A comparison of Endodontic Retreatment Decisions Making among Sudanese General Dental Practitioners and Endodontic Specialists

By
Nazik Musa Mahgoub
BDS (U of K) 2000

A thesis submitted in partial fulfillment for the requirement of the Degree of Master in Conservative Dentistry

Supervisor
Prof Yahia Eltayeb BDS, FDSRCSI

Decemper 2010
Dedication

To my lovely parents Musa & Awatif

To my honey husband Isam

To my uncle Muatasim

To my little sons Ayman & Eyad

To my sisters and brothers.
# Table of Contents

Dedication .................................................................................................................. ii

Table of Contents ...................................................................................................... iii

Acknowledgements .................................................................................................. v

Abstract ..................................................................................................................... vi

مختصر ....................................................................................................................... x

List of Figures ............................................................................................................ xiii

List of tables ............................................................................................................... 1

Chapter one…Introduction and Literature review

1.1 Introduction ........................................................................................................... 3

1.2 Justification .......................................................................................................... 6

1.3 Objectives ............................................................................................................. 7

1.4 Literature review ................................................................................................. 8
    1.4.1 Definition of success and failure in endodontic treatment............................... 8
    1.4.2 Evaluation Method of Endodontic retreatment:.............................................. 11
    1.4.3 Clinical sign and symptoms .......................................................................... 11
    1.4.4 Radiographic findings .................................................................................. 12
    1.4.5 Factors affecting failures of endodontic treatment ....................................... 13
        1.4.5.1 Missed canal, under filled canal, inadequate compaction: .................... 13
    1.5.2 Extra radicular infection ................................................................................. 21
    1.4.5.3 Coronal sealing ......................................................................................... 26
    1.4.5.4 Fractured instruments within the root canal .............................................. 28
    1.4.6 Treatment of endodontic failure .................................................................... 30
    1.4.7 Decision making ............................................................................................. 34
    1.4.8 Previous studies .............................................................................................. 37

Chapter two material and methods
Materials and methods .................................................................43

2.1 Study population: General Practitioners and Endodontists. ...................... 43
2.2 Study area: Khartoum State ..................................................................... 43
2.3 Study design: Comparative study .......................................................... 43
2.4 Sample size: All Endodontists (30) and General Dental Practitioners (30). .... 43
2.5 Methodology ......................................................................................... 43
2.6 Statistical Analysis ............................................................................... 45
2.7 Ethical consideration ........................................................................... 47

Results ...................................................................................................... 48

Tables ....................................................................................................... 53

Discussion ............................................................................................... 76

Conclusions ............................................................................................. 84

Recommendation ..................................................................................... 85

References ............................................................................................... 86

Appendices ............................................................................................. 95

Appendices I: Questionnaire .................................................................... 95

Appendices II ........................................................................................... 98

Cases ....................................................................................................... 98
Acknowledgements

A Special thank you to ....

My supervisor Yahia Eltyayb who took time out of his busy scheduled to provide priceless guidance and close supervision.

My teacher Dr Neamat Hassan for her support, encouragement and assistance throughout my work.

The Dean of Faculty of Dentistry, University of Khartoum, Dr Nadia Ahmed Yahia for her invaluable help.

Dr Sally who contributed unselfishly to make this work better through donation of time, energy and she did most of layout of this work.

Dr Abeer who helped me in many steps at beginning of this work.

I would like to express my gratitude to all participants (Endodontists & GDP’s) for their patience and contribution in accomplishing this work.
I would like to thank Mr. Ali Almahi who helped me in printing the Arabic summary of this work.

Last, I would like to thank my husband and sons who tolerated these days without complaining.
Abstract

Background: Retreatment of teeth is a common occurrence in daily dental practice, however there is a large inter-individual discrepancy in endodontic retreatment decision making. This necessitates proper systemic evaluation of the type of retreatment preferred by General Dental Practitioners and Endodontists in Sudan. Design: Comparative study. Setting: Khartoum state. Objectives: The purposes of this study were to: (i) Compare retreatment decision-making choices among Sudanese Endodontists and General Dental Practitioners (GDP’s) generally; and specifically with different years of experiences, place of employment and educational background. (ii) Detect the most common factors that have affected the decision-making of Endodontists and General Dental Practitioners.

Methods: Eight radiographic cases of endodontically treated teeth in soft copy form with relevant brief history were submitted to thirty Endodontists and thirty GDP’s. Each participant were asked to tick one of the following options of treatment {1-no treatment, 2- observation (wait and see), 3-conventional retreatment, 4-apical surgery, 5 –
conventional retreatment and apical surgery. Additionally they were asked to select one of the following factors that affected their decision: Clinical symptoms; chronic apical periodontitis; loss of coronal restoration; underfilled canal; overfilled canal; missed canal; inadequate compaction and fractured instrument.

**Results:** Using Fisher exact test, the result showed that there were no significant differences between the years of experience of the Endodontists and the general dental practitioners and treatment choice (P=0.07, 0.053) respectively. Using Chi Square and Fisher Exact Tests, regarding each case there was no significant relation between the place of employment and treatment option among Endodontists.

When comparing Endodontists working at Ministry of Health with the General Dental practitioners, it was found that Endodontists were more likely preferred the conventional retreatment and apical surgery significantly (P=0.01). On the other hand extraction was the treatment of choice preferred by GDP’s working at Ministry of Health (P=0.020). Regarding Ministry of Higher Education the GDP’s working there
preferred the extraction more significantly than Endodontists. (P=0.02).

Using Chi-Square Test there was a significance difference between the two Groups in the selection of the option of treatment (P=0.00). The GDP’s tend to significantly choose the extraction (14.30%) more than Endodontist (5.50%) (P=0.01). There was no significant difference between the two group regarding the factors affecting their decision (P=0.88.) **Conclusions;** There was a significant difference between two groups (Endodontists and GDP’s) in the treatment options. Thus, general dental Practitioners appeared more likely to initiate more invasive treatment than Endodontists. There was no significant difference between the two group regarding the factors affecting their decision. Both groups regarded clinical symptoms as relevant to their decision making.
المستخلص

اقدة علاج الجذور للاسان المعالجة ليباً أمر شائع في ممارسة طب الأسنان. ومع ذلك، هناك تفاوت كبير بين الأطباء في اتخاذ قرار إعادة علاج الجزور. هذا يتطلب التقييم المهني السليم لمعرفة نوع إعادة علاج الجذور المفضل لدى مجموعة أطباء الأسنان العموميين واخصائيي علاج الجذور في السودان.

الأهداف: هدفت هذه الدراسة إلى مقارنة خيار اتخاذ قرار علاج الجذور بين اخصائيين علاج الجذور واطباء الأسنان العموميين. معرفة أثر عدد سنوات الخبرة ومكان العمل والخلفية التعليمية في اتخاذ القرار. معرفة العوامل الأكثر تأثيراً في اتخاذ قرار إعادة علاج الجذور بين اخصائيي علاج الجذور واطباء الأسنان العموميين.

الأساليب: عرضت ثماني صور أشعة لحالات أسنان معالجة ليبياً وقد تم عرض الحالات في شكل نسخة كترونية على الحاسب الآلي مع تاريخ مختصر. وقد تم عرض الحالات لثلاثين اخصائي علاج جذور وثلاثين طبيب أسنان عضو، طلب من كل مشارك اختيار نوع من انواع العلاج التالية: لا داعي للعلاج، مراقبة وملاحظة الحالة (نرى ونتظر)، إعادة علاج جذور تقليدية، إعادة علاج جذور تقليدية مع الجراحة، جراحة قمة الجذر، الخلع، وكذلك طلب من كل مشارك اختيار العامل الذي أثر على اتخاذ القرار من العوامل التالية: الأعراض السريرية، الالتهاب حول قمة الجذر، القناة غير كاملة المليء، قناة مملوءة فوق الحد المسموح
النتائج: أظهرت النتائج باستخدام اختبار Fisher الدقيق أن عدد سنوات الخبرة لم يؤثر في اتخاذ القرار لدى أخصائيي علاج الجذور واطباء الأسنان العموميين، (P= 0.07)، باستخدام اختبار square الدقيق بخصوص كل حالة لم يكن هناك علاقة بين مكان العمل وخيار العلاج لدى أخصائيي علاج الجذور. عند مقارنة أخصائيين علاج الجذور العاملين في وزارة الصحة مع ممارس طب الأسنان العام تبين أن أخصائي علاج الجذور كانا أكثر ميلاً للمعالجة التقليدية مع الجراحة القمية بشكل مؤثر (P=0.01). كان خيار الخلع هو الخيار الأفضل من قبل أطباء الأسنان العموميين العاملين في وزارة الصحة ووزارة التعليم العالي (P=0.02). باستعمال اختبار Chi-Square كان هناك فرق ملحوظ بين أخصائيي علاج الجذور واطباء الأسنان العموميين (P=0.000) في اتخاذ قرار إعادة علاج الجذور. كان أطباء الأسنان العموميين أكثر ميلاً للخلع بنسبة 14.3% مقارنة بأخصائيي علاج الجذور 5.5% (P=0.01)، لم يكن هناك فرق كبير بين المجموعتين في اختيار العوامل المؤثرة في اتخاذ القرار (P=0.88).

الخلاصة: وجد فرق كبير بين أخصائيي علاج الجذور واطباء الأسنان العموميين في اتخاذ قرار إعادة علاج الجذور وهكذا كان أطباء الأسنان العموميين أكثر ميلاً للخلع من أخصائيي علاج الجذور. لم يكن هناك فرق ملحوظ بين المجموعتين في اختيار العوامل المؤثرة لاتخاذ قرار إعادة علاج الجذور.
وجد فرق كبير بين اختصاصي علاج الجزور واطباء الأسنان العموميين في اتخاذ قرار إعادة علاج الجزور وعندما كان اطباء الأسنان العموميين أكثر ميلا للخلع من اختصاصي علاج الجزور.

لم يكن هناك فرق مشوّض بين المجموعتين في اختيار العناوين المؤثرة لاتخاذ قرار إعادة علاج الجزور. كلا المجموعتين تأثرت بالاعراض السريرية في صنع القرار.
List of Figures

Figure 1 Distribution of Endodontists and General practitioners with in different place of employment ..........................................................67
Figure 3 factors affecting decisions of Endodontists & General Practitioners for case 1 ..................................................................................68
Figure 4 factors affecting decisions of Endodontists & General Practitioners for case 2 ..................................................................................69
Figure 5 factors affecting decisions of Endodontists & General Practitioners for case 3 ..................................................................................70
Figure 6 factors affecting decisions of Endodontists & General Practitioners for case 4 ..................................................................................71
Figure 7 factors affecting decisions of Endodontists & General Practitioners for case 5 ..................................................................................72
Figure 8 factors affecting decisions of Endodontists & General Practitioners for case 6 ..................................................................................73
Figure 9 factors affecting decisions of Endodontists & General Practitioners for case 7 ..................................................................................74
Figure 10 factors affecting decisions of Endodontists & General Practitioners for case 7 ..................................................................................75
List of tables

Table (1) Distribution of Endodontists and General Practitioners according to years of experience. ........................................53

Table(2): Retreatment decisions within Endodontist group with regards to years of experience,(n=240). .................................54

Table(3): Retreatment decisions within General practitioners group with regards to years of experience,(n=240). ......................55

Table(3): Retreatment decisions within General practitioners group with regards to years of experience,(n=240). ......................55

Table(4): Effect of the years of experiences on the treatment chosen in each case within each participants.................................56

Table 5 Relation between years of experience of Endodontists and treatment option for (case 4 ) ..................................................57

Table 6: Relation between years of experience of Endodontists and treatment option for (case 7). ..................................................58

Table 7 : Relation between place of employment and treatment option for General Dental Practitioners (Case7) ...............................59

Table 8: Effect of the place of employment on treatment options within each case for Endodontists and General Practitioners.60

Table 9: Odd Ratio(OR)of treatment option for Endodontists and General practitioners working at Ministry of Health............61
Table 10: Odd Ratio (OR) of treatment option for Endodontists and General practitioners working at Ministry of Higher Education. .............................................................................62

Table 11: Distribution of Endodontists and General Practitioners according to educational background. .................................................................63

Table 12: Percentage of votes for treatment options among the Endodontists and General practitioners. .................................................................64

Table 13: Percentages of votes for factors affecting the choice to retreatment decisions among the Endodontists and General practitioners........................................................................................................65

Table 14: Effect of the factors on the treatment options in each case for both participants (Endodontists and General Dental Practitioners). ........................................................................................................66
1.1 Introduction

Patients are becoming increasingly reluctant to lose teeth, which has led to the practitioner being faced with requests for retreatment of failing root canal treatment. [1]

Endodontic retreatment has been defined as a procedure performed on a tooth that has received prior attempted definitive treatment resulting in a condition requiring further endodontic treatment to achieve a successful result. [2]

It has been documented to be necessary in 36.7% of cases. [3] Cross-sectional studies of populations in various countries, including the United States, indicate that, overall, treatment failure, characterized by endodontic disease (apical periodontitis), is seen in more than 30% of root canal treated teeth[4]

When faced with a clinical situation that may require intervention, dentists vary in the decisions they take [5]. In a restorative context, variations in diagnoses and treatment decisions have been shown to occur equally whether dentists are asked to examine patients, radiographs or extracted teeth [6-8]. The reasons for
these variations are poorly understood, which has contributed to a perception that clinical decisions tend to be made intuitively, and that dentists do not share a common decision making process [9].

Post-treatment disease (apical periodontitis associated with root canal-treated teeth) is primarily caused by infection of the root canal system. Microorganisms may either have survived the previous treatment or invaded the filled canal space after treatment, mainly because of coronal leakage. Less often, specific microorganisms (Actinomyces species in particular) may have become established in the periradicular tissue [10].

The affected teeth can be treated either by retreatment (orthograde) or by apical surgery (retrograde). These two approaches differ significantly in rationale. Retreatment is an attempt to eliminate root canal microorganisms, whereas surgery is an attempt to confine the microorganisms within the canal. The main benefit of retreatment, therefore, is better curtailment of the root canal infection. Being limited in this regard, surgery is a compromise unless microorganisms are assumed to be harbored periapically, retreatment is unfeasible or restricted, or a retreatment attempt has failed[4].
This study is to evaluate whether retreatment of root fillings is judged necessary or not and which kind of retreatment is preferred among a group of General Dental Practitioners and Endodontists in Sudan.
1.2 Justification

Retreatment of teeth is a common occurrence in daily dental practice, however there is a large inter-individual discrepancy in endodontic retreatment decision making. This necessitates proper systemic evaluation of the type of retreatment preferred among a group of General Dental Practitioners and Endodontists in Sudan.
1.3 Objectives

**General:**

To compare retreatment decisions between General Dental Practitioners and Endodontists in Khartoum state.

**Specific:**

- To determine if there is any influence of place of employment, educational background, and years of experience on the decisions within the two groups (Endodontists and General Dental Practitioners).
- To determine the influence of several factors (clinical symptoms; periapical radiolucency; underfilled canals; overfilled canals; missed canals; and loss of coronal restoration.) on decisions between the two groups.
1.4 Literature review

1.4.1 Definition of success and failure in endodontic treatment.

With a vital pulp, success means that the root canal treatment prevents bacteria from entering the canal system; thereby, the treatment prevents a periradicular lesion from developing. With a necrotic pulp, the treatment is considered successful if it eliminates or significantly reduces bacteria in the root canal system so that an associated periradicular lesion heals[4]

Unfortunately, not all root canal treatments are successful. Root canal treatment usually fail when the treatment is carried out inadequately. However there are some cases in which the treatment have followed the highest standards yet still resulted in failure. In most of the cases, the endodontic failure results from persistent or secondary intraradicular infection Extraradicular infections may also be implicated in the failure of some cases. In addition, it has been claimed that a few cases can fail because of intrinsic or extrinsic non microbial factors. [11]
Recognition, acceptance, and management of treatments that do not resolve and heal can be difficult and often involve a complex set of factors. Importantly, the clinician should attempt to predict the outcome of each treatment based on the existing situation and current knowledge and then inform the patient about the expected outcome. The status and prediction should be assessed before and immediately after the treatment, and then at reasonable intervals.[4]

Studies on prognosis have analyzed the effects of various factors in relation to success and failure.[12] These numerous variables can make interpretation and comparison of prognosis study results difficult. However some of those studies have clearly shown a significant effect of some factors on the ultimate outcome of treatment.

Elimination or at least significant reduction in the number of bacteria seems to produce results similar to those expected when non-infected canals are treated. Success is the absence of an apical radiolucent lesion. This means that a resorptive lesion present at the time of treatment has resolved or if there was no lesion present at the time of treatment, none has developed. Thus, success is evident by the elimination or non-development of an area of rarefaction for a
minimum of 1 year after treatment. Failure is the persistence or development of radiographically evident pathosis. Specifically, this is a radiolucent lesion that has remained the same, has enlarged, or has developed since treatment.[4]. Questionable status indicates a state of uncertainty. The situation (radiolucent lesion) has neither become larger nor significantly decreased in size. A questionable status is considered to be non-healing if there is no resolution after more than 1 year [4]

Recently, considerable interest has been generated regarding the potential role of extraradicular persistent microorganisms in the failure of the root canal treatment. Cultural and microscopic studies have reported the occurrence of extraradicular infections in both treated and untreated root canals[13-17]. Since microorganisms established in the periradicular tissues are inaccessible to endodontic disinfection procedures, extraradicular infection may be a factor in the failure of endodontic therapy.[11]
1.4.2 Evaluation Method of Endodontic retreatment:

The most accurate determinations of healing or nonhealing are based on signs and symptoms and radiographic and histologic examinations. Obviously, at present only clinical findings and radiographic criteria can be readily evaluated by the dentist, current technology precludes histologic examination without surgical intervention.

1.4.3 Clinical sign and symptoms

Signs and symptoms of failure include: A discharging sinus; Pulpal pain; or Tenderness on biting. Frequently, however, symptoms may be absent, with retreatment decisions being taken on incidental radiographic findings, for example, the appearance of a periradicular radiolucency or an increase in its size following root canal therapy, or restorative treatment being proposed on a tooth without a lesion but with an apparently incompletely obturated root canal. Failure, depending on its aetiology, is normally treated in one of three ways: Root canal retreatment; Periradicular surgery; or Extraction. [1]
Signs and/or symptoms, if marked and persistent, are probably indications of disease and of failure. Importantly, absence of pain or other symptoms does not confirm success. This is because periradicular pathosis without significant symptoms is usually present in teeth before as well as after root canal treatment. This is because periradicular pathosis without significant symptoms is usually present in teeth before as well as after root canal treatment.[18].

There is little correlation between the presence of pathosis and corresponding symptoms; yet when signs and/or symptoms are evident there is a strong likelihood that there is a pathosis.[19].

1.4.4 Radiographic findings

According to the findings, the outcome of each treatment could be classified as a success, a failure, or a questionable status. To be able to accurately compare radiographs made at different times, it is important that they are taken in a reproducible fashion and with minimal distortion. The best way to ensure reproducibility is with paralleling radiographic devices.
Success is the absence of an apical radiolucent lesion. This means that a resorptive lesion present at the time of treatment has resolved or if there was no lesion present at the time of treatment, none has developed. Thus, success is evident by the elimination or non development of an area of rarefaction for a minimum of 1 year after treatment.

Failure is the persistence or development of radiographically evident pathosis. Specifically, this is a radiolucent lesion that has remained the same, has enlarged, or has developed since treatment.[4]. Questionable status indicates a state of uncertainty. The situation (radiolucent lesion) has neither become larger nor significantly decreased in size. A questionable status is considered to be non-healing if there is no resolution after more than 1 year [4].

1.4.5 Factors affecting failures of endodontic treatment

1.4.5.1 Missed canal, under filled canal, inadequate compaction: -

Root canal treatment usually fails when treatment falls short of acceptable standards[20-23]. Undoubtedly, the major factors
associated with endodontic failure are the persistence of microbial infection in the root canal system and/or the periradicular area [24, 25].

The presence of bacteria in the canal before obturation predicts a poorer prognosis." In relation to extension of the obturation, healing is less predictable if the filling is too short (more than 2 mm from the radiographic apex) or too long (exiting the apex) [20, 26, 27]

Emphasis is frequently placed on mechanical problems that may have contributed to failure. However, as the principal aetiology is usually biological, with the common factor being microorganisms, it is important to understand their role in endodontic disease. Reasons for failure of root canal therapy can be summarized as follows. Frequent intraradicular causes include: Necrotic material remaining in the root canal either through failure to identify all canals or treating canals short; Untreated or undertreated canals; Contamination of an initially sterile root canal during treatment; Persistent infection of a root canal after treatment; Bacteria left in accessory or lateral canals; Loss of coronal seal; and Re-infection of a disinfected and sealed canal system. Extraradicular causes of failure include: Persistent periradicular infection; Radicular cysts; and Vertical root fractures.[1]
Sundqvist [28] confirmed the important role of bacteria in periradicular lesions in a study using human teeth, in which bacteria were only found in root canals of pulpless teeth with periradicular bone destruction. The chances of a favourable outcome with root canal treatment are significantly higher if infection is eradicated effectively before the root canal system is obturated. However, if microorganisms persist in the root canal at the time of root filling or if they penetrate into the canal after filling, there is a higher risk that the treatment will fail[29, 30]. Nonetheless, in all cases where viable bacteria remain in the root canal system there is a constant risk that they may perpetuate periradicular inflammation.[11].

Untouched areas may contain bacteria and necrotic tissue substrate even though the root canal filling appears to be radiographically adequate [18, 24] Indeed, a radiograph of a seemingly well-treated root canal does not necessarily ensure the complete cleanliness and/or filling of the root canal system [31] Environmental influences operate in the root canal system during treatment, allowing certain microorganisms to survive and, depending on several factors, induce failure. Such influences are affected by intracanal disinfection
measures (chemomechanical preparation and intracanal medication) and the low availability of nutrients within a well-treated root canal. To survive in the root-filled canal, microorganisms must withstand intracanal disinfecting measures and adapt to an environment in which there are few available nutrients. Therefore, the few microbial species that have such ability may be involved in the failure of root canal treatment. Environmental influences operate in the root canal system during treatment, allowing certain microorganisms to survive and, depending on several factors, induce failure. Such influences are affected by intracanal[11] Disinfection measures (chemomechanical preparation and intracanal medication) and the low availability of nutrients within a well-treated root canal. To survive in the root-filled canal, microorganisms must withstand intracanal disinfecting measures and adapt to an environment in which there are few available nutrients. Therefore, the few microbial species that have such ability may be involved in the failure of root canal treatment. Bacteria located in areas such as isthmuses, ramifications, deltas, irregularities and dentinal tubules may sometimes be unaffected by endodontic disinfection procedures [18, 32] It is probable that the supply of
nutrients to bacteria located in ramifications and deltas will remain unaltered after root canal therapy. Nonetheless, bacteria present in areas such as dentinal tubules and isthmuses may have a drastically reduced substrate. In such anatomical regions, bacteria entombed by the root filling usually die or are prevented from gaining access to the periradicular tissues. Even interred, some bacterial species will probably survive for relatively long periods, deriving residues of nutrients from tissue remnants and dead cells. If the root canal filling fails to provide a complete seal, seepage of tissue fluids can provide substrate for bacterial growth. If growing bacteria reach a significant number and gain access to the periradicular lesion, they can continue to inflame the periradicular tissues. The fact that studies have reported the occurrence of viable microbial cells in treated teeth with a persistent periradicular lesion indicates that microorganisms derive nutrition, presumably from tissue fluid which can seep into the root canal space[22, 23, 33] The ability to survive in such conditions is important for most bacteria because periods of starvation are commonly experienced. Several regulatory systems play essential roles in the ability of bacteria to withstand nutrient depletion. These systems
are under the control of determined genes, whose transcription is activated under conditions of starvation. For instance, under conditions of nitrogen starvation, the activation of the Ntr gene system enables bacteria that require ammonia as a nitrogen source to scavenge even small traces of ammonia. Under high concentration of ammonia, the Ntr gene system is uncoupled. Some facultative bacteria may activate the Arc system (aerobic respiration regulatory), composed of the arc A and arc B genes, under conditions of low concentrations of molecular oxygen. As a consequence, metabolic pathways are activated, which permit the utilization of alternate terminal electron acceptors for respiratory metabolism so that a shift can occur from aerobic to anaerobic metabolism. Under low concentrations of glucose, some bacteria can activate the catabolite repressor system, under control of the genes cya (adenylate cyclase) and crp (catabolite repressor protein), which induce the synthesis of enzymes for the utilization of various other organic carbon sources. Under conditions of phosphate starvation triggered by low concentrations of inorganic phosphate, cells turn on genes for utilization of organic phosphate compounds and for the scavenging of trace amounts of inorganic phosphate [34]
Depending on the availability of nutrients within the root canal system and the ability to survive in conditions with low availability of nutrients, the remaining microorganisms may either die or remain viable. In such cases, proliferation may be impeded or reduced. Failure of endodontic treatment attributed to remaining microorganisms will only occur if they possess pathogenicity, reach sufficient numbers, and gain access to the periradicular tissues to induce or maintain periradicular disease.[11]

The microbiota associated with failed cases differs markedly from that reported in untreated teeth (primary root canal infection). Whereas the latter is typically a mixed infection, in which gram-negative anaerobic rods are dominant, the former is usually composed of one or a few bacterial species, generally gram-positive bacteria, with no apparent predominance of facultatives or anaerobes. Möller [35] after examining failed cases, reported a mean of 1.6 bacterial species per root canal. Anaerobic bacteria corresponded to 51% of the isolates. Enterococcus faecalis was found in 29% of the cases.[23] observed a mean of 1.3 bacterial species per canal and 42% of the recovered strains were anaerobic bacteria. E. faecalis was detected in
38% of the infected root canals. Whilst this facultative bacteria is restricted to a few cases of primary root canal infections, usually in low numbers, it is frequently isolated from secondary and/or persistent root canal infections, usually as the single species of microorganism.

E. faecalis strains have been demonstrated to be extremely resistant to several medicaments, including calcium hydroxide [36-38]. Therefore, when E. faecalis is established in the root canal, its eradication by conventional means may be extremely difficult [33].

Yeast-like microorganisms have also been found in root canals of obturated teeth in which treatment has failed [24]. This suggests that they may be therapy-resistant. In fact, it has been demonstrated that Candida spp. are resistant to some medicaments commonly used in endodontics [39]. The microbiota associated with poorly treated teeth is more likely to contain a greater number of microbial species, predominated by anaerobes, and be similar to that found in untreated teeth (primary infections) [23, 40]. This probably occurs because the microorganisms causing the initial infection persisted in the canal after inadequate cleaning of the root canal system.
1.5.2 Extra radicular infection

A- Apical periodontitis

In most cases, failure of endodontic treatment is a result of microorganisms persisting in the apical portion of the root canal system, even in well-treated teeth. Studies have demonstrated that part of the root canal space often remains untouched during chemomechanical preparation, regardless of the technique and instruments employed [18, 41]

It is important to remember that apical periodontitis, which is often a principle indication of a failing endodontic treatment, is frequently asymptomatic; the radiograph is the only way to demonstrate the lesion.[42] Clearly a very significant factor is the presence of a periradicular lesion associated with the tooth before treatment"if there is a periradicular lesion before treatment the prognosis for success is reduced by 10% to 20%." Elimination or at a least significant reduction in the number of bacteria seems to produce results similar to those expected when non infected canals are treated[4]
Recently, considerable interest has been generated regarding the potential role of extraradicular persistent microorganisms in the failure of the root canal treatment. Cultural and microscopic studies have reported the occurrence of extraradicular infections in both treated and untreated root canals[13-17]. Since microorganisms established in the periradicular tissues are inaccessible to endodontic disinfection procedures, extraradicular infection may be a factor in the failure of endodontic therapy.[11]

The major consideration regarding treatment of periradicular biofilms is that the clinician cannot detect a biofilm in any particular clinical case. Theoretically, in a therapy-resistant clinical case a microbiological sample could inform the clinician if the root canal is bacteria free or if there are persistent intracanal microorganisms.

Once root canal samples yield negative cultures, the canal is obturated. If subsequent healing does not occur, then one may suspect extraradicular infection. However, it should be emphasized that microorganisms may have been present within the root canal system but have escaped detection in the samples that were taken. This is
particularly true in retreatment cases, where microbial sampling from previously filled root canals is difficult to carry out.[11]

It is well known that intracanal disinfection procedures or systemically administrated antibiotics cannot easily affect bacteria located outside the apical foramen. The placement of endodontic medicaments into the periradicular tissues in order to eliminate microorganisms and to decompose periradicular biofilms does not appear to be an adequate procedure. First, as discussed, it is currently difficult or even impossible to clinically diagnose extraradicular infections. Secondly, most endodontic medicaments are cytotoxic and/or may have their antimicrobial effects neutralized after apical extrusion.[11] The development of a nonsurgical strategy to combat biofilms appears questionable. Therefore, intransigent extraradicular infections, if present, must be treated by means of periradicular surgery.[11]
B- Overfilling

It has been claimed that the success rate of the root canal treatment is decreased in cases of overfilling [21, 43]. The toxicity of root canal filling materials has been considered to play an important role in this regard [44].

Conversely, it has been reported that the apical extent of root canal fillings has no correlation with treatment failure [25]. Most of the materials used in root canal obturation are either biocompatible or show cytotoxicity only prior to setting [45, 46]. Apart from the paraformaldehyde-containing materials, sealer toxicity is significantly reduced or even eliminated after setting. Therefore, it is highly improbable that most of the contemporary endodontic materials are able to maintain a periradicular inflammation in the absence of a concomitant endodontic infection. This statement is reinforced by the high success rate of treatment in teeth without periradicular lesions even in cases of overfilling [25],[30]. Initially, microorganisms may be either absent or present in low numbers in these cases [28, 41].
Obviously, overfilling should be prevented as often as possible since undesirable postoperative complications such as flare-ups can develop – usually when a large amount of filling material extrudes through the apical foramen. In truth, the role of concomitant infection as an actual cause of failure of overfilled root canals emphasizes the need to properly prevent and control endodontic infection.

Thus, failure associated with overfilled teeth is usually caused by a concomitant intraradicular and/or extraradicular infection. In most cases, apical sealing is inadequate in overfilled root canals. Percolation of tissue fluids rich in glycoproteins into the root canal system can supply substrate to residual microorganisms, which can proliferate and reach sufficient number to induce or perpetuate a periradicular lesion.

Another phenomenon is likely to occur in most of the overfilled teeth. It is well known that over instrumentation usually precedes overfilling. In teeth with infected necrotic pulps over instrumentation induces the displacement of infected dentine or debris into the periradicular tissues. In this situation, microorganisms are physically protected from the host defence mechanisms and thereby can survive
within the periradicular lesion and maintain periradicular inflammation. The presence of infected dentine or cementum chips in the periradicular lesion has been associated with impaired healing [47]. Indeed, this is probably the most common form of extraradicular infection.

1.4.5.3 Coronal sealing

It has been stated that coronal leakage may be an important cause of failure of endodontic treatment [48]. There are some situations in which obturated root canals may be contaminated from the oral cavity: leakage through the temporary or permanent restorative material; breakdown, fracture or loss of the temporary/permanent restoration; fracture of the tooth structure; recurrent decay exposing the root canal filling material; or delay in the placement of permanent restorations [38]. In such circumstances, if root canal obturation does not impede saliva leakage, microorganisms may invade and recolonize the root canal system. If microbial cells and their products reach the periradicular tissues, they can induce and/or perpetuate periradicular disease.
Recontamination of the root canal system by coronal leakage will occur through: sealer dissolution by saliva; percolation of saliva in the interface between sealer and root canal walls (particularly if smear layer is present) and/or between sealer and gutta-percha [38]. In addition, voids and other minor flaws in the obturation, which often are not detected radiographically, may be responsible for the rapid recontamination of the root canal system.

Taken together, some studies [42], [38] have revealed that, regardless of the obturation technique or filling material employed, entire recontamination of the root canal can occur after a short period of microbial challenge. Once the coronal seal is lost, microorganisms, their products and other irritants from saliva may reach the periradicular tissues via lateral canals or apical foraminas, and thereby jeopardize the outcome of root canal treatment. Clinically, it is impossible to determine whether the entire root canal system is recontaminated after exposure to saliva. Obviously, it appears inconsistent to restore a tooth with a root canal that may be completely recontaminated.
Therefore, from a clinical standpoint, coronal exposure of the root canal obturation to saliva for a relatively short period of time (30 days or more) might be considered an indication for retreatment[11].

When the root canal filling is completed, a temporary coronal restoration is applied until the placement of the permanent restoration. Since temporary cements are water-soluble and have low resistance to compression, the temporary restoration should be replaced as soon as possible with the definitive restoration.[11]

Further causes of failure may be iatrogenic in nature, in particular, when post space has been created without consideration being given to the internal and external root anatomy, with resultant perforation or root fracture.[1]

1.4.5.4 Fractured instruments within the root canal

Instruments which have fractured in a root canal do not necessarily result in failure of the root treatment. They should be removed if possible, but if this is impossible, then an attempt should be made to seal the rest of the canal with the instrument in place. Surgery is only necessary if the tooth develops symptoms, or radiographic
review shows a failure of healing. The incident should, of course, be recorded in the records, and the patient informed.[49]
1.4.6 Treatment of endodontic failure

Treatment options for failed endodontic therapy include nonsurgical or surgical endodontic retreatment and extraction with or without replacement of the tooth.[50-55] It is increasingly accepted by patients that endodontic treatment is a pre-requisite for the restoration of a large proportion of teeth. The healing rates of conventional root canal treatment have been reported to be in the range of 81–95% [12, 56, 57] However, these figures may be deceptively high since they relate to controlled clinical settings such as dental schools and specialist practices, whereas the frequency of posttreatment disease in general practice settings has been reported to be as high as 36%.[58]

Retreatment is clearly indicated when a periapical radiolucency is accompanied by clinical signs and/or symptoms, and the relative success of such treatment rises to 91%. When no or only small radiographic evidence of periapical pathology is present, and clinical signs and symptoms are absent no treatment appears to result in complications in only a small percentage of cases, despite what appears to be a less than ideal root filling. If radiographic monitoring
alone is contemplated there should be no suspicion of more sinister pathology.[59]

A number of approaches are available in the management of asymptomatic periapical lesions associated with root filled teeth. This gives rise to variation in the choices clinicians make when faced with decisions to re-treat or not, and how to treat if re-treatment is decided upon [60-66].

Only one of the factors, intraradicular infection, can be managed by retreatment of the root canal. Although knowledge of the cause of failure of endodontic therapy would facilitate the choice of an appropriate therapy, at the present time such diagnoses can usually be made only after surgery. Assuming that persistent intraradicular infection is the most common cause of failure, it is worth while retreating failed teeth prior to surgery in order to exclude such a possibility. Clearly, appropriate measures for the control and prevention of infection are essential to maximize the permanent coronal restoration should be placed as rapidly as possible, ideally in the first week after treatment[11]. The success rate of retreatment may reach approximately two-thirds of cases [22] Thus, one should try to
retreat a failed root canal, particularly when the previous treatment falls short of the accepted technical standard success of retreatment.
Periradicular surgery is indicated in the following cases: the treatment or retreatment is impossible (fractured instruments, ledges, blockages, filling material impossible to remove, etc.); failure of retreatment; where the prognosis of the nonsurgical retreatment is unfavourable; where a biopsy is needed [67]. Retreatment is clearly indicated when a periapical lesion, clinical signs, and/or symptoms are present [50, 52].

Dentists seem to ignore patients’ symptoms and base their treatment decisions mainly on radiographic findings.[68] However, substantial variation exists among clinicians’ management of cases with periapical radiolucencies.[64]

The technical quality of previous endodontic treatment also played a role in the decision to retreat.[64] Active treatment is seldom suggested in cases with underfilled root canals and widened periapical periodontal ligament space.[68] Technical quality of the coronal restoration is an important factor for apical periodontal healing in endodontic treatment.[69]
Retreatment and initial root canal treatment share similar biologic principles and objectives. However, the following are unique to retreatment: An extensive restoration may have to be sacrificed and remade, retreatment may be performed to prevent potential disease, morphologic alterations resulting from the previous treatment may present unusual technical and therapeutic challenges, root filling and possibly restorative materials must be removed from the canals, The healing rate is generally slower than that after initial treatment, because of greater difficulty in eliminating the infection. [4], Patients may be more apprehensive than with the "routine" initial treatment; effective communication is required. These considerations distinguish retreatment from initial root canal treatment and make patient selection complicated. As a result, clinicians faced with post-treatment disease frequently hesitate to intervene despite the presence of pathosis. [70, 71]

Post-treatment disease definitely requires intervention, even when symptoms are absent. When treatment and apical surgery should be considered. Comparing the two modalities, retreatment offers a greater benefit—a better ability to eliminate the disease's etiology (root
canal infection) with minimal invasion-and a smaller risk significantly less postoperative discomfort and a lesser chance of injuring nerves, sinuses, or other structures.[72] Therefore, retreatment is generally considered the treatment of choice; however, it is not always feasible.

1.4.7 Decision making

A number of approaches are available in the management of asymptomatic periapical lesions associated with root filled teeth. This gives rise to variation in the choices clinicians make when faced with decisions to re-treat or not, and how to treat if re-treatment is decided upon,[61-66].

There are no general guidelines on the indications and procedures for retreatment, but there is obviously a consensus that retreatment procedures have to be performed at least in all cases with persisting pain, the presence of clinical signs such as swelling or sinus tract, and in teeth with periapical pathosis refractory to endodontic therapy.[50, 73, 74] However, differences in treatment planning choices do exist and are dependent on educational background, clinical
experiences, attitudes and values of involved persons, and also economic resources.[75, 76]

In normative decision-making models, such as that proposed by Strindberg, root canal treatment outcome may be dichotomized as either ‘success’ or ‘failure’ solely on the basis of biomedical parameters, which, in turn, unambiguously delineates the management decision into non-treatment or re-treatment. Such stringency in decision-making is challenged by the finding that many dentists do not automatically re-treat teeth with intractable periapical radiolucencies[71]. It would seem that any approach that is so narrow that it excludes some of the less tangible aspects of the decision-making process, such as the cognitive and behavioural determinants of dentists’ clinical management strategies, could lead to poor treatment planning [8, 77].

To gain a better understanding of the complexities involved, various aspects of the endodontic re-treatment decision-making process have been explored [60, 62, 78, 79]. Amongst these, the Praxis Concept (PC) theory [64] proposes that dentists visualize periapical lesions of progressively larger radiographic sizes as
corresponding to increasingly more severe disease on a continuous scale. Accordingly, PC theory suggests that variations in dentists’ re-treatment behaviour may be explained by differences in their personal thresholds at which intervention is deemed necessary along a health disease continuum. The explanatory ability of PC theory with regard to endodontic re-treatment choices has been confirmed in groups of dental students at schools in three European countries[64], as well as amongst groups of endodontists[65] and general dental practitioners[66].

In the cited studies, when participants were asked to make their re-treatment choices for a tooth with varied qualities of root filling, restorative complexity, and a range of apical conditions, it was found that when they opted for re-treatment at a certain size of periapical lesion, then re-treatment was always suggested for lesions of a larger size, and additionally that there were large inter-individual variations in the cut-off point at which re-treatment was felt to be necessary. Many factors can potentially influence a clinician’s decision to undertake treatment. The importance of personal values in making endodontic re-treatment choices has been shown in a group of Swedish
dental students [79], whilst educational background, differing cultural values and structural conditions relating to health and health care may also be influential in the process [8, 80].

1.4.8 Previous studies

Al-ali et al. 2005 [81] tested the applicability of praxis concept theory in endodontic re-treatment decision-making amongst dental students of similar background but from two dental schools. A set of forms containing schematic variants of a hypothetical clinical scenario, paper patient cases (PPC), and related re-treatment options, adapted from a method described by Kvist et al. (1994)[64], Kvist & Reit (2002)[65], and Kvist et al. (2004)[66] was distributed to all the final year dental students at King Saud University (KSU), Riyadh, and King Abdul Aziz University (KAU), Jeddah, Saudi Arabia, during April and May, 2002. All students had completed the formal component of their education and clinical training in Endodontic. He found that there were large inter individual variations in Individual re-treatment preference scores (RPS) within the cases at both schools.
Aryanpour et al [82] evaluated the consensus, if any, amongst dental schools, students and their instructors managing the same clinical cases, all of which involved endodontically treated teeth; and determine the predominant proposed treatment option. The results indicate wide inter- and also intra-school disagreements in the clinical management of root canal treated teeth. Analysis of variance showed that the main source of variation was the 'school effect', explaining variations. No other factor explained as much variance. Decision difficulty was moderately correlated to technical complexity.

Balto, and Al-madi, 2004 [83] at Kingdom of Saudi Arabia compared the difference in decision making regarding retreatment of endodontically treated teeth by General Dental Practitioners and Endodontists. The results showed statistically different decisions among these two groups regarding retreatment cases. More Endodontists opted for retreatment of cases, while higher percentages of general dentists decided to observe, not treat or to extract.

Dechouniotis, et al 2010[84] compared decision-making choices among Dentists with different levels of training. Scanned periapical
radiographs and a leaflet with relevant information of 17 endodontically treated teeth were mailed to 40 undergraduate students, 25 General Practitioners, 20 postgraduate students, and 40 Endodontists. All teeth were symptom-free. The hypothetical scenario referred to patients who sought treatment for first time and had noncontributory medical history. Five treatment options were given for each situation: (1) Extraction, (2) Surgical Retreatment, (3) Nonsurgical Retreatment, (4) Wait and See, and (5) No Therapy. Statistical analysis was performed by using multinomial logistic regression models. The overall response rate was 70.4%, with Endodontists exhibiting the lowest response. The undergraduates gave 4 or 5 treatment solutions for all cases, in contrast to Endodontists, who gave 2 or 3 treatment solutions in a percentage of 82%. Nonsurgical Retreatment predominated among the participants' choices. Significant differences were detected in (1) Extraction for postgraduate students (P =0.008) and Endodontists (P = 0.001), (2) Surgical Retreatment for general practitioners (P = .002), postgraduate students (P = .002), and Endodontists (P = .001), and (3) Wait and See for postgraduate students (P = .023). The study concluded that
Differences in specialty training and experience strongly influence endodontic decision making. Endodontists showed the most consistent agreement among the groups.

Pagnosis et al, 2000 [85] compared the endodontic retreatment planning decisions for endodontically treated teeth between 12 general practitioners and 12 endodontic postgraduate students. Utilizing dental radiographs of completed cases, both groups were asked to make treatment choices based on two hypothetical ages of a case: 1 or 3 yr postoperatively. General practitioners chose to initiate treatment at an earlier date and also chose more extensive treatment modalities. The age of the root filling was looked on as more important in treatment planning by the endodontic postgraduates.

Hulsmann, M. 1994[63] Compared the Retreatment decision making by a group of General Dental Practitioners Results obtained from 43 questionnaires returned indicate that non-intervention or further radiographic monitoring were preferred by the majority of General Practitioners in 10 of 19 cases, even in the presence of periapical pathosis. Only five cases were judged to require conservative endodontic retreatment and, in four cases, root resection.
The results revealed large inter- and intra individual discrepancies in the estimation of endodontic retreatment need.

Kvist, et al 2004[66] examined endodontic retreatment concepts among 157 General Dental Practitioners from Varmland, Sweden. The investigation showed large inter individual variation in retreatment behavior among the General Dental Practitioners. Only 9 dentists (6%) where found to repeatedly suggest retreatment of endodontic failures. A majority of General Dental Practitioners (79%) performed in accordance with pc(Praxis Concept).

Kvist, et al 2002[65] Based on (the 'Praxis Concept (PC) theory'). , an individual's inclination to propose retreatment can be expressed in the Retreatment Preference Score (RPS). This study it hypothesized that: (i) the PC theory is valid amongst experienced Endodontists; and that (ii) inter individual variation in RPS can be explained by a corresponding variation in the perceived benefit of endodontic retreatment. The RPS and RTB (The retreatment benefit (RTB) was defined as the gain in utility when a root-filled tooth with a persistent periapical lesion ('health state B') moved to a state where the lesion had healed ('health state A'). ) were found to be subjected to
substantial inter- and intra rater variation. The decision makers acted in accordance with the PC theory. No significant correlation between RPS and RTB was detected.

Kvist, et al 1994[64]. hypothesized that dentists regard various periapical conditions as different stages on a health continuum. Variations could then be regarded as the result of the individuals selection of differing cut-off points for prescribing retreatment. The hypothesized decision-making model was tested using dental students in Amsterdam (Netherland), Gothenburg (Sweden) and Pavia (Italy). The investigation showed large inter individual variations in Retreatment Preference Score (RPS). A statistically significant higher mean RPS was seen among students in Pavia compared with students in Amsterdam and Gothenburg. Among all observers and cases it was found that if retreatment was proposed for a certain size of lesion, retreatment was subsequently selected for all larger lesions.
Materials and methods

2.1 Study population: General Practitioners and Endodontists.

2.2 Study area: - Khartoum State.

2.3 Study design: - Comparative study.

2.4 Sample size :- All Endodontists (30) and General Dental Practitioners (30).

2.5 Methodology

Eight radiographic cases of previously endodontically treated teeth were presented in soft copy form to 30 Endodontists and 30 General Dental Practitioners. The Endodontist group in the sample included clinicians who had obtained postgraduate training in endodontics.

The General Practitioner group in the sample included clinicians who had not received postgraduate training in endodontics nor any advanced general dentistry programs or courses that included endodontics beyond their basic undergraduate training. All clinicians
were approached personally and handed a questionnaire and a soft copy form of radiographs of endodontically treated cases with their corresponding history. The demographic data requested were the years of experience, school of graduation, and place of employment. The clinicians were given enough time to answer all the questions.

No attempt was made to match the Endodontists or General Practitioners regarding their years of experience, school of graduation, or place of employment. The cases have been selected under supervision and assistance of a senior clinician. The criteria of the selection was to include a wide variety of clinical cases such as clinical symptoms, chronic apical periodontitis, underfilled canals, overfilled canals, missed canals, inadequate compaction, fractured instruments, and loss of coronal restorations. The cases included case description in the form of patient age, gender, age of root canal filling, and patient’s complaints. (Appendix .page 99)

The clinicians in the two groups were provided with six

Different treatment alternatives: (1) no treatment, (2) observation (wait and see), (3) Conventional retreatment, (4) apical
surgery, (5) conventional retreatment and apical surgery, (6) extraction[63, 82-84]

They were asked to tick the factor that affects their decision from the list below:

1) Clinical symptoms, 2) Chronic apical periodontitis, 3) Loss of coronal restoration, 4) Under filled canal, 5) Over filled canal, 6) Missed canal, 7) Inadequate compaction, 8) Fractured instrument, 9) Others factors, specify:

2.6 Statistical Analysis

The effect of years of experiences in decision making was analyzed by Fisher Exact Test. Chi –square test was used to compare decision making and factor affecting the decisions making between Endodontists and GDP’s regarding each case.

Fisher Exact and Chi-square Tests were used to detect effect of place of employment in decision making with in each case.

Odd ratio was used to compare decisions of Endodontists and General dental practitioners working in same place.
All tests were used at significance level equal or less than 0.05.

The data were analyzed by using STATA version 8.
2.7 Ethical consideration

No attempts were made to judge the knowledge of neither endodontic specialists nor General Dental Practitioners.

The demographic data and results obtained were used only for the purpose of the study.
Results

Years of experiences

The experience of each group varied from 1-25 years. Sixty three percent and 73% of the Endodontists and GDP’s respectively, have experience from 1-5 years, Compared with 72% of Endodontists and 17% of GDP’s from 6-10 years (Table 1). Using fisher Exact Test the result showed that there was no significant difference between the years of experience of the Endodontists and the treatment chosen (P=0.07, (Table 2). Using fisher Exact Test the result showed that there was no significant difference between the years of experience of GDP’s and the treatment chosen P=0.053, (Table 3). There was significant relation between the years of experiences of Endodontists and decision making regarding Case number 4 and Case number 7. Using Chi Square Test P=0.019, 0.000 respectively (Table 4), (Table 5), (Table 6).

Place of employment

Most of the Endodontists were from Ministry of Higher Education (56.6%), while most of the General Dental Practitioners were from
Ministry of Health (63.3%)(Figure1). Using Chi-Square and Fisher Exact Tests regarding each case there was no significant relation between the place of employment and treatment option among Endodontists (Table 8). There was significant relation between place of employment and option of treatment among GDP’s regarding case number 7, P=0.026 (Table 7). The Endodontists working in Ministry of Health chose conventional retreatment and apical surgery more probably than General Practitioners, odd ratio=3.08, P=0.012 (Table 9). Extraction is treatment of choice for GDP’s working in Ministry Of Health more than Endodontists, odd ratio=0.24, P=0.02 (Table 9). Regarding Ministry of Higher Education; the GDP’s preferred the extraction more than Endodontists, odd ratio=0.23, P=0.015 (Table 10).

**Educational back ground**

Most of dentists graduated from Khartoum University so the educational back grounds have no influence on the result of this study. Seventy seven percent of Endodontists were postgraduate from Khartoum University, only 23% was postgraduate from different schools. Sixty three percent of GDP’S graduated from Khartoum
University, while 37% were graduated from other different schools (Table11).

**Comparison between the two groups**

There was a significant difference between the two groups regarding treatment options, $P=0.00$ (Table12). The choice to retreat in general was higher than the other choices 191(39.8 %), (Fig. 2). However, most Dentists chose to retreat the cases, there was no significant difference ($P=0.227$) between the percentage of Endodontists who chose to retreat and the percentage of GDP’s (46.2 %) and (34 %) respectively (Table12). The General Dental practitioners opted for extraction (14.30%) compared with Endodontist (5.50%) at high significant level $P=0.009$ (Table12). Endodontist decided apical surgery only (1.7%) compared with GDP’s (5%) insignificantly $P=0.066$ (Table12).

**The influence of each factor in the decision making**

There was no significant difference between the two groups regarding the factors affecting their decision $P=0.876$ (Table 13) The clinical
symptoms and under filled canals were the most factors that affected the Endodontists decision (39.7%) and (17.3%) respectively. These two factors had same impact on GDP’s, which affected them (35.4%) and (19.9%) respectively (Table13).

Regarding each case, the dentists irrespective of their specialty were influenced by the factors. There was significant relation between the factors and the options of treatment except in cases number 4 and 6 (Table14).

Regarding each case Chi-square and Fisher exact tests were used to test the dependence of the factors from the treatment chosen in each case within each group, the test revealed that there was significant relation between factors and option of treatment in case no1,2,5,7,8, when Endodontists made the decision P=0.000 but there was no significant relation in cases number 3,4,6 with in the Endodontists P=0.667,P=0.80,P=0.904 respectively (Fig. 3) to (Fig. 10).

Among the GDP’s there was no significant relation between the factors and treatment options in cases number 1, 3, 4, 5, 6, 7, (P=0.357,P=0.102,P=0.833 P=0.849,P=0.131,P= 0.553) respectively
but there was significant relation in case number 2 and case number 8 within the GDP’s, \( P=0.002, P=0.000 \) respectively (Fig. 3) to (Fig. 10).
Tables

Table (1) Distribution of Endodontists and General Practitioners according to years of experience.

<table>
<thead>
<tr>
<th>years of experience</th>
<th>Endodontists</th>
<th>General</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-5 years</td>
<td>19(63%)</td>
<td>22(73%)</td>
<td>41(68%)</td>
</tr>
<tr>
<td>6-10 years</td>
<td>8(27%)</td>
<td>5(17%)</td>
<td>13(22%)</td>
</tr>
<tr>
<td>11-15 years</td>
<td>1(3%)</td>
<td>2(7%)</td>
<td>3(5%)</td>
</tr>
<tr>
<td>16-20 years</td>
<td>1(3%)</td>
<td>0(0%)</td>
<td>1(2%)</td>
</tr>
<tr>
<td>21-25 years</td>
<td>1(4%)</td>
<td>1(4%)</td>
<td>2(3%)</td>
</tr>
<tr>
<td>Total</td>
<td>30(100%)</td>
<td>30(100%)</td>
<td>60(100)</td>
</tr>
</tbody>
</table>
Table (2): Retreatment decisions within Endodontist group with regards to years of experience,(n=240).

<table>
<thead>
<tr>
<th>years of experience(Percentage of experience)</th>
<th>Options of treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No treatment (wait and see)</td>
</tr>
<tr>
<td>1-5 years(63%)</td>
<td>32 16 76 1 21 6</td>
</tr>
<tr>
<td>6-10 years(27%)</td>
<td>21 8 19 3 7 6</td>
</tr>
<tr>
<td>11-15 years(3%)</td>
<td>2 1 2 0 0 1</td>
</tr>
<tr>
<td>16-20 years(3%)</td>
<td>0 0 8 0 0 0</td>
</tr>
<tr>
<td>21-25 years(4%)</td>
<td>2 1 5 0 0 0</td>
</tr>
<tr>
<td>Total</td>
<td>57 26 110 4 28 13</td>
</tr>
</tbody>
</table>

Using fisher exact test the result showed that there is no significant differences between the years of experience of Endodontists and the treatment chosen (p-value=0.07)
Table (3): Retreatment decisions within General practitioners group with regards to years of experience, (n=240).

<table>
<thead>
<tr>
<th>Years of Experience</th>
<th>Options of treatment</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No treatment (wait and see)</td>
<td>Retreatment Apical surgery</td>
</tr>
<tr>
<td>1-5 years 73%</td>
<td>40</td>
<td>21</td>
</tr>
<tr>
<td>6-10 years 17%</td>
<td>12</td>
<td>8</td>
</tr>
<tr>
<td>11-15 years 7%</td>
<td>2</td>
<td>6</td>
</tr>
<tr>
<td>16-20 years 0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>21-25 years 4%</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Total</td>
<td>56</td>
<td>36</td>
</tr>
</tbody>
</table>

Using Fisher exact test the result showed that there is no significant differences between the years of experience of General Dental Practitioners and treatment option (p-value=0.053)
Table (4): Effect of the years of experiences on the treatment chosen in each case within Endodontists and GDP’s.

<table>
<thead>
<tr>
<th>Case number</th>
<th>Significance of the test</th>
<th>Significance of the test</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0.74</td>
<td>0.77</td>
</tr>
<tr>
<td>2</td>
<td>0.31</td>
<td>0.09</td>
</tr>
<tr>
<td>3</td>
<td>0.96</td>
<td>0.16</td>
</tr>
<tr>
<td>4</td>
<td>0.01*</td>
<td>0.16</td>
</tr>
<tr>
<td>5</td>
<td>0.9</td>
<td>0.16</td>
</tr>
<tr>
<td>6</td>
<td>1.0</td>
<td>0.54</td>
</tr>
<tr>
<td>7</td>
<td>0.02*</td>
<td>0.66</td>
</tr>
<tr>
<td>8</td>
<td>0.09</td>
<td>0.45</td>
</tr>
</tbody>
</table>

Chi-square test and Fisher exact tests at p level equal or less than 0.05.
Table (5) Relation between years of experience of Endodontists and treatment option for case number 4.

<table>
<thead>
<tr>
<th>Years of experience</th>
<th>Wait and see</th>
<th>Retreatment</th>
<th>Apical Surgery</th>
<th>Retreatment and apical surgery</th>
<th>Extraction</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>%</td>
<td>%</td>
<td>%</td>
<td>%</td>
<td>%</td>
<td>%</td>
<td>%</td>
</tr>
<tr>
<td>1-5</td>
<td>5.30%</td>
<td>42.10%</td>
<td>0.00%</td>
<td>47.40%</td>
<td>5.30%</td>
<td>100.00%</td>
</tr>
<tr>
<td>6-10</td>
<td>0.00%</td>
<td>12.50%</td>
<td>37.50%</td>
<td>25.00%</td>
<td>25.00%</td>
<td>100.00%</td>
</tr>
<tr>
<td>16-20</td>
<td>0.00%</td>
<td>100.00%</td>
<td>0.00%</td>
<td>0.00%</td>
<td>0.00%</td>
<td>100.00%</td>
</tr>
<tr>
<td>21-25</td>
<td>100.00%</td>
<td>0.00%</td>
<td>0.00%</td>
<td>0.00%</td>
<td>0.00%</td>
<td>100.00%</td>
</tr>
<tr>
<td>Total</td>
<td>6.90%</td>
<td>34.50%</td>
<td>10.30%</td>
<td>37.90%</td>
<td>10.30%</td>
<td>100.00%</td>
</tr>
</tbody>
</table>

Fisher exact (P=0.019*)
Table (6): Relation between years of experience of Endodontists and treatment option for case number 7.

<table>
<thead>
<tr>
<th>Years of experience</th>
<th>Wait and see</th>
<th>retreatment</th>
<th>Apical surgery</th>
<th>retreatment and apical surgery</th>
<th>extraction</th>
<th>total percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>percentage</td>
<td>percentage</td>
<td>percentage</td>
<td>percentage</td>
<td>percentage</td>
<td>percentage</td>
</tr>
<tr>
<td>1-5</td>
<td>15.80%</td>
<td>10.50%</td>
<td>57.90%</td>
<td>5.30%</td>
<td>10.50%</td>
<td>100.00%</td>
</tr>
<tr>
<td>6-10</td>
<td>62.50%</td>
<td>0.00%</td>
<td>0.00%</td>
<td>12.50%</td>
<td>25.00%</td>
<td>100.00%</td>
</tr>
<tr>
<td>16-20</td>
<td>0.00%</td>
<td>0.00%</td>
<td>0.00%</td>
<td>0.00%</td>
<td>100.00%</td>
<td>100.00%</td>
</tr>
<tr>
<td>21-25</td>
<td>0.00%</td>
<td>0.00%</td>
<td>100.00%</td>
<td>0.00%</td>
<td>0.00%</td>
<td>100.00%</td>
</tr>
<tr>
<td>Total</td>
<td>100.00%</td>
<td>0.00%</td>
<td>0.00%</td>
<td>0.00%</td>
<td>0.00%</td>
<td>100.00%</td>
</tr>
</tbody>
</table>

Fisher exact (p=0.00)
## Table (7): Relation between place of employment and treatment option for General Dental Practitioners (Case7)

<table>
<thead>
<tr>
<th>place of employment</th>
<th>Wait and see</th>
<th>retreatment</th>
<th>Apical surgery</th>
<th>retreatment and apical surgery</th>
<th>extraction</th>
<th>total percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>percentage</td>
<td>percentage</td>
<td>percentage</td>
<td>percentage</td>
<td>percentage</td>
<td>percentage</td>
</tr>
<tr>
<td>Ministry of health</td>
<td>52.90%</td>
<td>11.80%</td>
<td>11.80%</td>
<td>0.00%</td>
<td>23.50%</td>
<td>100.00%</td>
</tr>
<tr>
<td>Ministry of high education</td>
<td>0.00%</td>
<td>0.00%</td>
<td>50.00%</td>
<td>0.00%</td>
<td>50.00%</td>
<td>100.00%</td>
</tr>
<tr>
<td>Military dental hospital</td>
<td>100.00%</td>
<td>0.00%</td>
<td>0.00%</td>
<td>0.00%</td>
<td>0.00%</td>
<td>100.00%</td>
</tr>
<tr>
<td>Private</td>
<td>33.30%</td>
<td>33.30%</td>
<td>0.00%</td>
<td>33.30%</td>
<td>0.00%</td>
<td>100.00%</td>
</tr>
<tr>
<td>Total</td>
<td>42.90%</td>
<td>10.70%</td>
<td>17.90%</td>
<td>3.60%</td>
<td>25.00%</td>
<td>100.00%</td>
</tr>
</tbody>
</table>

Fisher exact $\chi^2$-square ($P=0.026$)
Table (8): Effect of the place of employment on treatment options within each case for Endodontists and GDP’s.

<table>
<thead>
<tr>
<th>Case number</th>
<th>Endodontists</th>
<th>GDP’s</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Significance of the test</td>
<td>Significance of the test</td>
</tr>
<tr>
<td>1</td>
<td>0.644</td>
<td>0.0952</td>
</tr>
<tr>
<td>2</td>
<td>0.643</td>
<td>0.111</td>
</tr>
<tr>
<td>3</td>
<td>0.976</td>
<td>0.463</td>
</tr>
<tr>
<td>4</td>
<td>0.055</td>
<td>0.584</td>
</tr>
<tr>
<td>5</td>
<td>0.448</td>
<td>0.66</td>
</tr>
<tr>
<td>6</td>
<td>0.538</td>
<td>0.167</td>
</tr>
<tr>
<td>7</td>
<td>0.616</td>
<td>0.026*</td>
</tr>
<tr>
<td>8</td>
<td>0.289</td>
<td>0.880</td>
</tr>
</tbody>
</table>

Chi–square and Fisher Exact Test.
Table (9): Odd Ratio (OR) of treatment option for Endodontists and General practitioners working at Ministry of Health.

<table>
<thead>
<tr>
<th>Option of treatment</th>
<th>OR</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>No treatment</td>
<td>1.14</td>
<td>0.702</td>
</tr>
<tr>
<td>Observational (wait and see)</td>
<td>0.45</td>
<td>0.1</td>
</tr>
<tr>
<td>Conventional retreatment</td>
<td>1.51</td>
<td>0.161</td>
</tr>
<tr>
<td>Apical surgery</td>
<td>0.25</td>
<td>0.195</td>
</tr>
<tr>
<td>Conventional retreatment and Apical sugery</td>
<td>3.08</td>
<td>0.012 *</td>
</tr>
<tr>
<td>Extraction</td>
<td>0.24</td>
<td>0.024*</td>
</tr>
</tbody>
</table>
Table (10): Odds Ratio (OR) of treatment option for Endodontists and General practitioners working at Ministry of Higher Education.

<table>
<thead>
<tr>
<th>Option of treatment</th>
<th>OR</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>No treatment</td>
<td>1.5</td>
<td>0.351</td>
</tr>
<tr>
<td>Observational (wait and see)</td>
<td>1.08</td>
<td>0.883</td>
</tr>
<tr>
<td>Conventional retreatment</td>
<td>1.48</td>
<td>0.251</td>
</tr>
<tr>
<td>Apical surgery</td>
<td>0.53</td>
<td>0.49</td>
</tr>
<tr>
<td>Conventional retreatment and Apical surgery</td>
<td>0.68</td>
<td>0.444</td>
</tr>
<tr>
<td>Extraction</td>
<td>0.23</td>
<td>0.015*</td>
</tr>
</tbody>
</table>
Table (11): Distribution of Endodontists and GDP’s according to educational background.

<table>
<thead>
<tr>
<th>professional</th>
<th>School of graduation</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Endodontists</td>
<td>karolinska Institute Sweden</td>
<td>1</td>
<td>3%</td>
</tr>
<tr>
<td></td>
<td>Niigata Japan</td>
<td>1</td>
<td>3%</td>
</tr>
<tr>
<td></td>
<td>Russian Federation</td>
<td>1</td>
<td>3%</td>
</tr>
<tr>
<td></td>
<td>The Maxim Gorke University Ukraine</td>
<td>1</td>
<td>3%</td>
</tr>
<tr>
<td></td>
<td>United kingdom</td>
<td>1</td>
<td>3%</td>
</tr>
<tr>
<td></td>
<td>University College Cork</td>
<td>1</td>
<td>3%</td>
</tr>
<tr>
<td></td>
<td>University of Khartoum</td>
<td>23</td>
<td>77%</td>
</tr>
<tr>
<td></td>
<td>University of Western Cape</td>
<td>1</td>
<td>4%</td>
</tr>
<tr>
<td></td>
<td><strong>Total</strong></td>
<td><strong>30</strong></td>
<td><strong>100%</strong></td>
</tr>
<tr>
<td>General practitioners</td>
<td>Elrazi College of Medical &amp;Tech. Sciences</td>
<td>2</td>
<td>7%</td>
</tr>
<tr>
<td></td>
<td>Khartoum College Of Medical Sciences</td>
<td>1</td>
<td>3%</td>
</tr>
<tr>
<td></td>
<td>Mgr-India</td>
<td>1</td>
<td>3%</td>
</tr>
<tr>
<td></td>
<td>Syria Allepo</td>
<td>1</td>
<td>3%</td>
</tr>
<tr>
<td></td>
<td>University of Khartoum</td>
<td>19</td>
<td>63%</td>
</tr>
<tr>
<td></td>
<td>University of Medical Sciences &amp;Technology</td>
<td>1</td>
<td>3%</td>
</tr>
<tr>
<td></td>
<td>University of Science and Technology</td>
<td>4</td>
<td>14%</td>
</tr>
<tr>
<td></td>
<td>University of Science and Technology</td>
<td>1</td>
<td>3%</td>
</tr>
<tr>
<td></td>
<td><strong>Total</strong></td>
<td><strong>30</strong></td>
<td><strong>100%</strong></td>
</tr>
</tbody>
</table>
Table (12): Percentage of choices for treatment options among the Endodontists and GDP’s.

<table>
<thead>
<tr>
<th>treatment option</th>
<th>Endodontists</th>
<th>GDP’s</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>No treatment</td>
<td>57 (23.9%)</td>
<td>56 (23.5%)</td>
<td></td>
</tr>
<tr>
<td>Observations (wait and see)</td>
<td>26 (10.9%)</td>
<td>36 (15.1%)</td>
<td>0.282</td>
</tr>
<tr>
<td>Conventional retreatment</td>
<td>110 (46.2%)</td>
<td>81 (34%)</td>
<td>0.227</td>
</tr>
<tr>
<td>Apical surgery</td>
<td>4 (1.7%)</td>
<td>12 (5%)</td>
<td>0.066</td>
</tr>
<tr>
<td>Conventional retreatment and Apical surgery</td>
<td>28 (11.8%)</td>
<td>19 (8%)</td>
<td>0.293</td>
</tr>
<tr>
<td>Extraction</td>
<td>13 (5.5%)</td>
<td>34 (14.3%)</td>
<td>0.009*</td>
</tr>
</tbody>
</table>

chi –square ,(P=0.00).
Table (13): Percentages of different factors affecting the choice of retreatment decisions among the Endodontists and GDP’s.

<table>
<thead>
<tr>
<th>Factor</th>
<th>Endodontists</th>
<th>GDP’s</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Count</td>
<td>Percent</td>
<td>Count</td>
</tr>
<tr>
<td>Clinical symptoms</td>
<td>94</td>
<td>39.7</td>
<td>80</td>
</tr>
<tr>
<td>Chronic apical periodontitis</td>
<td>15</td>
<td>6.3</td>
<td>12</td>
</tr>
<tr>
<td>Loss of coronal restoration</td>
<td>21</td>
<td>8.9</td>
<td>20</td>
</tr>
<tr>
<td>Under filled canal</td>
<td>41</td>
<td>17.3</td>
<td>45</td>
</tr>
<tr>
<td>Over filled canal</td>
<td>21</td>
<td>8.9</td>
<td>27</td>
</tr>
<tr>
<td>Missed canal</td>
<td>21</td>
<td>8.9</td>
<td>17</td>
</tr>
<tr>
<td>Inadequate compaction</td>
<td>12</td>
<td>5.1</td>
<td>15</td>
</tr>
<tr>
<td>Fractured instrument</td>
<td>12</td>
<td>5.1</td>
<td>10</td>
</tr>
</tbody>
</table>

There were no significant differences between the factors chosen by the participants and the specialty of the participant (p-value=0.876).
Table (14): Effect of the factors on the treatment options in each case for both participants (Endodontists and General Dental Practitioners).

<table>
<thead>
<tr>
<th>Case number</th>
<th>Significance of the test</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0.000*</td>
</tr>
<tr>
<td>2</td>
<td>0.000*</td>
</tr>
<tr>
<td>3</td>
<td>0.02*</td>
</tr>
<tr>
<td>4</td>
<td>0.787</td>
</tr>
<tr>
<td>5</td>
<td>0.002*</td>
</tr>
<tr>
<td>6</td>
<td>0.796</td>
</tr>
<tr>
<td>7</td>
<td>0.001*</td>
</tr>
<tr>
<td>8</td>
<td>0.000*</td>
</tr>
</tbody>
</table>

Chi-square.
Figure 1: Distribution of Endodontists and GDP’s within different place of employment.

Figure 2: frequency of treatment options (all participants)n=480
Figure 3: Relationships between the options of treatment and factors affecting the options of treatment within case number 1.

Case no 1

Endodontists

General practitioners

- Fractured instrument
- Inadequate compaction
- Missed canal
- Over filled canal
- Under filled canal
- Loss of coronal restoration
- Chronic apical periodontitis
- Clinical symptoms
Figure 4: Relationships between the options of treatment and factors affecting the options of treatment within case number 2.
Figure 5: Relationships between the options of treatment and factors affecting the options of treatment within case number 3.
Figure 6: Relationships between the options of treatment and factors affecting the options of treatment within case number 4.
Figure 7: Relationships between the options of treatment and factors affecting the options of treatment within case number 5.
Figure 8: Relationships between the options of treatment and factors affecting the options of treatment within case 6.
Figure 9: Relationships between the options of treatment and factors affecting the options of treatment within case number 7.
**Figure 10**: Relationships between the options of treatment and factors affecting the options of treatment within case number 8.
Discussion

The use of radiograph-based clinical cases to evaluate practitioners’ attitudes towards root canal treated teeth is not new [83]. In this study the questionnaire was handed personally and the radiographs with relevant information were presented in soft copy form similar to George Dechouniotis [84] who Scanned Periapical radiographs and a leaflet with relevant information of endodontically treated teeth and mailed to participants.

The decision-making process regarding the retreatment necessity and the selection of the appropriate therapeutic alternative not only requires a sound evidence-based knowledge but might also be influenced by subjective factors emanating from both the clinician and the patient [65, 79]. The educational background and the differences in the clinical experience level constitute significant retreatment factors [76, 78, 82, 83, 85]. The results of this study emphasized that the level of experience(specialty) have significant role in decision making. Most of participants in this study were from the same educational background and their years of experiences ranged
from 1 to 5 years, so the years of experience and school of graduation haven’t had a significant relation in decision making.

Regarding each case Endodontists’ decision of retreatment showed no significant relations with their places of employment. This is in agreement with Balto [83] who reported that there was no significant differences found within the Endodontists regarding their educational background, years of experiences and place of employment. Heinikainen [68] reported that the Treatment decisions by GDP’s in most cases were independent of the dentist's work and practice related characteristics. This supports the finding that GDP’s prefer extraction regardless of place of employment.

**Options of treatment**

The results of this study showed that conventional retreatment scored the highest percentage (39.7%) of treatment chosen by dentists. This is in agreement with Balto [83] and Dechouniotis et. al [84]. When a patient moves from a worse to a better health state he or she benefits, from a medical point of view. Thus, a patient potentially benefits from endodontic retreatment if he/she moves from a health
state with a periapical inflammation to a post retreatment situation where the lesion has healed [65] thus justifying the high preference.

Although Endodontists prefer retreatment more than GDP’s, the difference was insignificant (P= 0.227) This is in agreement with Pagnosis [85] who reported that there was no significant differences between GDP’s and post graduate students in retreating the cases, but disagree with Balto [83] who reported that GDP’s underestimate the option of conventional retreatment.

GDP’s significantly preferred the option of extraction compared to Endodontists (P= 0.009). Thus; GDP’s appeared more likely to initiate more invasive treatment. This was in agreement with Pagnosis [85] et.al and Dechouniotis et .al[84] who reported that the lower threshold that GDP’s displayed toward extraction might be attributed first to the lack of retreatment know-how; second, their experience on prosthetic matters facilitates the tooth replacement procedure.[84].

Unsurprisingly that GDP’s prefer surgical retreatment more than Endodontists who when selected this option they combined surgical and conventional retreatment together. This evidence based knowledge
was expected to be known by the specialists and justified their lowest
tendency toward apical surgery compared with nonsurgical
retreatment. The majority of failed endodontically treated teeth;
orthograde retreatment will be the first option. Periradicular surgery
should be contemplated only in strictly defined cases, and clinicians
undertaking such surgery should ensure that they are fully conversant
with the relevant up to date literature.[86]

**Influence of the factors**

In the present investigation, both general dentists and Endodontists
agreed on the need for retreating teeth with clinical symptoms and
roots with deficiency of root filling as appeared on the radiograph.
This was in agreement with Balto [83]and Van nieuwenhuysen
[59]who regarded clinical symptoms as relevant to their treatment
decision, so in the absence of signs and symptoms they decided not to
treat or to observe.

There is obviously a consensus that retreatment procedures have to be
performed at least in all cases with persisting pain, the presence of
clinical signs such as swelling or sinus tract, and in teeth with periapical pathosis refractory to endodontic therapy.[50]

More Endodontist regarded clinical symptoms, under filled canal, missed canals and loss of coronal restoration as relevant to their treatment decision. This is in agreement with Balto[83]. It has been stated that coronal leakage may be an important cause of failure of endodontic treatment[48], immediate success will only result when all the bacteria are eliminated from the root canal system.[21] Long-term success will depend on the quality of the obturation in its ability to resist further bacterial invasion.[56] that is why Endodontists opted for these factors.

Most of the studies showed that bacteria remaining in untouched areas as in missed canals and under filled canal contribute to failure. [18, 41] GDP’s regarded under filled canals relevant to their decisions.

Regarding each case; this study found that there was significant relation (P=0.000) between the option of no treatment and clinical symptoms in cases number 1&8. This illustrated that Endodontists in these cases ignored the radiographic findings and depended on absence
of pain and age of root filling which was 5 years for case 1 and 20 years for case 8. This agreement might be justified by that evaluation of endodontic therapy is limited to the observation of clinical symptoms.

In cases number 2, 5 and 7 Endodontists depended on radiographic findings and regarded the missed canal, loss of coronal restoration relevant to conventional retreatment decision making. This large intra-individual discrepancies cannot be explained solely by the quality of radiographic investigation of endodontically treated teeth. The dentist's endodontic background, his or her technical standard and general treatment concepts also appear to influence the decision-making process.[63]

GDP’s ignored the loss of coronal restoration in case 7 and decided not to treat. From a clinical standpoint, coronal exposure of the root canal obturation to saliva for a relatively short period of time (30 days or more) might be considered an indication for retreatment[11]
In case 2 most of GDP’s opted for apical surgery and considered missed canal relevant to their decision. This demonstrated a less conservative approach by GDP’s.

Regarding case 4 with increasing in years of experience, Endodontists showed less invasive treatment. They decided to wait and see in spite of pain and radiographic findings. On other hand in case 7 there was in consistency between increasing of Endodontists’ experience and treatment options, surprisingly Endodontist opted to extraction. These extraordinary findings draw attention to the variation on decision making.

Such a radiograph-based clinical case study does not reflect the practitioner's decision making process in real life for two reasons. First, there is a considerable difference between what is learned from dental textbooks, what is expressed in a survey and what is actually done in clinical practice. Incorporation of clinical elements in theoretical concepts is a complex process and may explain these variations.
Secondly, clinical decision making is a multifactorial problem. Practitioners consider several contributing factors when prescribing treatments and a radiograph-based clinical case does not provide all the required elements. Multidisciplinary research is required if the effects of these contributing factors on the decision making process is to be understood.

This study is therefore may be inadequate in identifying all of the causes of decision variations.

The eight cases used in the study were carefully selected to represent a wide range of clinical situations, including endodontically treated teeth with or without radiographic evidence of periapical lesions and/or clinical symptoms and also with varying quality of root canal filling and coronal restoration. There is no reason to think that another selection could have led to different results.
Conclusions

- There was a significance difference between the Endodontists and General Dental Practitioners regarding the selection of the option of treatment.

- General Dental Practitioners appeared more likely to initiate more invasive treatment than Endodontists.

- The conventional retreatment had the highest selection by two groups.

- Extraction was the treatment of choice by GDP’s working at ministry of health or ministry of higher education.

- Years of experience did not have a significance on decision making.

- There was no significant difference between the two groups regarding the factors affecting their decision.

- Clinical symptoms appeared to have more influence than radiographs in treatment decision making in some cases.
**Recommendation**

1. The establishment of evidence based guidelines for the management of failed root treated teeth.

2. The establishment of a continuous intensive development programs.

3. Further research is needed to clarify the relationship between clinicians’ value judgments and their re-treatment decision-making.
References


[68] Heinikainen M, Vehkalahti M, Murto M. Retreatment in endodontics: treatment decisions by general practitioners and dental


Appendices

Appendices I:

Questionnaire

Place of employment (employer) :- 
D. Military Dental hospital  
Ministry of health  
Ministry of high education  
Police Dental hospital  

School of graduation (if general practitioner) :  
School of postgraduation (if endodontist) :  

Years of experience:-

..............................................

Case no. (.....) treatment options:

E. Conventional retreatment and apical surgery.

No treatment  
Observations (wait and see).

Conventional retreatment.
## Apical surgery

<table>
<thead>
<tr>
<th>Case number</th>
<th>Option of treatment</th>
<th>Factors affecting option of treatment</th>
<th>If others specify.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Case number 1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Case number 2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Case number 3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Case number 4</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Case number 5</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Case number 6</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Case number 7</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Case number 8</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Cases(1,2,3,4,5,7,8) are selected under supervision of supervisor from Balto HA, Al-Madi EM. A comparison of retreatment decisions among general dental practitioners and endodontists. Journal of dental education. 2004 Aug;68(8):872-9. Case (No 6) from
Appendices II

Cases

Case no 1:-

Tooth #36 in thirty-six-year-old female; age of root canal filling is five years; there is bleeding and discoloration of the gingival, but otherwise no complaint; . Crown has to be renewed.
Case no 2

Tooth #26 in thirty-eight-year-old female; age of root canal filling is two years; no complaints; new restoration is planned.
Case no 3

Tooth #46 in twenty-nine-year-old female; age of root canal filling is nine months; patient presents with severe, spontaneous pain; replacement of the restoration is planned.
Case no4

Tooth #46 in eighteen-year-old female; age of root canal filling is one year; mild pain triggered by chewing; permanent restoration is planned.
Case no5

Tooth #37 in thirty-eight-year-old female; age of root canal filling is five years; no complaints; grade I mobility; restoration with a crown is planned.
Case no 6

Tooth#36 in 36 years old male; age of root canal filling is 9 months; patient present with discomfort; new restoration is planned
Case no7

Tooth #16 in forty-year-old female; age of root canal filling is four years; no complaints; no coronal seal since six months ago; restoration with a crown is planed.
Case no 8

Tooth #14 in fifty-two-year-old female; age of root canal filling is more than twenty years; no complaints; restoration with a crown is planned.