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Literature Review

Associated Pathology Influencing the Treatment Decision of Mandibular Impacted Third Molars. A Literature Review

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Abstract

Aim: The aim of this professional project was to evaluate the prevalence of various pathologies associated with impacted mandibular third molar teeth.

Methods: A literature review, an electronic research strategy employed for this study through the University of Warwick Library. Databases such as PubMed, Medline, Cochran, and electronic medical journals were searched. Out of 74 articles initially retrieved, 5 were selected for critical appraisal following the inclusion and exclusion criteria. The papers selected included a human study and published on the last 10 years with English language. The study consisted of analysis of radiographies and pathologic examination to determine the prevalence of pathologies and treatment option for impacted mandibular third molars.

Results: Caries and bone resorption were the most common lesions seen. While periocoronitis, periodontities, cyst and tumour respectively were less common. Pericoronitis and periapical infection were more frequently seen with partially impacted mandibular third molars than completely impacted teeth. Regarding the lower impacted molar teeth position, well know that mesioangular, horizontal, vertical and distoangular respectively were the most common inclinations associated with prevalence pathology of the impacted mandibular third molars. The relative absence of prophylactic removal as an indication could be recognized for socioeconomic and logistic reasons.

Conclusion: awareness of guidelines indications for removal of impacted mandibular third molar teeth will help in managing such patients. The mesioangular, horizontal and vertical inclinations associated with symptomatic impacted mandibular third molars were the most common. The treatment plan to extract the impacted mandibular third molars in the absence of specific surgical conditions and medical should be discontinued. There is no existing literature to confirm these recommendations about whether to remove impacted mandibular third molars or not.

Keywords: *Impacted mandibular third molar, Pericoronitis, Third molar pathology, Surgical extraction*

Introduction

Tooth impaction occurs when a tooth is prevented from erupting into a fully functional position (Ireland, 2010). However, removing asymptomatic third molar teeth is controversial, and dental practitioners are still undecided about the treatment plan to be undertaken which may be either prophylactic or therapeutic (Knutsson *et al*., 2001). The literature shows that tooth impaction is a frequent phenomenon (Morris *et al*., 1971: Yamaoka *et al*., 1995). However, there is considerable variation in the prevalence of impacted teeth influenced by the timing of tooth eruption (Aitasalo *et al*., 1972: Yamaoka *et al*., 1995).

Surgeons must consider the interests of the patient when evaluating the risks and the benefits the removal of impacted mandibular third molar teeth. Therefore, it is necessary to take into account the pathological conditions associated with impacted mandibular third molars. Guidelines for the management of impacted mandibular third molars published in 2005 have shown that pathologies such as unrestorable caries, periapical infection, bone resorption, recurrent pericoronitis, periodontitis, cyst and tumours are all well-defined criteria for impacted third molar removal (NICE. 2005).

Definition

An impacted tooth is any tooth prevented from reaching it is normal position in the mouth by bone, soft tissue or another tooth. However, most commonly impacted teeth are mandibular and maxillary third molars, canines, second premolars and supernumerary teeth (luke *et al.,* 2011).

Classification

The classification of impacted mandibular third molars based on the nature of the overlying tissues and the variety of different positions.

The nature of the overlying tissue

Soft tissue impaction

The impacted mandibular tooth and surrounding alveolar bone are covered by soft tissue and this tissue can be fibrous tissue.

Bony impaction (Hard tissue)

When the impacted wisdom tooth fails to erupt due to obstruction by the overlying bone. However, this classification can be sub-divided into complete and partial bony third molars impactions.

Complete bony impaction

The impacted third molars are completely covered by bone, and the tooth is not visible.

Partial bony impaction

The occlusal surface of the tooth is covered only by soft tissue, and the height of the mandibular third molar tooth is buried inside the alveolar bone.

Winter's Classification

In 1926 G.B. Winter illustrated a method of assessing the position, angulation and extent of impaction mandibular third molars. Winters drew three lines as on figure 1, the first line along the occlusal surface of erupted mandibular molars demonstrating the axial inclination of wisdom tooth; this also gives some indication of the depth of the tooth in the mandible. The second line, extending from the surface of the bone distal to third molar to the interdental septum between first and second molars, shows the amount of alveolar bone. The third line is perpendicular to the second line extending to the amelo-cemental junction on the mesial surface of the impacted tooth. The purpose of this classification is to assessing the position and angulation of impacted mandibular third molars with alveolar bone (Ireland, 2010).

Figures 1-5 shows the different positions of impacted mandibular third molars.

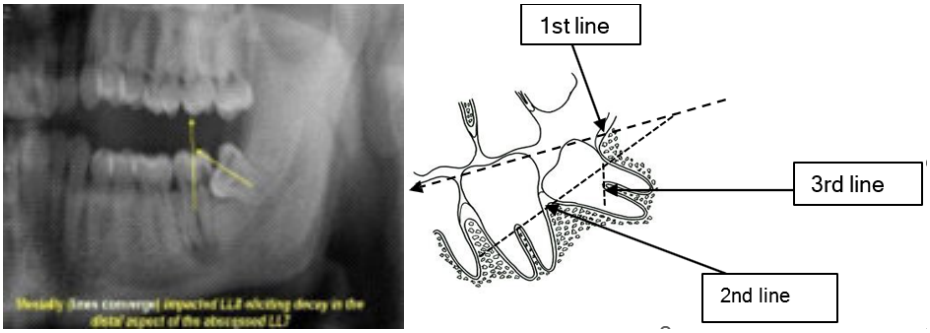

Figure 1. A mesio-angularly impacted molar. (http://www.exodontia.info/Wisdom_Tooth_Impaction_Classification.html). (Ireland, 2010).

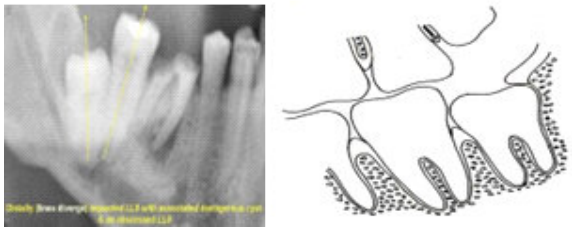

Figure 2. A disto-angular.

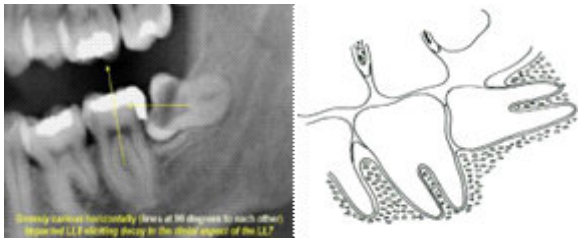

Figure 3. Horizontal

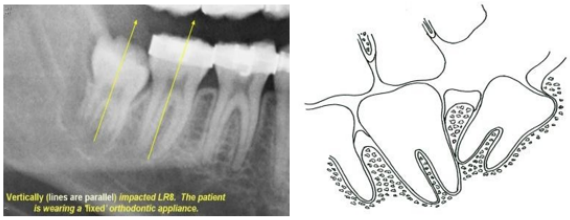

Figure 4. Vertical

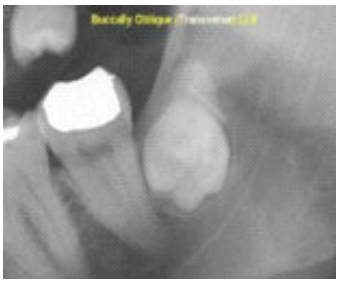

Figure 5. Buccally Oblique (Transverse) (http://www.exodontia.info/Wisdom_Tooth_Impaction_Classification.html). (Ireland, 2010).

Prevalence

Mandibular third molar impaction is a common condition (Knutsson *et al.,* 1996). Almost 70% of people aged between 20 and 30 years have at least one or two impacted lower third molar teeth. The impacted mandibular third molar teeth usually erupting into the mouth between the ages of 17 and 24 years (Garcia *et al.*, 1989: Hugoson *et al*, 1988). The most common tooth to become partially or completely impacted is the mandibular third molar (Howe *et al.,* 1978: Tetsch *et al.,* 1985). The impaction of wisdom teeth in the lower jaw is more common than in the upper jaw (Hugoson *et al.,* 1988).

Aetiology

Tooth impaction occurs where uncompleted eruption into a normal functional position is prevented and completion of the root growth is fully established. This can be due to a lack of space in the mouth, obstruction by another tooth, or development in an abnormal position (Venta *et al.,* 1999). Most dental practitioners unfortunately neglect extracted unerupted third molars rather than sending them to a laboratory for examination by a pathologist for histological analysis. That is why no accurate information is available regarding the etiology of the impaction (Yildirim *et al.,* 2008).

Signs & Symptoms

Impacted mandibular molar teeth can cause symptoms of pain or pathological changes, such as swelling or ulceration of the gingiva, inflammation, pericoronitis, periodontal disease and infection; this may affect the adjacent teeth and bone (Baykul *et al.,* 2005).Pathological changes can be associated with impacted mandibular third molars such as caries, bone resorption, cyst and tumours.

Treatment options

Therapeutic treatment

Observation (no treatment) option

Regular review and follow up of the patient is necessary to examine and assess the long term management of impacted mandibular third molars. As well as, prescribing some mouthwash such as chlorhexidine to decrease pericoronal inflammation (Ireland, 2010).

Also appropriate restorative treatment to grinding the cusps of any opposing tooth (Coulthard *et al.*, 2003).

Treatment with medication option

In case of pericoronal infection, trismus or a raised temperature antibiotic therapy may be indicated (Paul et al., 2003).

Surgical treatment option

Removal of impacted wisdom teeth can be an appropriate procedure when associated with pathology or clinical manifestation (Guralnick *et al.,* 1980). The surgical removal of impacted third molars is one of the most frequent procedures performed by oral and maxillofacial surgeons (Rakprasitkul *et al.,* 2001: Baykul *et al.,* 2005: Knutsson *et al.,* 1996). Most of the difficulties following surgical removal, such as postoperative pain, discomfort and restricted activity, are related to lower wisdom teeth.

Prophylactic treatment

The convenience of prophylactic extraction of impacted mandibulare third molars when they are still asymptomatic has been the subject of argument (Adeyemo *et al.,* 2006: Mettes *et al.,* 2005). However, prophylactic treatment of third molars in young adults has been undertaken as a preventive measure on poorly defined indications (Knutsson *et al.,* 2001). There seems to be no argument about removal of symptomatic impacted third molar teeth in the mandible (Erasmus *et al.,* 2002), but the prophylactic removal of asymptomatic impacted mandibular third molars may be regarded as controversial (Sasano *et al.,* 2003).

Treatment with associated pathology

Removal of diseased or symptomatic wisdom teeth alleviates pain and suffering, and improves oral health and function (Baykul *et al.,* 2005). Approximately one third of asymptomatic unerupted wisdom teeth have been found to change position with time, resulting in wisdom teeth that are partially erupted, but non functional or non hygienic (Phillips *et al.,* 2007). Knutsson *et al.,* (1996) and Almendros *et al.* (2006) stated that evaluation of the impacted wisdom teeth in the mandible may be expected to develop pathology over time, so the decision to remove or not these impacted teeth should be taken.

Treatment without associated pathology

The rationale behind accepting or rejecting prophylactic treatment of asymptomatic impacted lower third molars teeth are not commonly agreed by surgeons (Baykul *et al.,* 2005: Adeyemo *et al.,* 2006: Polat *et al.,* 2008), causing ambivalence in dental practitioners as to whether or not to advise patients to leave asymptomatic impacted third molar teeth in place (van *et al*., 1995). Osaki (1995) said that retaining impacted third molar teeth may sometimes lead to infection in elderly patients, and it was proposed that removing these teeth in younger people might be considered a preventive measure against development of lesions in adulthood. On the other hand, Stephen (1989) stated that the risk of retained impacted third molars has been exaggerated and suggested their extraction only be performed if a definitive pathologic entity was found.

Aims

The aim of this professional project is to evaluate the associated pathologies related to impacted mandibular third molar teeth and to review the evidence for the appropriate treatment option and whether this would be prophylactic or therapeutic.

Objectives

The objectives of this professional project are:

- An electronic search strategy will be undertaken in order to identify relevant literature.
- Electronic databases will be searched for high level evidence related to the pathologies associated with the mandibular third molars.
- Critical appraisal of the selected literature by using Critical Appraisal Skills Program (CASP) tools.
- Evaluation of the results to establish if evidence based recommendations can be applied to clinical practice.

2. Methodology

The methodology employed for the current professional project was a literature review. The benefit of the literature review is that it gives an opportunity to present an objective picture and a balanced assessment of the current literature. Therefore, in terms of achieving the project aims a literature review of good quality, evidence based papers has been selected as the most appropriate method. The present professional project is to critically appraise the available literature in order to evaluate the pathologies associated with mandibular impacted third molar teeth and the treatment options.

PICO

In this project the PICO format tools were used in formulating an answerable question. The short form of PICO stands for: (P) for population, (I) for intervention, (C) for comparison, and (O) for outcome.

Population (P)

Patients who have mandibular third molars. The criteria were set to include patients who:

Were referred to an oral surgery clinic for consultation, diagnosis, and treatment of impacted third molars in the mandible.

Were exposed to prophylactic or therapeutic removal of symptomatic and asymptomatic impacted wisdom teeth (this is defined as removal of impacted mandibular third molar teeth in the absence of local disease).

Intervention (I)

The relationship of the prevalence of pathologies with impacted mandibular third molar teeth and treatment option.

Comparison (C)

Comparing different pathologies and the position in relationship with impacted mandibular third molars.

Outcome (O)

To reach the most common pathologies associated with mandibular third molar teeth and successful treatment option.

Search strategy

In order to have the research question answered objectively, a thorough and comprehensive literature review with all key articles needs to be identified. A search strategy was designed. An electronic search through Warwick Library was carried out.

The searches were done in Medline and PubMed as a famous literature websites, also electronic medical journals such as British journal of surgery, British medical journal and Oral surgery journal were conducted using search terms presented in alphabetic order as it showed in Table 1 between (2000 and 2011).

Search terms including synonyms

Table 1. *IMPACTED THIRD MOLARS and PATHOLOGY and MANDIBLE. Search terms used.*

- Impacted
- impacted third molars
- mandible
- molars
- pathology
- third

The searches were conducted using the following search terms presented in alphabetic order (Table 1): ("mandible"[MeSH Terms] OR "mandible"[All Fields] OR "mandibular"[All Fields]) AND ("tooth, impacted"[MeSH Terms] OR ("tooth"[All Fields] AND "impacted"[All Fields]) OR "impacted tooth"[All Fields] OR "impacted"[All Fields]) AND ("molar, third"[MeSH Terms] OR ("molar"[All Fields] AND "third"[All Fields]) OR "third molar"[All Fields] OR ("third"[All Fields] AND "molars"[All Fields]) OR "third molars"[All Fields])) AND (associated[All Fields] AND ("pathology"[MeSH Terms] OR "pathology"[All Fields] OR "pathologies"[All Fields]). (IMPACTED THIRD MOLARS and PATHOLOGY and MANDIBLE). Search terms used: impacted, impacted third molars, mandible, molars and pathology and third.

Databases

A literature search was performed through University of Warwick library website using the following databases: Medline (OVID), PubMed and the Cochrane Library. Also electronic searching for medical journals. Articles of interest were accessed using the following databases:

Medline (OVID) PubMed Cochrane Medical Journals

Inclusion criteria

- Global studies.
- Published articles.
- Studies written in the English language.
- Primary Research studies.
- Human Studies.

Exclusion criteria

- Non-research studies.
- Studies waiting publication.
- In vitro or animal studies.
- Case report studies.
- Clinical trials.

Search results

The PubMed search yielded 115 studies. It was narrowed down by choosing full text and publication date in the last 10 years from (2000 to 2011), Medline yielded 41 human studies and electronic medical journals were 15. If the articles were not available electronically, the University of Warwick Library was contacted to see if hard copies of the articles were available. Figure 6 shows the selection procedure of the 74 studies. The databases were including Medline, PubMed, and the Cochran and electronic medical journals. However, 20 duplicate studies were removed; also 30 non topic related studies were removed too. The search yielded 24 studies; afterwards 19 full articles were excluded due to improper information as it showed in Table 2. Overall, 5 full papers were selected for critical appraisal.

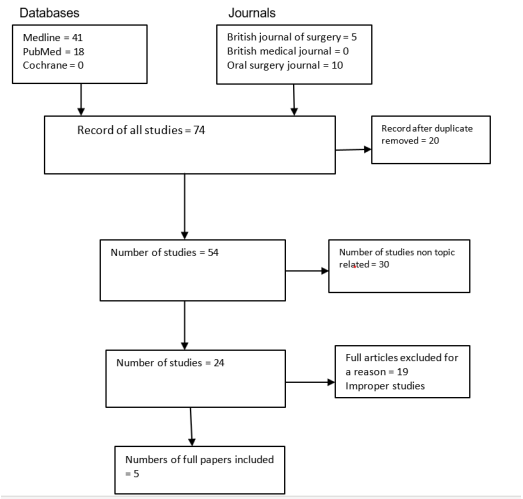

Figure 6. The selection procedure of the Studies (PRISMA 2009 Flow Diagram)

Table 2. Excluded studies with reasons for rejection.

Excluded Studies	Study Design	Reason for Exclusion
Kaushal *et al,*. 2012	Case Report	The authors used only two cases. There was one pathology mentioned in this study dentigerous cyst. No histopathology finding.
Akinbami *et al,*. 2010	A pilot study	The study was to determine how some physical characteristics can be used to predict the occurrence of impacted mandibular third molars. Small sample size. There were not different pathologies included in this study.
Mohammed *et al,*. 2010	Case report	Small sample size, two cases. One of the cases was treated 20 years ago. The authors talking about Osteomyelitis of the mandible secondary to Pericoronitis.
Mesgarzadeh *et al*,.2008	Retrospective study	Evaluate the frequencies of the pathologies around maxilla and mandible. It was not a clear study about the prevalence of pathology associated with
Nance *et al,*. 2006	Retrospective study	To assess changes in third molar position and angulations in young adults. One pathology was assessed (periodontal disease).
Kruger *et al,*. 2001	Retrospective study	To describe the presence and impaction status of people's third molars at age 18 years
Lysell *et al,*. 1993	Retrospective study	To judge the need for removal of 36 asymptomatic impacted third molars. This study is not specified to prevalence of the pathologies associated
Artun *et al,*. 2005	Retrospective study	It is not related to pathology associated with impacted third molar. Purpose was to determine the angulations of impacted third molars after
Nance *et al,*. 2006	Prospective study	To assess changes in third molar position and angulations in young adults. One pathology was assessed (periodontal disease).
Kruger *et al,*. 2001	Prospective study	To describe the presence and impaction status of people's third molars at age 18 years. Frequencies of the positions (inclinations) of wisdom teeth.
Artun *et al,*. 2005	Retrospective study	It is not related to pathology associated with impacted third molar. Purpose was to determine the angulations of impacted third molars after
Chye *et al,*.2005	Case report	This case report describes a large odontogenic keratocyst. No evaluation to the pathology prevalence.
Shinohara *et al,*. 2010	Prospective study	The frequency of simultaneously impacted second and third molars in teenagers. The traditional treatment is the removal of the third molar.

Databases

Search results

The titles and authors of the six papers for critical appraisal:

1. Prevalence of impacted teeth and associated pathologies a radiographic study of the Hong Kong Chinese population. (Chu, FCS; Li, TKL; Lui, VKB; Newsome, PRH; Chow, RLK; Cheung, LK Hong Kong Medical Journal, 2003).

2. Incidence of cystic changes in radiographically normal impacted lower third molar follicles. (Timuc ¸in Baykul, DDS, PhD,aAli A. Saglam, DDS, PhD,bUlkem Aydin, DDS, PhD,cand Kayhan Bas xak, MD,dIsparta, Turkey SU ¨LEYMAN DEMIREL UNIVERSITY AND ISPARTA GOVERNMENT HOSPITAL, 2005).

3. Pathology Associated With Impacted Mandibular Third Molars in a Group of Jordanians. (Taiseer Hussain Al-Khateeb, MScD, FDSRCS, FFDRCS, and Anwar B. Bataineh, MScD, CSOS, MDSc, 2006).

4. Prevalence of commonly found pathoses associated with mandibular impacted third molars based on panoramic radiographs in Turkish population. (Hidayet Burak Polat, DDS PhDa, Fatih Özan, DDS PhDa, I˙sa Kara, DDSa, Hakan Özdemir, DDS PhDb, Sinan Ay, DDS PhDc, Sivas and Gaziantep, Turkey CUMHURIYET UNIVERSITY AND GAZIANTEP UNIVERSITY, 2008).

5. Indications for removal of impacted mandibular third molars: a single institutional experience in Libya. (Krishnan B1· Mohammad Hossni El Sheikh2 · Rafa El- Gehani3 · Orafi H4, 2009).

Level of Evidence to be searched

This study will critically appraise the studies that were chosen in order to fulfil the aim of the professional project. It has long been recognized that not all research designs are equal in terms of the risk of error and bias in their results. When seeking answers to specific questions, some research methods provide better evidence than those provided by other methods. That is, the validity of the results of research varies as a consequence of the different methods used. For example when evaluating the effectiveness of an intervention, the randomised control trial, prospective and retrospective are considered to provide the most reliable evidence (Muir Gray *et al.*, 1997).

Screening and Selection

Each article will be critically appraised using the Critical Appraisal Skills Programme (CASP) tools. There are four elements to framing a question about an intervention program or treatment: population, intervention, comparison, and outcome. Outlining the search terms in the PICO format helps to develop a focused search strategy for collecting the available evidence for critical appraisal (Fineout *et al*., 2005).

The appraisal tools were developed by Critical Appraisal Skills Programme for use when assessing the quality of the research. The outline is important to critically appraising scientific literature review and it has been used for assessment of the articles, and judging the risk of bias. The patients and the operators should be blinded to the intervention, if the studies designs allow it. Also, if it is impossible to blind the surgeon, ideally the allocation group should be revealed just before the procedure.

Critical appraisal

There is no doubt on that each study has strength and weakness points. However, in this section of the professional project will critical appraisal the studies related to evaluation of the pathologies associated with impacted mandibular third molar teeth. The papers will be critically appraising in way from old to most recent studies. Also, the CASP tools of critical appraisal will used.

Paper 1:

The first study that spotted the light for prevalence of impacted teeth and associated pathologies by using a radiographic study of the Hong Kong population. In 2003 the study was carried out by Chu and his colleagues. The authors tried to examine the prevalence and pattern of impacted teeth and associated pathology in primary care clinic in Prince Philip Dental Hospital, and it was retrospective study. The design was a cohort study and the P value < 0.05. The test method used for investigating the prevalence and pattern of impacted teeth and associated pathologies by using panoramic radiograph and the sample size was a clinical record of 7486 patients.

The patients who arrived at the reception of primary care clinic at the Prince Philip Dental Hospital between September 1997 and August 1998 were retrieved for this study. The minimum age of the patient who attended the clinic reception was 17 years, which is the proper age for mandibular wisdom tooth eruption. The panoramic radiographs were taken and the researchers examined the radiography at the same time on the light box to determine the number and types of impacted teeth and associated pathologies. Chu and his colleagues defined impacted tooth as follows: if the embedded tooth was covered by bone but no adjacent tooth was obstructing it is on the eruption pathway. Moreover, the depths of the impacted teeth were measured by winter's line classification. Since the study relies on x-rays, there are a lot of weak points. Firstly, the authors used only panoramic radiographs to evaluate the pathologies associated with wisdom teeth. The authors could have used periapical radiographs which are intraoral radiographs that show the crown and root of tooth and detect periapical pathology. However, the authors only examined caries, root resorption of adjacent teeth which are the second molars, periodontal bone loss of adjacent tooth and periodontal pockets. Secondly, the authors mentioned that periodontal bone loss of the adjacent teeth were more than 5 mm below the cementoenamel junction, and the pericoronal space of the dental follicle of more than 4 mm around the mandibular impacted third molar teeth. However, Chu and his colleagues did not explain the criteria for measurement of the radiolucent area on the panoramic radiographs. Thirdly, there was no clear radiographic follow up examinations post operative to evaluate any recurrent pathology. Fourthly, the high cost of panoramic tomography is limited to dental hospital patients and private dental practices because of the associated costs and ethical considerations such as high doses of radiation (Morris *et al.,* 1971: Yamaoka *et al.*, 1995).

Paper 2

The second study with respect to time of publication was a study by Timuc et al. in 2005 at Leyman Demirel University and Isparta Government Hospital. This study considered the cystic changes associated with impacted mandibular third molars by using panoramic radiography. Also cystic changes in relation with both the angular position and the contact of impacted lower molar with adjacent tooth. The studies carried out by Timuc et al. (2005) were trying to find a general agreement need for surgical removal of asymptomatic impacted mandibular third molars. However, in 2009 Adelsperger et al. said that there is a pericoronal pathology generally accepted reason for surgical removal lower impacted wisdom tooth. The sample size was 94 patients who were referred to the university hospital for removal of impacted mandibular third molars, and the age was ranging between 14 and 45 years. The reasons for referred patients were orthodontics, pain and destruction of adjacent teeth. The disadvantages of this study were as follows: the age of patients who selected for this study was from 14 to 45 years. However, obviously the impacted mandibular third molar teeth erupted between 17 and 24 years. Radiographically, the patients selected had follicular spaces smaller than 2.5mm. On the other hand, Timuc said that in 1989 Eliasson et al. mentioned that a pericoronal radiolucency of smaller than 2.5mm in width is not a pathologic lesion. Cystic changes around impacted third molar teeth and angular positions were descriptively statistically analysed in this study, and the P value was < 0.05. However, the relation between the cystic changes and communication of impacted mandibular third molar teeth with the second molar was not statistically significant P >.05. There was no clear Follow up review in this present study in terms to assess the highly cystic recurrent. The advantages of this study, the relationship between cystic changes and angular position of impacted lower third molars and with adjacent tooth were explained in detail. The authors in this study found that approximately 50% of histologic evaluation of the follicles obtained from panoramic radiographics of impacted mandibular third molars showed cystic changes. Therefore, the authors mentioned that age between 20 and 25 years may be used as an indication for surgical removal of impacted mandibular third molars as they showed cystic changes. Timuc et al. found that a higher probability of cystic changes was found in the vertical impacted mandibular third molars, than horizontal and mesioangular positions respectively.

Paper 3

In 2006 Taiseer and his colleagues conducted a retrospective study which determined the frequency and type of radiographically detectable pathologic condition around impacted mandibular third molars in Jordanian patients. The patients were referred from dental practices to the Oral and Maxillofacial Surgery unit for surgical removal of impacted mandibular molars. The materials and methods of the study were described accurately and they used tables and figures. The strength of this study: firstly, the sample size was 1398 patients with 2432 impacted mandibular third molars. Secondly, this paper was published in a well known journal: American Association of Oral and Maxillofacial Surgeons J Oral Maxillofac Surg 64:1598-1602, 2006. Furthermore, the authors were trying to avoid bias: the target population was not a sample of the general population, for example, dental students, but persons with known mandibular third molar impaction. Nevertheless, Taiseer et al. were admitting that their study had some bias, taking a sample from the general population, for example: dental students probably have some degree of bias. However, the authors were selected patients with known impacted mandibular third molars to avoid such a bias.

The authors had difficulties in avoiding some bias, like the inclusion of only teeth referred for surgical removal and with a preoperative panoramic radiograph, and that at least one third molar teeth had to be scheduled for removal. On the other hand, there are a lot of weak points in this study. First of all, the authors did not explain the procedure of measurement of the radiolucent area around the impacted mandibular third molars. Secondly, the authors did not explain their histopathologic investigation of radiolucent areas. Thirdly, the authors excluded Mandibular third molars fully erupted to the level of the occlusal plane, and also, there were some cases in which lesions were not verified histologically were also excluded from this study without reasons being given. There was much descriptive statistical analysis in this study.

Paper 4

In 2008 Hidayet and his colleagues were brought into the literature with a retrospective study about prevalence of pathologies associated with mandibular impacted third molars based on panoramic radiographs in the Turkish population. The authors in this study were used to find justification for and against prophylactic removal of asymptomatic impacted mandibular molars; also it often led to confusion in the mind of practitioners whether to advise patients to leave asymptomatic lower wisdom teeth in place (van der Linden *et al*., 1995). Hidayet et al (2008) examined the population of patients who referred for surgical removal of impacted mandibular third molars in an eight year period from 1997 to 2005 at the Oral and Maxillofacial Surgery Clinic, Faculty of Dentistry, Cumhuriyet University. The first advantage is sample size which contains 1,914 panoramic radiographs with 3,050 impacted lower third molar teeth which were examined to evaluate the pathologies associated with mandibular wisdom teeth. The second advantage of this study was that, the authors used a good statistical analysis of the complete study data and a chi-squared test was used. The third advantage is that, Hidayet et al. mentioned that there was some bias in this study which was in obtaining and taking radiographs from the general population, especially in diseases free people or those who were unaware of their problem. On the other hand, there are disadvantages regarding to this study. Firstly, there was no available information about clinical symptoms, and the need for dental care was not considered. Secondly, there was no a radiographic review in this present study. However, in 2000 Güven et al. stated that regular radiographic follow up is necessary so as to be able to intervene surgically when pathology arises.

Paper 5

In 2009 Krishnan and his colleagues conducted a study which studied the removal of impacted mandibular third molars in a dental school in Libya. The study was retrospective and carried out over a 3 year period and records of patients who underwent a surgical removal of lower impacted teeth were reviewed. Panoramic radiographs were studied to determine the angular position as well as the pathologies associated with such teeth. The sample size was 439 patients who were referred to the department of Oral and Maxillofacial Surgery, Al Arab Medical Sciences University, Benghazi, Libya. There was no clear number of how many wisdom teeth were examined. The authors mentioned that five patients were excluded from the sample in this study due to two patients who went for regular dental checkups and sought consultation only when their symptoms persisted, and three patients were unwilling to accept any risk associated with removal of an asymptomatic impacted mandibular third molar. Krishnan and his colleagues were not clear about this study bias. The strength of this current study was that it was only study from the above mentioned studies so far which used two different x-rays; intraoral periapical and panoramic radiographs were used to determine the angular position and associated pathologies with the impacted wisdom teeth. Moreover, periapical radiography is a useful intraoral x-ray to assess the position and root length of wisdom teeth. Statistical analysis was descriptive. The authors were justified in that the symptoms and indications for removal of wisdom teeth were as follows: recurrent pericoronitis, caries, periodontities, orthodontics, cyst and tumour, root resorption, facial pain and no reason.

To summarise, none of the studies discussed above used a new x-ray machine method such as cone beam computed tomography for impacted mandibular third molars examination. The advantages of cone-beam computerized tomography are; firstly, to measure the proper size of the radiolucent area around the impacted wisdom teeth. Secondly, this technique enables three dimensional reconstructions and decreases the radiation dose to the patient. Thirdly, there is a rapid scan time in a single rotation, scan time is rapid: 10–70 seconds. Fourthly, low dose of radiation (William et al., 2006). However, the disadvantage of the machine which is the high cost for the patients. None of the studies mentioned above explained the medical status of their patients such as epileptic seizures, diabetes or high blood pressure.

Discussion

An impacted mandibular third molar tooth is defined as that which is prevented from erupting in the lower arch position due to lack of space, malposition and interference with the lower second molar (Peterson *et al.,* 2003). In this present study the indications that are considered as important reasons for removal of lower third molars are caries not restorable, periocoronitis, periodontal disease, resorption of the teeth or roots, periapical infection, cyst and tumour. The aim of the present study was to evaluate the prevalence of the pathologies associated with the lower impacted third molar teeth in the literature and five studies were selected as shown in Table 3.

Table 3. Quality assessment of included studies.

Study	Study type	Allocation	Dropout
Chu, et al. 2003	Retrospective	Adequate	Position 3rd Molar
Timuc et al. 2005	Retrospective	Inadequate	Non
Taiseer et al 2006	Retrospective	Adequate	Position 3rd Molar
Hidayet etal 2008	Retrospective	Inadequate	Position 3rd Molar
Krishnan et al 2009	Retrospective	Adequate	Position 3rd Molar

Age:

In the studies reviewed, the mean ages of patients were between 18 and 24 years, and this finding differs from a number of similar studies (Leone *et al.,* 1987: Lysell *et al.,* 1988). Nordenram *et al*. (1966) published a study which produced a mean age between 18 and 25 years, which was in agreement with the findings of Knutsson *et al.* (1996). The prevalence of impacted mandibular teeth a relatively high figure compared with studies involving a wider age range of patients, including patients younger than 18 years (Aitasalo *et al.,* 1972: Ahlqwist *et al.,* 1991).

Symptoms and age related to the impacted mandibular third molars:

In the studies were reviewed, age of patients between 17 and 24 years were most likely to present with symptomatic impacted mandibular third molar teeth such as pain, inflammation and recurrent infection. It shows that symptoms related to the impacted mandibular third molar teeth decreased with corresponding increase in the age of patients. These results were in agreement with the studies of Sasano *et al.* (2003) and Knutsson *et al.* (1996) who reported that patients with symptomatic impactions were mainly seen in the third decade. Knutsson *et al.* (1992) and Lysell *et al*. (1993) stated that the judgments of general dental practitioners and oral surgeons have demonstrated that the dentists had difficulties in establishing a consistent policy with respect to asymptomatic mandibular third molars. There is little controversy about the value of the removal of impacted third molars when they cause pathological changes and severe symptoms (National Institute of Health. 1980). The rate of postoperative complications and the risks of permanent squeal increase with age. Therefore, it is recommended that, once a decision has been made to remove an impacted mandibular third molar, the surgery should be carried out as soon as possible and well before the age of 24 years (Blondeau *et al.,* 2007). However, it is asserted that the probability of future pathological changes associated with impacted third molars has been exaggerated (Shepherd *et al.,* 1994).

Gender in relationship to symptomatic impacted mandibular third molars:

The studies reviewed indicate that symptomatic impacted mandibular third molar teeth were more common in females than males. This finding was in agreement with that of Timuc *et al.* (2005) in their study. Histopathological diagnosis of cystic changes showed a male to female ratio of 1.3:1. Male predominance was reported in several studies, but the reason for this gender difference is still unknown (Adelsperger *et al.,* 2000: Daley *et al.,* 1995: Knights *et al.,* 1991: Rakprasitkul *et al.,* 2001). In 1995 Daley et al. reported that male predominance than females for follicle tissue changes such as cyst and tumour changes and suggested that may be due to prophylactic extraction of third molars. On the other hand, Van der *et al.* (1995) and Litonjua *et al.* (1997) found that the majority of impacted mandibular third molars had at least one radiographically detectable lesion such as caries, periodontal pocket, periapical infection and recurrent episodes of periocoronitis. Also Van der *et al*. (1995) agreed that male gender predominance at least one pathology was detected radiographically.

The position of impacted mandibular third molars in relation to the development of pathology:

In the studies mentioned above, there was a slightly significant difference in the prevalence of pathologies in vertical, horizontal, mesioangular and distoangular inclinations of the impacted mandibular third molars. Krishnan *et al* (2009) reported that the most common types of inclination seen were vertical and mesioangular impacted mandibular third molar. Chu et al. (2003) found that more in (80%), out of 3853 impacted mandibular third molars were either horizontally or mesially angulated against the mandibular second molar teeth. Hidayet *et al.* (2008) reported that the horizontal and mesioangular inclinations of impacted mandibular third molars had significantly higher scores of the prevalence of caries on the second molar teeth and recurrent periocoronitis on mandibular third molar. On the other hand, Timuc *et al.* (2005) reported that there were mesioangular, horizontal, and vertical of impacted the mandibular third molars with higher scores of the prevalence of caries and bone resorption. Overall, the higher probabilities of impacted mandibular third molars inclinations in relationship with the pathologies were mesioangular, the horizontal positioned and vertically positions respectively.

The prevalence of pathological conditions associated with impacted mandibular third molars:

Caries and tooth resorption in association with impacted mandibular third molars:

In the studies reviewed, the authors used radiographs such as panoramic and periapical to differentiate between dental caries and bone resorption around impacted mandibular teeth. It was difficult to assess the prevalence of caries and tooth resorption of either impacted third molars and/or second molars from the literature. In the above articles reviewed, it depends on radiographic finding whether panoramic or periapical x-rays in the literature review. The prevalence of caries and resorption of either the impacted mandibular third molars or the second molars was studied by Taiseer *et al*. (2006). They found that dental caries was the most common radiographic lesion. The authors' findings in the studies were reviewed in general agreement concluding with those of others (van *et al.,* 1995: Bataineh *et al.,* 2002: Chu *et al.,* 2003). However, the figures obtained here are probably an underestimate of the true rate of dental caries because the diagnosis was based on orthopantomogram radiograph. It agreed with the findings of previous studies (Van der *et al*., 1995: Knutsson *et al*., 1996: Yamaoka *et al.,* 1996), but in contrasts with the findings of earlier investigators by (Nitzan *et al.,* 1981: Nordenram *et al.,* 1987). They found that caries in lower second molars and bone resorption were recorded in the literature as high condition associated with impacted mandibular teeth. The difference in reported frequency can be explained by different definitions of impacted mandibular third molar root resorption. Krishnan *et al.* (2009) mentioned caries lesions were found in the mandibular second molars and third molars. Moreover, the cause of caries lesions usually occurs as a result of the natural food trap in the space between second molar and impacted third molar teeth. Caries involving the radicular portion of the second molar make a restorative procedure very difficult and such teeth often end up extracted. For that reason McArdle *et al.* (2006) proposed prophylactic removal of third molars to avoid the negative consequences of distal cervical caries in the lower second molar. Caries lesions were mentioned in the literature as one of the common pathological features associated with extracted mandibular third molars (Battaineh *et al.,* 2002: Lysell *et al.,* 1988: Punwutikom *et al.,* 1999). Chu *et al.* (2003) reported that there were many cases of root resorption with impacted mandibular third molars. However, Nitzan *et al.* (1981) reported that few second molars adjacent to impacted mandibular third molar teeth showed root resorption. Conversely, Sewerin et al. (1990) did not find any resorption caused by impacted third molars, and Ahlqwist et al. (1991) reported only one instance of second molar resorption in a study of 141 impacted third molars. On the other hand, Stanley et al. (1988) found difficulty in determining radiologically whether coronal radiolucency adjacent to an impacted third molar is due to caries or root resorption. Hidayet *et al.* (2008) reported that caries were observed in the second molars more than in those impacted mandibular third molars which were examined.

Although very few impacted third molars seem to cause caries of second molars, with estimates varying between 1% and 7.9%, the 12.6% found in the present study support the views for removal of third molars to prevent second molar caries (Knutsson *et al*., 1992: Al-Khateeb *et al.,* 2006: Lysell *et al*., 1993: Mercier *et al.,* 1992).

Pericoronitis in association with impacted mandibular third molars:

The studies reviewed, demonstrated that Pericoronitis was the single most common cause for mandibular third molar removal. Krishnan *et al.* (2009) said recurrent episodes of Pericoronitis were the most common indication for the removal of impacted mandibular third molars and similar conclusions were come to the study by Goldberg *et al.* (1983). Krishnan *et al.* (2009) had stated that current trends support a more conservative approach in patients with a single episode of Pericoronitis with emphasis on the management of the acute infection and review when symptoms have subsided. Hidayet *et al*. (2008) found mesioangular positions of impacted mandibular third molar teeth were high and this similar to that reported by Knutsson *et al*. (1996). Venta *et al*. (1993) however stated less than those reported by Punwutikorn *et al*. (1999). In fact mandibular mesially inclined third molars are usually associated with pathoses, including pericoronitis, caries, and root resorption of the second molar (Knutsson *et al.* 1996). Chu *et al*. (2003) mentioned that three quarters of patients in their study had problems on one side only, and the two most common complaints were pain and swelling related to pericoronitis.

Periodontitis in association with impacted mandibular third molars:

Periodontal diseases associated with impacted mandibular third molars in the studies were reviewed not clear. In 2008 Hiday and his colleagues stated that periodontitis detected from the panoramic radiographs by measuring the vertical bone loss between the impacted mandibular third molars and adjacent second molar. Moreover, distoangular and vertical inclinations of impacted molar teeth were found mostly to cause radiolucency of the distal aspect of the impacted mandibular third molars. While, mesioangular and horizontal inclinations of impacted mandibular third molars were found mostly to cause periodontal bone loss of the distal aspect of adjacent tooth. Stanley *et al.* (1988) reported that radiolucency in distal aspects of the impacted mandibular third molars and periodontal bone loss of distal aspect of mandibular second molars can also be considered as pathologic conditions. Whereas, Blakey *et al.* (2006) performed a longitudinal clinical trial and found that asymptomatic third molars were affected by periodontal pockets, and the depth was more than 5 mm. However, White *et al.* (2006) reported that pocket depths more than 4 mm around impacted mandibular third molars region could be a cause of bacterial growth in the periodontal pockets. Also Nance *et al.* (2006) reported that 4mm pockets could be easily detected in erupted third molars tooth.

Cyst and tumour associated with impacted mandibular third molars:

Chu *et al.* (2003) stated that follicular tissues such as cystic and tumour changes around the impacted mandibular third molars were another major concern in the literature. Also, the prevalence of pericoronal spaces of more than 4 mm in impacted mandibular third molars is no more than 1% for patients older than 50 years old (Ahlqwist *et al.,* 1991: Stanley *et al.,* 1988). Thus, the cystic changes associated with long term impacted third molars should be considered as an indication for elective removal of asymptomatic impacted teeth. Taiseer *et al.* (2006) found the prevalence of cyst formations in relationship to impacted mandibular third molar teeth were low. However, the incidence of a paradental cyst is specifically linked to a partially erupting mandibular third molar that has been subjected to several episodes of pericoronitis (Ackerman *et al.,* 1987: Colgan *et al.,* 2002).

Radiographically, the radiolucent area around impacted wisdom teeth was dentigerous cyst (Brickley *et al.,* 1995: Eliasson *et al.,* 1989). Whereas, Taiseer *et al.* (2006) reported that dentigerous cyst was found in around some of impacted mandibular third molars. However, histologically based studies investigating the follicular tissues of radiologically normal teeth showed that some cases had histologic findings suggestive of dentigerous cyst formation (Adelsperger *et al*., 2000: Manganaro *et al.,* 1998).

According to Keith (1973) dentigerous cysts developing are associated with impacted mandibular third molar teeth. Also Guven *et al.* (2000) reported a prevalence of cyst formation associated with impacted third molars. In addition to that, other studies mentioned there is a relationship between cystic changes in follicular tissues and older age (Baykul *et al.,* 2005: Rakprasitkul *et al.,* 2001). Radiological surveys of the mouth and jaws have shown that about one in five people in their 30s have at least one unerupted third molar and that can remain in situ throughout life without any pathological changes (Hugoson *et al.,* 1988).

The possibility of tumour changes such as ameloblastoma, epidermoid carcinoma, and odontogenic carcinoma arising from impacted mandibular third molars have been stressed as another indication for removal of impacted mandibular third molars (Rakprasitku *et al.,* 2001: Shimoyama *et al.,* 2001), whereas the agreement of occurrence of ameloblastoma associated with impacted mandibular third molars were high especially in African and Afrocaribbean populations (Guven *et al.,* 2000: Shear *et al.,* 1978: Shimoyama *et al.,* 2001: Regezi *et al.,* 1978). Guven *et al*. (2000) reported an incidence of 0.79% benign, 0.77% malignant and 0.02% of odontogenic tumour among 9994 impacted third molars in their study, and majority were mandibular. Although, prophylactic removal of impacted mandibular third molars with cystic and tumour changes were important, the literature shows that the incidence of cyst and tumor development from impacted third molars is apparently low (Guven *et al.,* 2000: Baykul *et al.,* 2005: Stephens *et al.,* 1989: Mourshed *et al.,* 1964).

Traditional indications for removal the impacted mandibular third molars

In the studies reviewed, there were different indications for removal of impacted mandibular third molars such as recurrent episodes of pericoronitis, cellulitis, abscess,

osteomyelitis, disease of follicles including cysts and tumours, un restorable caries or periodontal disease and prophylactic removal in the presence of medical or surgical conditions (National Institutes of Health. 1979: Peterson *et al.,* 1993). Then in 1997, the Faculty of Dental Surgery of the Royal College of Surgeons of England published guidelines for the management of patients with impacted mandibular third molars (Peterson *et al*., 1993). The support of these guidelines by the National Institute for Clinical Excellence (NICE) of England in March 2000, with the added comment that a first episode of pericoronitis, unless it is severe, should not be considered an indication for removal. Nevertheless, prophylactic removal in the absence of specific medical and surgical conditions is unjustifiable (National Institute for Clinical Excellence, 2000). Recurrent pericoronitis, un restorable caries, and periapical infection are generally accepted as a defined indication for impacted mandibular third molar extraction (Stephens *et al.,* 1989).

Limits of Review

A literature review as a research strategy which is methodology for this present professional project. This literature review has a few limitations such as; it only considers a published literature. Also there was a bias of these retrospective studies to publish research with positive effect of an intervention rather than a negative effect (Aveyard *et al.,* 2007). The final search of the studies reviewed was limited to the English language and full articles as shown in figure 6 (P. 19). The authors used in the retrospective studies; reasons for referral and radiographs for impacted mandibular molar teeth, number of patients and cost. Also the prevalence of pathologies associated with impacted mandibular third molars were evaluated on panoramic and periapical radiographies in order to be able to subject the kind of pathology and the position of lower impacted third molar. On the other hand, there was a limitation for histopathology analysis of follicular tissue whether cyst or tumour. There were some studies used patients ages under 18 years. Moreover, the authors mentioned that it was difficult to diagnosis the periodontal disease on the x-ray. The authors did not mention follow up review of the patients is necessary to assess the long term management of impacted mandibular third molar teeth.

Conclusions and Recommendations

Evidence based dentistry helps clinicians to integrate the available research evidence with personal experience in order to make decisions that improve their clinical practice (Hackshaw *et al.,* 2006). In fact, the principles and methods of evidence based dentistry give dental practitioners the opportunity to apply research findings to the care of their patients (Sutherland, 2001).

The studies reviewed established that females were more likely to present with symptomatic impacted mandibular third molars than males. The most common positions of impacted lower third molars were mesioangular, horizontal, vertical and distoangular respectively and rarely buccally oblique (Transverse). Caries and bone resorption were the most common lesions seen on the panoramic and periapical radiographs. In addition to that, periocoronitis, Periodontitis, cysts and tumours were subjected to radiographic and histological examination to obtain a definite diagnosis. Pericoronitis was more frequently seen with partially impacted mandibular third molars than completely impacted molar teeth (Ackerman *et al.,* 1987: Colgan *et al.,* 2002).

In the studies reviewed, females were predominant in symptomatic impacted mandibular third molars in contrast with males. Also caries and pericoronitis were the most common symptoms associated with impacted mandibular third molar teeth. However, the findings in this present study show that the mean age of the patients was between 17 and 24 years, as well as the mesioangular and horizontal inclination associated with symptomatic impacted mandibular third molars was the most common.

The treatment plan to remove the impacted mandibular third molars in the absence of the symptoms which mentioned above should be discontinued. The decision to remove or leave the impacted mandibular third molars must be individualised, rather than generalized. Overall, all patients suffering from symptoms associated with impacted mandibular third molars should be evaluated. A decision should then be made on what type of treatment needs to be undertaken based on their individual presentation as opposed to standardised generic treatment protocol. Extraction of impacted third molars should be limited to those teeth with well defined pathological medical and surgical indications.

Implications for Research

More well designed retrospective studies with large population and longer radiographic follow up periods for patients with symptomatic impacted mandibular third molars are needed to assess the associated pathologies.

There were well established indications for removal of impacted mandibular third molars. Although impacted mandibular third molars may sometimes be associated with pathologies which occurred in a relatively small proportion of patients according to the literature. There were confounding factors, such as age, gender differences, medical history, clinical experience, that include similar implantation site associated with impacted mandibular third molars that could be conducted in the future.

Periapical, panoramic radiographs, cone beam computed tomography and the surgeon's experience are the important elements to be considered when choosing subjects for the study. This study will help dental practitioners and oral surgeons to decide on the best treatment plans for impacted mandibular wisdom teeth. However, after assessing individual cases dentist should then be able to make a decision as to whether referral to a specialist unit is the best treatment plan.

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