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A Review on Triple Antibiotic Paste as an antimicrobial agent in Endodontics

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ABSTRACT: The favorable outcome of an endodontic treatment depends on the elimination of the microbial colonies present in the root canal and periapical region. Also, if any necrotic tissue is left remaining in the root canals, the efficacy of the root canal medicaments decreases. Triple antibiotic paste (TAP) containing metronidazole, ciprofloxacin and minocycline has been proposed as a suitable root canal medicament due to its antimicrobial effects. This review article discusses the properties of TAP and its efficiency on the root canal disinfection, both in primary and permanent dentition, along with its relation in regenerative endodontic procedures. This paper also reviews the present disadvantages of the Triple antibiotic paste.
Keywords: Endodontics treatment, Triple antibiotic paste, root canal medicaments

I. INTRODUCTION:

Micro-organisms are a predominant factor in Endodontics infections. Several Microbial colonies have been identified in root canal infections which include both aerobic and anaerobic organisms. Keeping in mind the complexity of the root canal systems, a combination of antibiotics is required along with mechanical instrumentation to target the diverse flora and create a bacteria-free environment. For this purpose, the antibiotic combination that appears most effective is that of metronidazole, ciprofloxacin and minocycline, commonly known as the Triple Antibiotic Paste.

Dating back to 1951, Grossman was one of the first to use an antibiotic paste in Endodontics. He formulated a poly-antibiotic paste known as PSBC, which was a combination of Penicillin, bacitracin, streptomycin and caprylate sodium in a silicone vehicle. Although the PSBC showed significant effects, it was not quite effective against the anaerobic microbes. As a result the use of PSBC was very limited.

Presently, antibiotic preparations containing corticosteroids as anti-inflammatory agents are also being used commercially, which include Ledermix (Lederle Pharmaceuticals, Wolfratshausen, Germany) and Septomixine Forte (Septodont, Saint- Maur, France). But because of their narrow spectrum of activity none are rendered suitable for use in Endodontics.

Hoshino and colleagues initially developed the Triple Antibiotic Paste (TAP) and investigated the efficacy of the paste in eliminating microorganisms from the root canal system. TAP is a combination of Metronidazole, ciprofloxacin and minocycline with 1:1:1 ratio. The outcome showed excellent results in the elimination of the bacteria from the radicular system.

Metronidazole is a broad spectrum nitroimidazole. It is known for its antibacterial activity against anaerobic cocci and gram-negative as well as gram-positive bacilli.

Tetracyclines such as minocycline and doxycycline are broad spectrum antibiotics with bacteriostatic activity against gram-positive and gram-negative organisms. They are also considered to be effective against anaerobic and facultative bacteria.

Ciprofloxacin is a Fluoroquinolone with a bactericidal mode of action. It is highly effective against gram-negative microorganisms. Due to the tendency of resistance development against ciprofloxacin, it is usually combined with metronidazole in the treatment of poly microbial infections.

A study by Sato et al showed that TAP was very effective in killing bacteria in the deep layers of radical dentin. This antibiotic combination was also used by Banchs and Trope in a recent clinical report, as well as by Iwaya et al in a case report demonstrating revascularization of an immature tooth with Apical periodontitis.

II. APPLICATIONS OF TAP:

- Root canal disinfection

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Root canal infections consist of both aerobic and anaerobic bacteria. Keeping this in mind, the most effective and practical combination of antibacterial is TAP. As previously discussed, an in situ study by Sato et al evaluated the potency of TAP and as per the results, no micro organisms were found in the infected radicular dentin within 24 hrs of TAP application. Thus putting forth the opinion to treat periodical lesions first with the Triple antibiotic paste, followed by other endodontic procedures. Özan and Er found the combination of drugs in TAP are also helpful in treating large cyst-like lesions and periodical lesions.

- Regeneration and revascularization

Tap is effective in eliminating microbes from the infected pulps, thus creating a favourable environment for new vital tissue to regenerate. Endodontics Regenerative procedures (ERPs) are considered the latest advancement in Endodontics. TAP has shown to present with thickening of radicular dentin walls, apical foramen closures and continued root development. Studies have also shown that the percentage of increased dentin thickness was higher with TAP as compared to Calcium Hydroxide or formocresol.

- As an Intracanal Medicament

During the root canal treatment, TAP acts as an antiseptic agent for the root canal systems. In a study, Murvindran and James exhibited the potential of TAP to remove the microbial colonies and create a suitable microbe free environment. At the same time, Kim and Kim investigated that the triple antibiotic paste also showed characteristics of inhibiting E. Faecalis. Additionally, various clinical studies and case reports of horizontally fractured teeth, where TAP was used as an intracranial medicament and MTA as the coronal obturator showed repair of the fracture on radiographs with disappearance of symptoms within 12 months from initiating the treatment.

- Treatment of Primary teeth

The lesion sterilization and tissue repair (LSTR) therapy, employs the TAP and has shown to be successful in eliminating pathogens from the root canals effectively. But the complete eradication of infection from the infected primary teeth is still a challenge, because of the complexity of the root canals leading to difficulty in mechanical debridement of the canals. Nakornchai et al demonstrated that both Vitapex and TAP were effective in root canal treatment of infected primary dentition. The study showed a success rate of 100% and 96% respectively for TAP and Vitapex.

III. DRAWBACKS:

Post treatment with the triple antibiotic paste, studies were conducted and tooth discolouration emerged to be a major concern. And Minocycline was considered the leading cause of discolouration. Reynolds et al before placement of the TAP used a dentin bonding agent to prevent the discolouration, but the discolouration was only reduced and not completely eliminated.

Also, numerous studies have shown that the concentration of TAP used in regeneration and revascularization procedures can cause notable loss of radicular dentin and a considerable increase in roughness of dentin.

To further add to the list, removal of the Triple antibiotic paste from the radicular canals is a tedious process. This is primarily because TAP penetrates and binds with the dentinal structures, making it difficult to be removed. Chlorhexidine is the least effective of all and ultrasonic activation of 5.25 % Sodium Hypochlorite is considered the most effective. Recently, an investigation by Turkaydin et al showed the use of XP-Endo Finisher, which removed a larger amount of TAP from the root canal space than syringe or ultrasonic irrigation techniques.

IV. CONCLUSION :

A root canal treatment is considered successful when the microbial colonies are either reduced or eliminated completely from the root canal system. Although a crucial part of endodontic treatment, Biomechanical instrumentation alone cannot provide a sterile environment in the canal system. To aid in the eradication of the microbiota, TAP can effectively be used for sterilization of the root canals. The triple antibiotic paste has shown to be a good medicament in revascularization and regeneration. While we continue to research and find the ideal antimicrobial material, TAP has truly shown to be one of the top contenders in Endodontics.

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