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Healing Rate for Radiolucent Lesions following Root Canal Treatment

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ABSTRACT

Objectives: This study was done to evaluate the healing rate of a radiolucent lesion in root canal treated teeth done at Hospital Universiti Sains Malaysia (HUSM) dental clinics by the students and dentists.

Materials and Methods: Seventy-eight patient's case sheets who attended HUSM dental clinic from January 2013 to December 2018 that met the inclusion criteria were collected, assessed, and compiled. The information was collected related to the period of treatment and radiolucency size by measurement through radiograph. Healing rate of radiolucent lesions for 56 root canal treated teeth were calculated and recorded.

Result: The result showed that the healing rate for radiolucent lesions of RCT treated by student involving 39 teeth (22 anteriors, 3 premolars, 14 molars) was 1.904mm^2/month and by dentist involving 17 teeth (6 anterior, 2 premolar, 9 molar) is 0.947 mm^2/month.

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Introduction

Root canal treatment (RCT) is done when the pulp is non-vital or when the pulp has been extripated [1]. When RCT is performed, radiographic resolution of the periapical lesion is often used to evaluate the success of the endodontic therapy [2]. Periapical radiolucency which is usually noted in association with non-vital teeth is due to inter relationship between the pulp and the periradicular tissues. Assessment of the intraoral radiograph is the most used method for evaluating periapical bone healing where lesion will appear as an area of radiolucency. The lesions of endodontic origin are not separated from the tooth apex and appear to be continuous with the tooth.

Clinical signs and symptoms, coupled with radiographic findings are commonly used for evaluation because RCT is a non-invasive treatment where the tooth is still in the oral cavity when the treatment is being performed. Hence, many researchers depend on these parameters because they are less invasive and cost much less compared to the microbiological analysis. Strindberg et al, reported that, success of RCT is generally based on the presence or absence of clinical signs and/or symptoms of the treated tooth at the time of recall coupled with radiographic findings analysis [3].

Understanding the factors associated with endodontic failure is a key factor to increase the chances of endodontic treatment success. For example, Grossman et al. reported that over extended filling will act as an irritant and this is also supported by Davis et al. where they found periapical healing was least successful in overextended canals [4,5]. Grossman et al. also suggest that, most common causes for failures were coexisting deep periodontal pocket which might contribute to the reinfection of the periapical tissue [4].

In this study, changes in size of periapical radiolucency were measured and calculated to evaluate the healing rate. The healing and repair of these lesions were evaluated by radiographic analysis of the reduction in size of the radiolucent area, which is suggestive of the amount of bone regeneration [6]. Healing rate might depend on operator's skill level and the technique of cleaning and shaping used. We divided the operator based on skill level into two categories, a) students and, b) dentists.

Materials and Methods

This retrospective study done after getting the required approval from Human Research and Ethic committee, USM (19010026) with records of 78 patients who attended HUSM dental clinic from January 2013 to December 2018 for endodontic treatment. The cases that fulfilled the inclusion criteria were collected, assessed, and compiled. The inclusion criteria included: i) tooth with periapical radiolucency at least 0.5 mm in size at the start of endodontic treatment, ii) periapical radiolucency of the RCT tooth healing during review with availability of pre- operative radiograph from the start of endodontic treatment, and iii) the latest post treatment radiograph after periapical healing. The radiolucency size before treatment started was collected and

recorded which were measured through conventional periapical radiograph film using metal ruler and magnifying lens, while digital periapical radiograph was measured using digital ruler present within the diagnostic software (Planmeca Romexis;version 3.6.0.R,2014). The square radius of each radiolucency was calculated by multiplying the apico-occlusal and mesio-distal extent of the periapical radiolucency [5].

The lesion size difference at beginning of the RCT and last review appointment were divided by number of elapsed months to determine the rate of healing. The data from each category was entered into statistical software package (IBM SPSS, version 24) and was analyses with descriptive analysis.

Result

Seventy-eight periapical radiolucency which involving anterior (38.4%), premolar (7.7%), and molar (53.9%) teeth and come from thirty-six males (46.2%) and forty-two females (53.8%) were analyzed. Table-1 shows the result of healing rate for radiolucent lesions of RCT treated teeth by students involving 39 teeth (22 anteriors, 3 premolars, 14 molars) which was 1.904 mm^2/month and, the healing rate for radiolucent lesion treated by dentists involving 17 teeth (6 anteriors, 2 premolars, 9 molars) was 0.947 mm2/month.

Table 1: Healing rate of healing radiolucency lesion of RCT treated either by student or dentist at HUSM

Operator's category	No of cases (n)	Mean (SD) size at baseline (mm^2)	Mean (SD) size at final calculation (mm^2)	Mean (SD) Duration of healing (month)	Mean of Healing Rate (SD) (mm^2/month)
Dentist	17	7.960 (14.517)	4.121 (7.222)	5.180 (5.480)	0.947 (0.944)
Student	39	12.231 (12.528)	4.963 (5.214)	5.000 (3.286)	1.904 (2.306)

Discussion

The collection of important information from past records provides evidence of current practices, success rates, and other information which are useful in upgrading materials selection, instrumentation option, operator's skills as well as standard facilities to give the best treatment for patients [7,8]. The weaknesses in keeping record of pre and post treatment radiographs at the clinics were one of the limitations in this study to fulfill the inclusion criteria. Among 251 records reviewed, only 78 cases had complete information with complete set of pre and post treatment radiographs. According to Murphy et al, radiographic resolution of the periapical lesion is often used to evaluate the success of the therapy [2].

Previously at Hospital USM dental clinic, radiographs were taken using conventional periapical films. The improper technique of keeping conventional radiographic films and the deterioration of the film over time make it difficult to assess and measure the radiograph for the purpose of this study. The quality of the radiograph also is an obvious limitation where some of the images do not offer any diagnostic value such as the image field did not reach the periapical area, blurred images, and faded images. A good radiograph should reach until periapical area with clear define image and must not be distorted.

In this study, RCT cases were performed by undergraduate students and dentists using standardized techniques of cleaning and shaping. The results show that healing rate of periapical radiolucency of RCT treated teeth by students (n=39) was 1.904mm^2/month. This was not compared to cases treated by dentists which was 0.947mm^2/month, where sample size (n) was 17 only. The difficulty in finding enough samples and the deficiency in available patient records was most likely due to poor patient compliance and loss of sample, when patients fail to turn up for review. Murphy et al. suggest that, patient might be reluctant to come for review because they no longer have any symptom and they also reported in their study the average repair rate was 3.2mm^2/month [2]. Previously, Ingle et al, reported in their study that there was no significant difference in success rates of endodontic treatment carried out by undergraduates and general dentists [9]. This was also supported by Gulabivala et al. who found that educational background and experience of the operators had no significant influence on respective success rates in individual studies with estimated pooled success rates for endodontists or postgraduate students were higher than for other dentist group [10].

In Hospital USM, we found that most of the dentists treated majority of the difficult cases referred by students, such as endodontic retreatment, broken instrument in canal retrieval and surgical endodontic treatment which might affect the healing rate of periapical lesions. From a previous study, it was discovered that endodontic retreatment carried out by endodontic specialists gave the lowest estimate of success, regardless of strict or loose criteria [11]. Other factors, such as biochemical preparation and root canal shaping are important steps in endodontic therapy to achieve the apical healing and the cleaning and modeling of the root canal system [12]. The study also stated that, complex root canal anatomy, associated with presence of curvatures and ramifications, the shape, and the position of the apical foramina, can interfere and compromise root canal shaping and cleaning [12].

The type of tooth undergoing RCT might also affect the results, as in our study, molars were the most commonly involved teeth, when evaluating the healing rate. According to Murphy et al. anterior lesions of both the maxilla and mandible healed at a faster rate than posterior lesions of either jaw and this claim was also supported by Imura et al. where anatomy of molar teeth have multiple roots presenting a greater challenge for elimination of root canal infection [2]. They also proved that molar teeth in the non-surgical retreatment sample had a significantly lower percentage of success than premolars and anterior teeth [13].

From our data, the average baseline lesion size that have been treated by undergraduate students (12.23mm^2) was larger than those treated by dentists (7.96mm^2) and we found that the rate of healing for bigger lesion was faster than for smaller lesions. This is in contrast with Moazami et al, who reported that there is better outcome for cases with small lesions compared to those with bigger periradicular lesions [14]. This may be due to the fact that, the authors in their study evaluated completely healed periradicular lesions, whereas in our current study majority of the post treatment patient visits were after one month of successful completion of RCT. Thus, the healing process cannot be monitored until the full healing is completed.

In our study, it was also noticed that most dentists did single visit RCT, meanwhile student did multiple visit RCT with placement of root canal medicaments and this might affect the healing rate. It is noteworthy to mention that Calcium hydroxide is a widely used material in endodontic treatment due to its high alkalinity and bactericidal properties. It has also been found that teeth, which are dressed with calcium hydroxide paste and then obturated, have significantly less leakage than unmedicated controls.

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Conflicts of interest statement
Nil

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