Original Article

Evaluation of Complications of Root Canal Treatment Performed by BDS Fresh Graduates

Complications of Root Canal Treatment

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ABSTRACT

Objective: This current case actually aimed at radiographic assessment of quality of RCT along with procedural and technical errors evaluation by free BDS fresh graduates during era of 2015 to 2018 at Dental OPD of different hospitals.

Study Design: Observational study.

Place and Duration of Study: This study was conducted at the Department of Oral Medicine, Avicenna Dental College Lahore from March 2017 to March 2019.

Materials and Methods: A chart was recorded to register record of RCT quality and its outcomes in 280 patients handled by fresh graduates. This case was performed at dental OPD of different hospitals, in which the root canal treatment outcome quality and shortcomings by BDS fresh graduates was judged.

Results: The results were recorded based on root canal obturation, its good adoption to root canal walls and obturated apex radiodenstisty ≤2 mm as compared to apex from radiograph of respected tooth. The root obturation that was not up to standard measurements were ended in root canal failures such as ledge formation, canal transportation, furcal perforation, instrument separation, strip formation, formation of voids and over and under filling of obturated material. It was estimated in case study that 87 patients (31.1%) had inadequate RCT whereas 193 (68.9%) patients were treated successfully by fresh graduates without any procedural defects.

Conclusion: It was finally concluded that RCT performed by an undergraduate student in 68 percent cases was adequate and without any technical and procedural errors, where as in 31.1 precent RCT was inadequate. The technical and procedural errors were mostly in molars and procedure that was not done adequately was obturation of root canal (under filling). The fresh graduates and final year students had same technical and procedural errors with no prominent differences.

Key Words: technicalquality, dental, endodontics, procedural errors, education, dental graduates

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INTRODUCTION

In dentistry, there is significant importance of RCT with respect to tooth health and care[1]. The quality from both technical and procedural aspect performed by fresh graduates & students has been demonstrated radiographicallyat Jorden, dental teaching centre[2] The dental students in turkey also performed RCT with radiographic evidences. From studies that had done RCT in past, we came to know the fact that there was about >90% success rate if conditions were all controlled carefully[3,4]. There was retrospective study performed to calculate success outcome regarding RCT in relation with 2000 cases done by endodontist, who was specialist in this field. There was decline in RCT success rate if case were allotted to general dentists by 40–65%[5]. The general public patients of Turkey were evaluated and their radiographic RCT view was assessed for quality and outcome. The decline in RCT success rate by general dentists was due to lack of proper educational program regarding in RCT and self-confidence regarding procedures[6]. A study of endodontic treatment carried out in dental practice within the UK.[7]. So, it is need of time to make efforts in dental educational training from both practical and theoretical aspects to improve the success rate of RCT in patients.[8,9].

The technical errors in RCT can be accessed by radiograph easily and most commonly[10,11]. The RCT of Japanese patients was accessed radio graphically especially the peri apical view. The judgment of canal

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obturation is very important from both procedural and technical aspect for successful RCT prognosis[9]. The quality of RCT accessed radio graphically done by fresh graduates & student.[12] In France regarding teaching centre indentistry, the root canal fillings were accessed technically done by free BDS fresh graduates & students. There were involvements of many technical factors that decide the prognosis of RCT like distance of obturation material from apex, voids in obturated canal and final taper of obturated material in canal[13]. The RCT quality done by fresh graduates during dental training [14]. In Jordan, university, RCT on posterior was performed by fresh graduates & final year student by hand and rotary and its quality was judged. The ideal radiographicobturation include absence of voids, uniform obturated material filling and smooth taper of obturated material from coronal to apical end[15]. The shortening of 1mm of working length along with presence of apical periodontitis cause failure of RCT with success 14%[16]. The prognosis of RCT success was also effected by under and overfilling of obturation material[17]. The assessment on basis of apical periodontitis and RCT prognosis in population of Belarusian was charted. The other factors involve regarding RCT failure and poor prognosis were formation of ledge, facture of instrument in canal, perforations especially apical one[4,18].

Several studies have reported the adequacy of RCT performed by undergraduate students as varying between 33% and 70%[13,19]. Assessment of treatment quality and frequency of procedural errors will help improve educational programs and enhance health services[14]. Technical quality of root canal treatment of posterior teeth after rotary or hand preparation by fresh graduate final year students[20]. Technical quality of root canal therapies performed by novice dental students in preclinical practice.

The endodontic course is offered to dental students in their third year of Bachelor of Dental Surgery. The whole endodontic course is divided between 30% training on extracted tooth and 70% on theory. Moreover, in fourth year (one semester) students were offered clinical course regarding RCT on patients that consists of 30% clinical and 70 theoretical. Both single and multi-rooted teeth were offered to students for complete practice. Each student was allotted with 3-6 numbers of cases that include either one or two molar, one or two premolar, and one or two incisors. The root canal treatment becomes the most important element of dental care course in final year and that must be performed under supervision of specialists.

MATERIALS AND METHODS

Between the time span March 2017 to March 2019, the RCT treatment was done by fresh graduate and final year students on 310 patients. The fourth year students did 131 patients and fresh graduates did 110 patient. A chart was made based on RCT treatment outcome on patients.

The technique used in root canal obturation was step-back instrumentation technique with the help of 0.02 tapered stainless-steel k files. 2.5% sodium hypochlorite was used for irrigation and to wash rootcanals. The technique that was adopted for obturation of root canals was the lateral condensation. The bisecting-angle technique was used to have clear radiographic view of affected tooth.

2.2. Evaluation of complications of RCT

The assessment of RCT with respect to technical and procedural errors was done by different qualified endodontists with >7 years of experience in operative dentistry. There was appointment of few endodontists in case of disagreement. The endodontists set basicscriteria for assessment of RCT like adequate and in adequate RCT. The adequate RCT include good root canal obturation with ≤ 2 mm canal obturation from the apex shown in radiograph along with smooth adoption and inadequate RCT include any kind of procedural and technical error that led to failure of RCT.

The complications regarding RCT performance were listed as errors that happened during access cavity formation, root canal instrumentation and canal obturation. In case of access cavity preparation, the most common error and mistake was furcalperforation that was detected by radiograph in case of multi rooted teeth. In case of instrumentation, ledges transportation, stripperforation, root perforation and instrument separation was most common. The ledge formation was detected radio graphically when root canal obturation deviates from its original canal route (especially happened in case of curved canal). when the obturated material radio graphically undesirably deviates from its original natural path, transportation said to occur. When obturated material undesirably identified in the distal and mesial root of mandibular molars or buccal root of maxillary molars in any root of other teeth strip perforation said to occur. If the obturated material extruded undesirably in the rootarea, root perforation said to occur. When radio opaque instrument segment found in root or peri apical region radio graphically. Instrument separation said to occur. The most common errors in obturation were voids, overfilling and undefilling. The voids could be detected in radiograph and can be seen visually seen in radiographs of roots. When root canal obturation material extended beyond apex radio graphically, overfilling said to take place and when root canal obturation was ≤2 mm then under filling said to occur.

2.3. Statistical analysis

IBM SPSS Statistics for Windows v20 (IBM Corp., Armonk, NY) was used to access and examine the case date statistically. $P < 0.05$ was marked as statistical significance. Statistically significant differences were calculated by using the chi-square tests regarding

technical and procedural error frequency among different too.

RESULTS

The technical quality of root canal obturation was accessed and recorded for280 teeth. In all 310 cases, the root canal in teeth was performed by an free BDS graduate student during year March2017 to 2019, at different OPDs. The distribution of root canal treated teeth according to academic level is shown by table 1

Table 1. At academic level, distribution of teeth are shown in table as

It was estimated that in 193 (68.9%) RCT patients ,root canal was successful with no technical and procedural errors and regarded as adequate ,whereas in 87 (31.1%), RCT treated tooth were ended in failed RCT and regarded as inadequate due to technical and procedural errors. There was successrate of 90 (68.7%) teeth and failure of 41 (31.3%) teeth by fourth year students and success rate of 103 (69.1%) teeth with failure of 46 (30.9%) teeth by final year with respect to RCT treatment.

Table 1. At academic level, the assessment of technical quality of treated teeth are shown in following table as

Table No.1: 3.2. Iatrogenic errors

Tooth type	Fourth year	Fresh Graduates	All students& Fresh Graduates
Upper incisor	29 (22.1%)	49 (32.9%)	78 (27.9%)
Lower incisor	7 (5.3%)	12 (8.1%)	19 (6.8%)
Upper premolar	19 (14.5%)	26 (17.4%)	45 (16.1%)
Lower premolar	17 (13.0%)	17 (11.4%)	34 (12.1%)
Upper molar	17 (13.0%)	15 (10.1%)	32 (11.4%)
Lower molar	42 (32.1%)	30 (20.1%)	72 (25.7%)
Total	131 (100)	149 (100%)	280 (100%)

The total frequency of procedural and technical errors was calculated as 31.1%. The procedural and technical errors in root canal treated teeth were mostly under filling of root canal, over filling of root canal, voids in obturation, broken instruments, apical perforation and root canal transportation with frequencies 49.9%; 24.1%; 12.6%; 9.2%; 2.3%; and 2.3%, respectively . Figure 1 shows the procedural error frequencies in all treated teeth.

3.3. Effect of academic level on frequency and type of procedural errors

The different patients were treated by Fresh Graduates and final year with 30.9% and 31.1% frequencies. The most common error detected by fresh graduates and final year was under filling of root canal obturation with frequencies (51.2%)and (47.8%), respectively. The least frequent procedural error done was transportationand apical perforation by fresh graduates and final year students with frequencies 2.4% and 2.2%, respectively. The errors regarding lower incisors RCTtreatment, fresh graduate did fewer errors than final year students.In both group of students of fourth and final year , there was no as such procedural error differences overall ($p > 0.05$) .The procedural errors and its frequencies done by fourth and final years students can be presented in tabular form.

3.4. Effect of tooth type on frequency and type of procedural errors

It was estimated from case study that maxillary incisors had the lowest technical and procedural error with respect to RCT(19.2%),whereasmandibular molars had highest (43.1%)as compare to other teeth maxillary molars with highest frequency ($p < 0.05$) of overfilling of canal obturation. In other teeth, technical errors frequency was same.

DISCUSSION

During the study, a dental study was conducted relatedto RCT success rate, its quality and complications due to failure by an undergraduate student. These results were recorded based on radiographic evidences especially periapical radiographs. Radiographs that showed root vision obstruction of tooth due to anatomical tooth structure or superimposition by other tooth were not included. This was done in order to get clear radiographic results with no doubts. The assessment of RCT quality from both procedural and technical aspect was done on basis of guidelines practised in Europe[9]. The root canal assessment was made radio graphically, performed by dental students of fourth and final year[21]. In a dental clinic RCT, assessment was made from technical aspect by undergraduate students. In the present report, about 68.9% were regarded as adequate RCT, without technical and procedural error. The outcome of this case somehow differs from the outcome of other reports where13% to 60.4% of RCT were regarded as adequate[22]. In Pakistan, technical aspect of RCT by fresh graduates & students were assessed[23]. The difference of opinion among different BDS colleges was thought due to difference in method, educational training, evolution criteria and number of patients treated. In current studies, about 31.1% of RCT cases were labelled as inadequate. This inadequacy might be because of procedural and technical errors in treatment. With respect to performance, the fresh Graduates and final year students were same as far as RCT success rate was considered. This thing clearly indicates that RCT success rate is not affected by academic grades. In Greece, the same results were filed by khabbaz[9].

In the current scenario, the records showed that final year students were able to perform successful RCT in case of lower incisors as compare to fresh graduates. This outcome was due to large number of patients with lower incisors defected have been treated by final year students than fourth year students. Another thought might be inexperience of fresh graduates in treating lower incisors as compared to fourth year students at preclinical training.

The incidence of RCT failure in maxillary incisors were lower (19.2%).There was similarity of results in other case study also with this[21].There was procedural and technical errors in RCT done by undergraduate students[24]. The RCT was performed by BDS graduates on single rooted teeth and its quality was judged. The success rate of RCT in maxillary incisors was due to its anatomy and location (easy to access). Moreover, it was thought that success rate of RCT in maxillary incisors was due to repeated practice at preclinical levels. Lower molars exhibited the mostprocedural errors (43.1%).Other studies also showed similar results of inadequate RCT with respect to lower molars with large number of procedural errors.[9,25] There was dental study conducted between success RCT outcome by rotary and hand instrumentation technique. This failure of RCT in mandibular molar is might be due to its complex anatomy or inadequate training at preclinical stage. So it is a need of time that experts should train students at best with respect to RCT of lower molars.

In the current scenario, the most common error was under filling of obturation (49.4%). This mistake by students was due to faulty measurement of working length (just radiographic alone) without the use of electronic apex locater that could help them in determining correct working length. From many retrospective studies, we came to know that electronic apex locators had success rate of 97%[26]. The shaping and cleaning of canals was done by two basics techniques i.e. step-back technique(with the help of stainless steel k-files) and secondly, lateral condensation technique. The application of technique by k files from apical to coronal part could lead to injury and damage to original anatomy of root canal and mishaps like ledges, root canal transportation and blocking that could lead to inadequate cleaning and shaping the root canal and ultimately under filling of root canal[28]. There was comparison made between step back RCT technique and 8-step method done by senior dentist. A case study was also carried out to note the prognosis of RCT by Ni-Ti rotary and between hand stainless steel files. The rotary is new technology in the world of dentistry and produce better prognosis of RCT success rate as compare to hand instrumentation because of its ability to maintain original curves of root canals of teeth[29]. The computer tomography was used to made comparison between rotary and k file RCT. There was poor prognosis of RCT performed by stainless steel k files as compare to canals obturated by Ni-Ti rotary because hand stainless steel instrumentation lead to more technical and procedural errors[25].

In the current scenario, the maxillary molars were most wrongly filled (overfilled) as compare to rest of teeth in mouth. Moreover, in contrast, other studies have reported the quality of root canal obturation of maxillary teeth to be better than that of mandibular teeth[1]. Radiographic technical quality of root canal treatment performed by dental students at the Dental Teaching Center in Lahore. It is thought that, teeth were overfilled because of negligence in control of k files usage during cleaning n shaping that resulted in missing the apical stop. So, it is very important and need of present age that availability of specialists should be there for guidance to students at clinical and pre-clinical levels. More over training timings should be increased to improve technical and procedural RCT elements. So, it is very important to re access the quality of RCT by fresh graduates repeatedly in order to modify dental educational system and trainings at preclinical and clinical level.

CONCLUSION

In this report, it was finally concluded that RCT performed by an undergraduate student in 68percent cases was adequate and without any technical and procedural errors, where as in 31.1 precent RCT was inadequate. The technical and procedural errors were mostly in molars and procedure that was not done adequately was obturation of root canal (under filling). The fresh graduates and final year students had same technical and procedural errors with no prominent differences. So, suggestion is made to enhance and upgrade the dental study program at dental college. Moreover, their dental studies evaluation should be done at regular intervals in order to access the need of improvement in dental discipline at clinical n preclinical levels.

Author's Contribution:

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