance in predicting the treatment outcome.*

Key words*: Periapical lesions, Ultrasound, Color Doppler, Vistascan, Diagnosis*

Imaging techniques play a very important role in the specialty of endodontics. Periapical lesions accompanying endodontic infection are usually diagnosed and treated based on the initial radiological findings. Sometimes periapical surgery is necessary to eliminate and diagnose the cystic and non-cystic nature of the lesion. To be better able to predict the outcome of non-surgical endodontic treatment and in some cases to try to avoid surgical trauma, it is important to evaluate new and perhaps more promising methods of imaging for the study of periapical lesions.[1]

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Conventional radiographs play an important role in the detection, treatment, and follow-up of periapical lesions.[2] However, routine radiographs cannot be relied upon due to the diffuse and infiltrative nature of the inflamatory process in bone, the inability of radiographic techniques to demonstrate non cortical radiolucencies, and radiation risk factors.[3,4]

Developments in digital radiography have given the dentist the ability to perform radiographic examination with up to 80% reduction of radiation dose when compared with conventional radiography.[5] In addition, digital radiography offers software controlled image enhancement.[1] However, recent studies have demonstrated that digital radiography even when used with image processing and color coding is no better than conventional radiography in the detection and measurement of periapical lesions.[6]

Ultrasound real time imaging (also known as sonography or echography) has wide application in numerous diagnostic fields of medicine.[1] Cotti et al. in 2003[7] proposed that ultrasound may help to make a differential diagnosis between cysts and granulomas by revealing the nature of the content of a bony lesion. Ultrasound is based on the evaluation of the reflected echoes from the interface between two different tissues having different acoustic properties. Hypoechoic area has a low echo intensity; anechoic is an area in which no reflection occurs (ie, any area filled with fluids), and hyperechoic is an area that has high echo intensity. In addition, power Doppler flowmetry provides information regarding the presence, direction, and velocity of blood flow within the lesion.[7]

The purpose of this study was to compare the diagnostic validity of vistascan and ultrasound with power Doppler Flowmetry in the diagnosis of periapical lesions and compare the findings with surgical biopsy report.

Methodology

Ten patients aged between 18 and 50 years, were selected for the study. The patients had been diagnosed with periradicular lesion of endodontic origin based on clinical signs and symptoms and conventional radiography. The patients were scheduled to be treated in the department of conservative dentistry and endodontics at Rajarajeswari Dental College and Hospital for endodontic treatment. Patients who agreed to take part in the study were asked to sign an informed consent form before undergoing the echographic examination. Detailed history of patient was recorded.

The patient was subjected to vista scan and findings were recorded. Next area of diagnostic interest in the mouth was selected for the echography. The ultrasound examination was performed in the Dept of Radiodiagnosis, Rajarajeswari Medical college, and the images were assessed for size, contents, and vascular supply The ultrasonic sensor covered with a layer of echographic gel was placed extra orally corresponding to the apical area of the, tooth of interest. The sensor was put in contact and moved slightly in order to obtain adequate number of transversal scans to define the defect, color power Doppler was applied to each examination.
For each lesion, a representative echographic image was selected, and analyzed by an expert echographist together with an endodontist. A tentative differential diagnosis between a cystic lesion and granuloma was agreed based on the following principles.

Cystic lesions:

A transonic (hypoechoic) well contoured cavity, surrounded by reinforced bone walls, filled with fluids and with no evidence of internal vascularization on color power Doppler examination.

Granuloma:

A poorly defined lesion, which could be frankly corpusculated (hyperechoic/echogenic) or could show both corpusculated and hypoechoic area exhibiting a rich vascular supply on color power Doppler examination.

It was followed by curettage of periapical tissues to enable histopathologic investigation, which is the gold standard in diagnosis.

Results

The results of this study showed that, out of 10 cases examined, VISTASCAN and ultrasound report for 9 cases were similar except in one case it was differed. (Table 1)

The sonographic examination revealed the presence of 6 lesions with well-defined contours and hypoechoic/anechoic content. Acoustic enhancement was also seen. The lesions showed no evidence of internal vascularization with color Doppler. These lesions were diagnosed as periapical cysts [Figures 1, 2].

	AGE	SEX	TOOTH NO	VISTA SACN	US	H/P
1	18	M	11,12	PAG	PAC	PAC
2	27	M	22	PAC	PAC	PAC
3	22	F	21	PAG	PAG	PAG
4	35	M	12,13	PAC	PAC	PAC
5	24	F	11,12	PAG	PAG	PAG
6	20	F	11,21	PAC	PAC	PAC
7	36	F	21	PAG	PAG	PAG
8	32	M	12,13	PAC	PAC	PAC
9	24	M	22	PAG	PAG	PAG
10	30	M	21,22	PAC	PAC	PAC

TABLE 1

Figure 1: Periapical cyst(VISTASCAN)

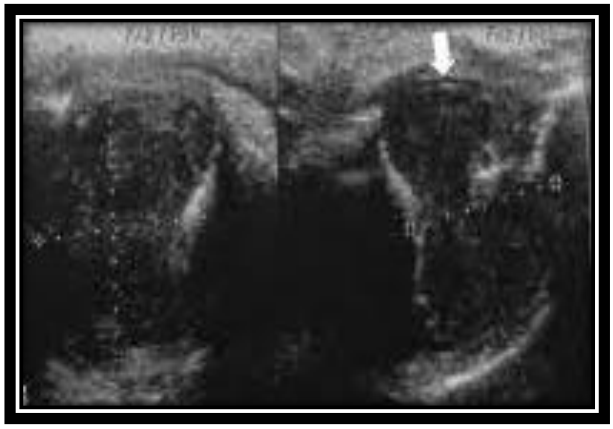

Figure 2: periapical cyst (USG)

Histopathology examination demonstrated the presence of a cavity lined by stratified squamous epithelium, either in a regular or in an arcading pattern. The lumen of the cavity was filled with fluids and cellular debris. Cholesterol clefts were occasionally present. These lesions were diagnosed as periapical cysts from a histopathological stand point [Figure 3].

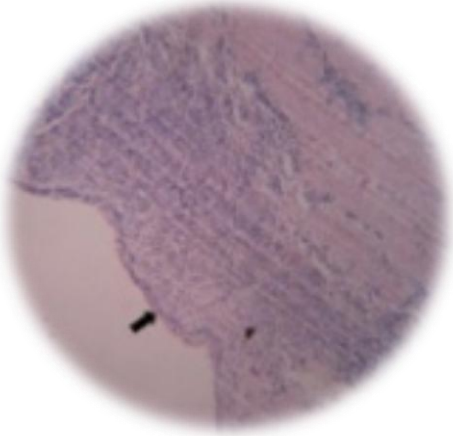

Figure 3: Histopathology of periapical cyst

Four lesions revealed hyperechoic or mixed content (showing both hyperechoic and hypoechoic areas) with poorly defi ned borders. The lesions showed evidence of rich internal vascularization on color Doppler examination. All these cases were diagnosed as periapical granulomas [Figures 4,5].

Figure 4: Periapical granuloma (Vistascan)

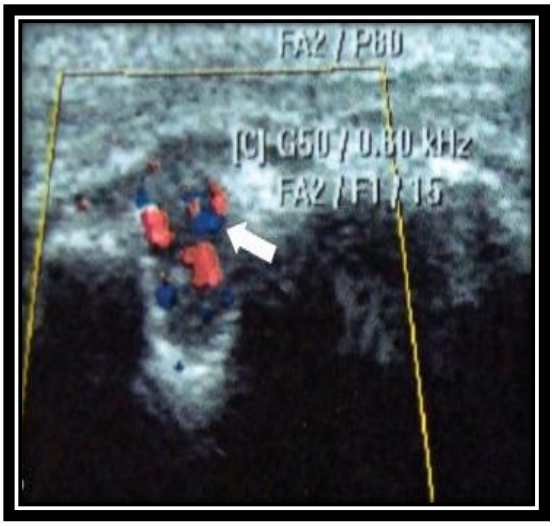

Figure 5:Periapical granuloma(USG)

Histopathologic examination demonstrated inflamed granulamatous tissue intermingled with neutrophils, plasma cells, and histiocytes. Cholesterol clefts with areas of red blood cell extravasation with hemosiderin pigmentation were observed in some cases. These lesions were diagnosed as periapical granulomas from a histopathological stand point [Figure 6].

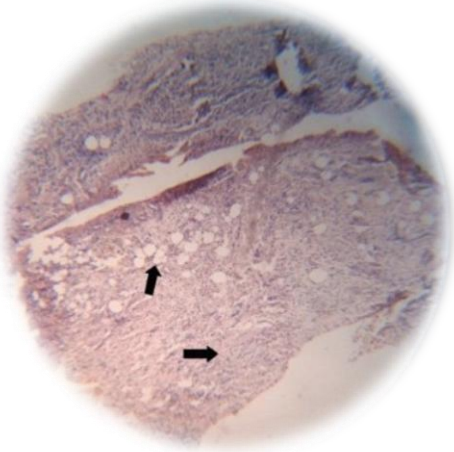

Figure 6:Periapical granuloma

DISCUSSION

Pulpal inflammation and necrosis eventually produce periradicular changes or apical pathology in the form of either a granuloma or a cyst. However, clinical examination and routine radiographs alone cannot differentiate between cystic and noncystic lesions. In the past, various

methods have been suggested, with limited success to diagnose the lesion without performing a biopsy.[8] McCall and Wal[9] proposed that periapical cysts could be differentiated radiographically from granulomas on the basis of their larger size (ie, more than 9.5 mm in diameter) and the presence of a radiopaque cortex. Grossman[10] suggested that although radiographic differentiation of cysts and granulomas was possible in most cases, small radicular cysts could not always be differentiated from granulomas.

The latest alternative to film for intra-oral radiography is VISTASCAN(Durr Dental), a digital imaging system utilizing an intra-oral sensor in place of radiographic film. This digital X ray offers dentists images with high resolution to meet all diagnostic demands. The VistaScan scanner makes the diagnostics even faster for dentists. The compact device is particularly easy to use and requires a minimum of space so that it can be installed in the treatment room**.** X-ray and scanning directly at the chairside with full flexibility in the image formats. The re-usable VistaScan image plates are read out in top quality within seconds.

Vista scan image enhancement produces images that are significantly more diagnostic then CR within bone. The clinical findings suggest that this digital radiographic method could provide an accurate method for detection of periapical pathosis with less exposure.

The advanteges of Vista Scan include substantial dose reduction; the production of instantaneous images; Control of contrast. Ability to enlarge specific areas, which may be of use in visualizing instrument location during endodontic treatment; and the potential for computer storage and subsequent transmissions of the images. As the technique is so different from the conventional, it is important for the observer to view the image produced without the constraints imposed by conventional radiography. The technique is simple to use, but assessment of images may require a certain degree of familiarization as the image is different from a conventional radiograph.[7]

Ultrasound real-time imaging is easy, reproducible and convenient to use.[1] The equipment is relatively cheap compared with other advanced imaging modalities. The images obtained are easy to read once the observer is trained. They are also simple to store and retrieve. By obtaining a real-time image, a working diagnosis could be made without delay and may prevent unnecessary exposure of the patient to ionizing radiation. No harmful effects of ultrasound waves have been observed in the tissues as a result of ultrasound examination.[11] Even if the effect of frequent ultrasound examination is not known, the risk involved in taking radiographs is undoubtedly much greater. In this study, ultrasound unequivocally identified the contents and the nature of all 10 periapical lesions. The ultrasound diagnosis agreed with the histopathological diagnosis in every case. The results showed that there was a definite correlation between the echostructure of the lesions and histopathological features. These findings are consistent with and confirm findings made by Cotti et al.[7]

This study has confirmed ultrasound real time imaging as a reliable diagnostic technique for differentiating periapical lesions, i.e. periapical cysts and granulomas.

CONCLUSION

Conventional radiography and direct digital radiography enable the diagnosis of the presence of periapical disease, but not of its nature. Ultrasound imaging with color power Doppler flowmetry is superior to conventional and digital radiographic methods for diagnosing the nature of periapical lesions through thinned or perforated cortical bone. It underestimates the dimensions of the lesions, but can provide accurate information on the pathological nature of periapical disease.

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Conflict of Interest: *None Decl*ared