



The Therapeutic Protocols and Endodontic Management of Acute Apical Abscess in Adults: A systematic Review

Faisal Alghamdi¹, Esraa Alharbi², Zeina Alhuseini², Esraa Aljahdali³,
Reem Alkhanbshi³, Othman Baradwan⁴ and Yousef Alnowailaty^{5*}

¹ Department of Oral Biology, King Abdulaziz University, Jeddah, Saudi Arabia

² Al-Farabi Dental College, Jeddah, Saudi Arabia

³ King Abdulaziz University, Jeddah, Saudi Arabia

⁴ Department of Conservative Dentistry, College of Dentistry, Al-Jouf University, Al-Jouf, Saudi Arabia

⁵ Department of Conservative Dentistry, King Abdulaziz University, Jeddah, Saudi Arabia

*Corresponding e-mail: yalnowailaty@kau.edu.sa

ABSTRACT

Objective: The current review aims to compile all the up-to-date and available studies including imperative information concerning the therapeutic protocols and endodontic management available for the diagnostic acute apical abscess cases. **Material and methods:** The electronic databases PubMed and Google Scholar were searched in this review using specific inclusion and exclusion criteria. The search was performed in December 2018 and updated in October 2019. Among 6328 studies, thirty-one studies satisfied the eligibility criteria and were included in the review to be analyzed. **Results:** The thirty-one studies showed the therapeutic Protocols and Endodontic Management of dentoalveolar abscesses in removing infections within the root canal system and their effect in periapical tissue healing. These studies investigated different aspects of an acute apical abscess, including endodontic management, antibiotic therapy, and therapeutic protocols. **Conclusion:** The compiled data observed that the decision for which treatment should be accomplished changes by patient manifestations when the exceptional acute apical abscess can show local and systemic causes, which can diversify the indicated therapy. At long last, a suitable finding is critical to characterize the patient's best treatment approach and life support. When it improves the determination of the best treatment approach to manage to be used and avoid medicine aimless use, mainly antibiotics, and maximally decreasing malpractice or potentially superfluous methods.

Keywords: Acute disease, Anti-bacterial agents, Periapical abscess, Therapeutic protocol, Root canal therapy, Adult

Abbreviations: ADAA: Acute Dento Alveolar Abscess; AAA: Acute Apical Abscess

INTRODUCTION

The soft tissue within the pulp cavity is formed of a loose conjunctive tissue greatly vascularized and innervated, containing lymphatic vessels and other cells, and with the odontoblasts standing out amidst them [1]. They are in charge of differentiating pulp tissue from other conjunctive tissues within the human body [1]. Owing to its intense metabolism, the dental pulp possesses an outstanding repairing capacity; nevertheless, because it is derived from conjunctive tissue when it is affected by contact with an aggressor agent, sufferably it experiences a process of vasodilation within confined space surrounded by rigid walls. Thus, the compression of the nerve cells is the reason for painful episodes [2]. The defense ability of the pulp is immediately afflicted when vasculature's exudative phenomenon occurs, as the pulp volume growth interferes with the region's bloodstream, rising the immunologic system response, together with the local blood supply [3]. As a result of not treating the decayed tooth and/or the encounter between the dental pulp and aggressive agents, the necrosis of the pulp is initiated and, so, infection and contamination of the radicular canal systems. When these etiologic agents surpass the tolerance limit, the pulp begins the settlement of pulp pathologies [1]. The diseases that irritate the dental pulp origin from aggressor agents, essentially

bacteriological, that can advance to pulp necrosis slowly or quickly, relying on the status of the host defense and the severity of the aggressor agent [4-6]. When the dental pulp undergoes the necrosis process, the reminiscent tissue is deprived of blood supply and defense cells, which permit both of the installation and colonization of dental pulp infection, and outgrowth of microbes in the periapical tissues [1]. The feature and evolution of the periapical disease are profoundly related to the host defense immunological capacity, aggressive agent's virulence and the diameter of the apical foramen [1]. In the existence of high virulence microbes related to the inefficiency of the host's organic defense system, the installation of an acute inflammatory tends to occur in the periapical area. This can progress to local infections that need less aggressive treatment and systemic infections at the facial spaces that can be fatal [7].

The first line of defense is acute apical periodontitis, which allows vascular permeability and exudates for spaces between tissue advancement, resulting in edema at the periapical area. The rise leads to a discrete dental extrusion, which makes the patient feels "bigger tooth than its normal size" [8]. Before the chronic inflammatory process, when the patient does not demonstrate any painful symptomatology, the pre-apical region that was previously acute goes through a chronic infections process, which is detected radiologically as a periapical space growth, thickening of the hard blade and denser bone trabeculate [8]. The acute dentoalveolar abscess (ADAA) demands an accurate diagnosis, since, according to the purulent collect localization, it can be classified as initial, in evolution or developed and each of them has different therapy conduct attempting to avert the ADAA evolution to a systemic complication as Angina de Ludwig, Turner teeth and even the demise of the patient [9]. Overall, the current review aims to compile all the up-to-date and available studies including imperative information concerning the therapeutic protocols and endodontic management available for the diagnosed acute apical abscess cases in adults.

MATERIALS AND METHODS

This review has been compiled according to the Preferred Reporting Items for Systematic Reviews and Meta-analyses (PRISMA) guidelines.

Research Question

The following was the research question for the systematic review: "What is the most appropriate protocol and management to be employed in the acute apical abscesses for adults?"

Literature Search

With respect to the question of the study, we searched the literature and identified relevant studies. The literature search was formulated in December 2018 and then updated in October 2019. A web search was done through PubMed (2005-2019) and Google Scholar (2005-2019) with MeSH terms and/or in various combinations ("Periapical lesion" OR "Periapical Abscess", "Dentoalveolar Abscess", "Infections", "Acute Apical Abscess", "Endodontic treatment". Relevant articles had been read and assessed by the introduction of the close meaning ideas by the study reviewers. Full articles were obtained for most of the titles and abstracts that met the inclusion criteria, the full text was accessed. From each included article, Study design, interventions, and findings were extracted. Articles used were categorized into two main groups (free and restricted). Free ones have been downloaded directly by the URLs generated from the database. The restricted group has been downloaded by the institutional access of the KAU library. Even though some articles didn't match the main idea, they have been reviewed again and decided to be either relevant or irrelevant.

Inclusion Criteria

- Native research released in the English language
- Time framed articles released within 15 years from 2005-2019
- Studies performed on human subjects

Exclusion Criteria

- Articles that illustrated no clinical relevance about the therapeutic protocols and endodontic management of acute apical abscess
- Articles that described the different aspects of acute apical abscess excluding the therapeutic protocols or endodontic management

- Articles that described the different aspects of acute apical abscess excluding the adult patients
- Articles that discussed healing of Periapical lesion after surgical root canal retreatment by percentages and samples taken from animals

Critical Appraisal

Eligible studies were independently analyzed by all reviewers according to the eligibility criteria as well as PRISMA guidelines. Any disagreement between the reviewers was resolved using discussion.

Data Extraction and Presentation

The search strategy using the keywords and MeSH of the databases like PUBMED and Google Scholar yielded a total of 6328 studies, of which 6225 were either unrelated or duplicate topics. Among the potential 103 studies, the eligibility criteria were applied and thirty-one studies were included in this systematic review. The summary of the search flow chart for this systematic review has been depicted in (Figure 1).

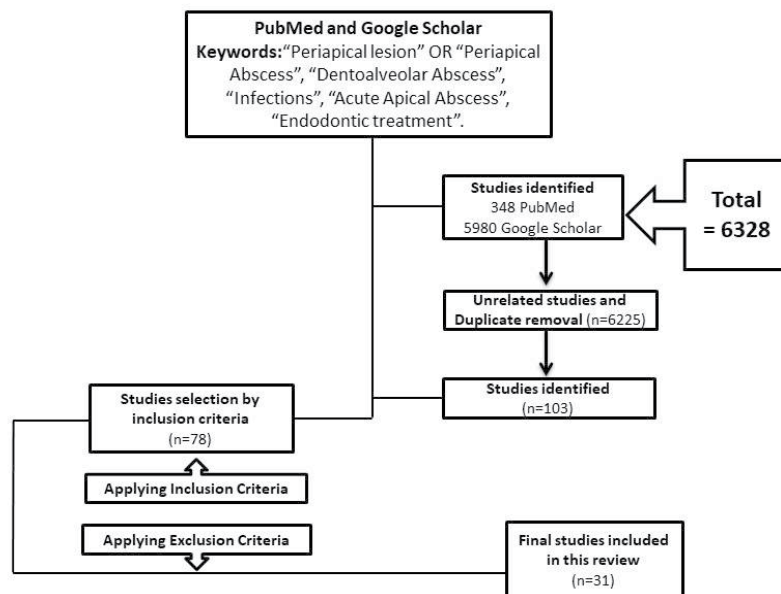


Figure 1 Flow chart of the search strategy used in this systematic review

RESULTS

The search culminated in thirty-one studies that fulfilled both the inclusion and exclusion criteria and which were conducted in the last 15 years ago. These studies investigated different aspects of an acute apical abscess, including endodontic management, antibiotic therapy, and therapeutic protocols. Although all the results were not assessed in the included studies, the included studies that conferred the endodontic management noticed that sensitive operation in the treatment of emergency cases of an acute apical abscess (AAA), the therapeutic protocols presented that there inappropriate therapy established, this can lead it to a distinguished contraction in the size of the periapical lesion and the microbial load. Besides, dentists are obliged to obtain wider knowledge concerning the prescription of antibiotic medications.

DISCUSSION

This systematic review was compiled to assess the efficacy of endodontic management when compared to a variety of other available treatment options for results such as removal of infection from the root canal system as we as the periapical recovery. Thirty-one studies were appraised for the outcomes of this review, and all of which were done on adult human teeth and conducted in the last 15 years ago. The (AAA) is an inflammatory reaction of the front of the periapical tissue of the aggression endured by the tooth, as a consequence of either dental decays or dental trauma

[10]. It involves considerable edema of the soft tissue, exhibiting mobility, extrusion of the dental element, together with spontaneous, intensified, unceasing and localized painful symptoms [11]. (AAA) is treated as one of the most common antecedents to the dental emergency [12]. The destruction of the tissue in this condition relies on the bacterial count, virulence factors and the reaction of the host [13]. An elevated virulence infection at the radicular system's interior that conquered the organism's immunological system results in the intensification of the acute apical abscess. Identified as poly-microbial infections to present microbial flora-variations that behaves synergistically, and rising its virulence as a consequence [14]. Researches have confirmed that strict anaerobic bacteria are the most abundant species at the radicular canals of the tooth structure that present agonizing symptomology of the endodontic source [15]. A study was conducted by Ribeiro, et al. [16], in 2011 that demonstrated that along with the dominance of the bacteria in endodontic infections. Also, it was perceived protozoan, fungus, yeasts and virus presence in the radicular conduct interiors. "Archaea" microorganism, in specific, which embraces a group of microbes capable of surviving in extreme conditions. Some bacteria species as "*Porphyromonas spp*", "*Prevotella spp*", "*Fusobacterium spp*", and "*Peptostreptococcus spp*", are related to clinical symptoms beyond being major in inflammatory lesions pathogenesis of the periapical area [17]. Despite that fact, it is well known that part of the endodontic microbial flora was not yet recognized, demanding further studies using procedures that have fewer limitations to estimating this microbiota diversity [17].

In case of further spread beyond the dental alveolar boundary, the apical abscess can be confined at the periapical area or continue the diffusion process through adjacent bones and soft tissues, as a diffuse abscess or cellulitis [18]. In the case of the apical abscess remaining untreated, it can reach the blood circulation resulting in systemic complications [19]. In both phases initial and acute, the dentoalveolar abscess presents multi-symptomatology that includes pulsatile pain, local and systemic hyperthermia, perspiring, general malaise, loss of appetite, irritability and inflammatory regional lymphadenopathy. When the dental element is found at the oral cavity (primary abscess), extensive dental caries or faulty dental restoration need to be examined [3]. This lesion can sometimes induct to a fistulous passageway formation to discharge from the necrotic process at the engaged area. A study was conducted by Carrillo, et al. [20] states, "the region where the fistula is going to manifest depends on the muscular insertions of the involved area". The fistula passageway between pathological space and a body anatomic cavity or skin surface. The drainage can be performed periodically and continuously and can be either intra or extra-buccal [1]. Following the purulent accumulation passes its first barrier, a drop in the pressure occurs, the symptoms begin to fade and, in a few cases, it completely disappears. This fistulous path and its floating-point occur intra or extra-buccal, occurring then spontaneous drainage [11]. Alfenas, et al. [19] assured that the capability of the human body in its healthy state to localize the origin of the infection, moreover, eliminating the infecting agent; it clears the body from any infection process. In like manner, the study of Cope, et al. [21] is in accord to avoid the prescription of antibiotics when the aggressor agent removal is achieved.

Endodontic Management of Acute Apical Abscess

A dentist is required to have comprehensive knowledge regarding the steps to follow in handling the treatment and regimens for the abscess. AAA is a result of a non-vital tooth or infection of the tooth. To manage the elimination of these infections of the infection is of prior significance [12,22]. To manage the acute apical abscess, surgical drainage and/or extraction of the involved tooth must be done [23]. The first step of the intervention for the clinician is discharged to accumulated pus. The drainage of the pus out of the root canal (access opening) must be achieved without delay. The moment access and initial drainage have been accomplished; the application of a rubber dam to the tooth must be followed to complete the management. In preparation for any further instrumentation to take place, the pulp chamber is required to be entirely washed with a solution of sodium hypochlorite (NaOCl) [24]. That will decrease the inflammation in the periapical area, hence the patient will be relieved. The next step will be the determination of the length of the root canal, which will be measured by the use of the apex locator device and the confirmation by periapical X-ray. Following the measure of the working length, proper cleaning and shaping to be fulfilled with hand K-file or nickel-titanium (NiTi) a rotary instrument up to a size of #20 or #25, between filing, copious irrigation of root canal by (NaOCl) [23]. The obturation of the canals will be performed with gutta-percha cones using AH Plus sealer and then the cavity will be restored with 3mm of Cavit over a small amount of cotton wool under an Intermediate Restorative Material (IRM) or Glass Ionomer Cement (GIC) for a resistant temporary restoration [24,25]. In regards to the prescription of both the antibiotics and the pain killer, to be prescribed to the patient for 3-5 days, besides,

to follow-up the progress of the patient after a week from the visit [24]. The advantageously clinical endodontic intervention will promote the healing process which will commence the fading of the symptoms and confirm the absence of any radiological indication of the infection of the periapical area [26].

In some cases, when a tooth is either non-restorable or not suitable for a root canal treatment, the extraction of the tooth is the choice of treatment to deal with these setbacks to eliminate the infection [27]. The healing of the abscess has been documented, albeit the fact that the root canal is not entirely washed during a root canal treatment [28]. Moreover, the role that systemic antibiotic usage adds to the result is beneficial in the clinical intervention of these infections [29]. The knowledge of the root anatomical variation must be taken into consideration, due to its crucial role in the clinical management of acute apical abscess [28]. Furthermore, the application of intra-canal medicaments might be urged due to their antibacterial properties [30].

Antibiotic Therapy for the Acute Apical Abscess

Regularly prescribed as a subsidiary therapy in endodontic infections, antibiotic has its use very often queried. The use of Systemic antibiotics is not widespread in apical abscesses. Nevertheless, with the involvement of a systemic infection, these drugs might be urged to be prescribed, disseminated infections initiating cellulitis, progressive diffuse inflammation and in some medically compromised patients [29,31]. Add to that, analgesics may be prescribed for pain alleviation in such conditions [32]. The majority of the involved bacteria in endodontic infections are an easy target for penicillin. Amoxicillin is semi-synthetic penicillin with a wide antibacterial range and may grant a rapid recovery enhancement in pain and swelling [33]. In severely advanced infections of acute apical abscesses, amoxicillin in conjunction with clavulanic acid or metronidazole may be essential to reach an effective antibacterial level [26]. The major point to deal with is the fact that some bacteria have already exhibited a challenging resistance to some antibiotic groups as a consequence of mistaken prescriptions, Given that its use is advised only to 20% of cases with endodontic infections and yet it has come to attention that it is prescribed in 80% of the cases, of which around half are faulty by its justification, dose or duration [19]. The studies that have been conducted to verify that antibiotic therapy is futile, because of the absence of blood flow inside the necrotic pulp, the drug does not reach and eradicate the microbes that occupy the root canal system [34]. Nevertheless, there are conditions where it is necessary to be ordered to patients, but always alongside with clinical intervention, for instance, when there are infectious process propagation symptoms and the patients present dyspnoea, palpable lymph nodes, fever, headache, trismus or when they have some defense system impairment, such as leukemia, decompensated diabetes, AIDS, and leukopenia [14]. It is highly important to attend those patients who do not show any abscess drainage pathway and infection aggravations that do not require antibiotic therapy. There is the necessity of heat physiotherapy objecting to assist an access pathway formation to discharge the abscess, the antibiotic present in the bloodstream, in this situation, leads to a chronic infection process [15]. A study was conducted by Madarati, et al. [35], investigated the predilection for treating pulp necrosis and acute apical abscess patients. The statistics of the study demonstrated that 26% of the interviewed clinicians prescribed antibiotics. While when asked about the selected endodontic treatment, only 26.9% would clean and shape the canal at the first examination, 56.8% stated that they would begin with disinfection and modeling. In cases which the exudates extravasation does not halt, 40.5% of them steal the canal in the first visit [35]. Finally, they deduced that there is no pre-established protocol on the treatment of these infections [35].

Bolfoni, et al. [36], researched the behavior of prescribing antibiotics by endodontists and the result was that 81.5% of the questioned order antibiotic as the first choice of treatment, and 30.7% prescribed amoxicillin supported with clavulanic acid. When asked regarding the acute apical abscess treatment exhibiting diffuse edema, fever, and trismus, 90.1% prescribed antibiotics, when 88.1% prescribed antibiotics despite the absence of systemic involvement. These outcomes were consistent with Al-Maslami, et al. [37], who stated that 92% of the dentists prescribed analgesics for the management of pain caused by an endodontic infection. Whereas 16% ordered antibiotics for intense dental pain; 62% prescribed antibiotics for acute apical abscess. Moreover, Amoxicillin and Ibuprofen were the most generally ordered medications [37]. Certainly, it is mandatory to raise the level of knowledge and awareness concerning the prescription of those medications, because many clinicians order it when the case is not indicated for it and for an unnecessary period.

Therapeutic Protocols

Different studies discussed the immediate endodontic care conduction, and also, it has been emerging a variety of

views regarding the type of treatment that should be selected in acute apical abscess cases. These studies differ from the intra-canal medicine choice of use, antibiotics class prescription, and quantity of sessions. Saini, et al. [15], reported that following the acute apical abscess diagnosis, dental surgeons have some treatment options. The endodontic care promotes the cleaning and disinfection of the radicular canal systems, eliminating the source of the acute complication, however, it does not remove the abscess itself [15]. Correspondingly, the discharge is the most beneficial and less aggressive method to alleviate the pain. Two studies [2,38] proposed that throughout the endodontic treatment, the length of treatment should go beyond the apical foramen by 2 to 3 mm, which would promote then, foramina extension. As per the fact that instrumentation beyond the apex stimulates the exudate discharge and the extravasation of the irrigating substance to the periapical area, lowering the microbe activity, facts that would favor the host immune system and utilize the body reconstruction process. Silva, et al. [7], deduced that the essential treatment to be performed in acute apical abscess cases includes eliminating the cause, which invariably is in the interior of the root canal. Discarding the irritant agents via mechanic instrumentation, the use of chemical substances to irrigate, and canal systems obturation must be done to reduce as much as possible the activity of the microorganisms in the area. Matthews, et al. [9], informed that the exudate drainage via the apical foramen cannot be ample for the resolution of the complication. Although the amplitude is a limitation since the purulent accumulation is usually vicious and the diameter of the foramen corresponds to an endodontic file size of #20 or #25, the amount of drainage achieved by this path becomes arguable and therefore should be calculated attentively to weight the risks and benefits of performing this procedure [9]. Leonardi, et al. [39], illustrated that the cases where drainage does not occur through the tooth, the floating tissue must be incised. Nevertheless, they affirmed that in case of having diffuse edema, this procedure is contraindicated, which highlights the specificity of each case. Cope, et al. [21], assured that the most beneficial and practical method of treatment to the cases of an acute abscess is supported by soft tissue drainage since the drainage through the tooth is unpredictable due to the foramen's diameter and the possibility of becoming blocked. Furthermore, after the drainage utilizing the incision of the soft tissue, there is no contraindication for endodontic therapy, since besides clearing periapical pressure; the drainage permits the dried radicular canal instrumentation without exudate leakage. The purpose of the intra-canal medication is to grant the antiseptic complementation to the biomechanical preparation, lowering to the furthest extent the microbial flora action in the root conduct. Soares, et al. [40], investigated the present properties of the Calen/PMCC paste in teeth of hounds with experimentally induced chronic periapical lesions and concluded that this would be more effective than the use of the isolated calcium hydroxide paste, since it is the association of calcium hydroxide paste with camphorated parachlorophenol, possessing all the antibacterial properties of both substances. Thus, being the medicine advisable for use in cases of pulpal necrosis. In line with Madarati, et al. [35], teeth that are not closed after the urgency session, intending to facilitate the exudate drainage through a root canal, have a higher possibility for a flare-up when in comparison with teeth that after the root canal system debridement, the coronary access was sealed with provisory obturation material. This fact is affiliated with the prevention of more bacteria contamination inside the oral cavity.

The major objective of systemic drug therapy is to minimize stress, relieve pain and avert the dissemination of the infectious process. Because of this, it should be considered a standard procedure, intending more comfort and protection to the patient in the urgent care of patients with acute apical abscesses. It can be prescribed preoperatively and postoperatively, always respecting the individual's general health [11]. The pre-surgery protocol recommended by Siqueira, et al. [14], illustrates that within 30 and 40 minutes ahead of the procedure, the analgesic should be taken by the patients, which can be 750 mg of paracetamol or 500 mg of sodium dipyron. It should have the maintenance of the drug therapy in the post-operation if required. When there are no systemic signs as fever, trismus, and lymphadenitis, the antibiotic prescription is inessential. When it is perceived that the infection is propagated and there is systemic involvement, 500 mg of amoxicillin or clindamycin in patients allergic to the penicillin group should be prescribed. It should be performed one dose attack with the ingestion of 2 pills 30 to 40 minutes before the procedure and guide the therapy of 1 pill every 8 hours for 7 days. There is no consensus about the antibiotic prescription in acute apical abscess cases yet. Thus, it requires more specific and intense studies to investigate and appraise a protocol to be followed.

Although the results collected from the included studies in this review, two reviews reported the effect of antibiotic therapy in acute apical abscess treatment. Cope, et al. [21] stated that, "There is very low-quality prove that is insufficient to determine the effects of systemic antibiotics on adults with symptomatic apical periodontitis or acute apical abscess". On the contrary, the second review study concludes that clinical isolates had low resistance to

β -lactams. Further well-designed studies are needed to clarify whether the differences in susceptibility among the antimicrobial agents may influence clinical responses to treatment [41]. Furthermore, the acute abscess diagnosis must be carefully done, evaluating the clinical history, signals, and symptomology presented by the patient, since there is no proper therapy established, this can evolve to a systemic complication. The therapy using antibiotics is restricted to cases where the patient shows propagated infection or systemic aggravations since the indiscriminate use of antibiotics can favor allergies, super-infection development due to the presence of resistant bacteria, and unnecessary exposure of the patient to the medicine's collateral effects. There is a consensus that the most effective dentoalveolar abscess treatment is to eliminate the offender. It is observed that the choice of leaving the tooth opened after the endodontic instrumentation aiming for it to drain is up to the professional. Since some studies consider that the foramen's diameter can prevent the total drainage through conduct. Fluctuant tissue incision drainage is an alternative if it does not happen through the root canal, considering that its implementation promotes a relief in the symptomatology presented. Therefore, its practice is not indicated in cases of diffuse edema. Finally, each patient needs to be evaluated individually by reasons of the progression and evolution of the abscess being intimately related to the host's immunologic capacity, which interferes in the care protocol determination in these cases.

CONCLUSION

This systematic review concluded that endodontic treatment proved better results in certain parameters such as a reduction in bacterial load, mild inflammatory infiltrate and improved periapical healing as a part of (AAA) management. But, there was considerable heterogeneity among the included studies, so inconclusive results suggestive of a lack of evidence towards the superiority of a particular antibiotic therapy might affect clinical responses to Acute Apical Abscess treatment.

DECLARATIONS

Conflicts of Interest

The authors declared no potential conflicts of interest concerning the research, authorship, and/or publication of this article.

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