



ROLE OF TRIPLE ANTIBIOTIC PASTE IN ROOT CANAL THERAPY (TAP).

Dental Science

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ABSTRACT

The elimination of microorganisms from the root canal and periapical area is essential for the endodontic procedure to be successful. A sterile state cannot be achieved with only endodontic instrumentation. Local administration of antibiotics has been studied in light of the development of non-instrumentation endodontic treatment, lesion sterilisation, and tissue healing. A beneficial regimen for managing non-vital young permanent teeth and primary teeth has been described as triple antibiotic paste (TAP), which contains metronidazole, ciprofloxacin, and minocycline.

KEYWORDS

Non-Vital, Triple Antibiotic Paste, Young permanent tooth, Primary Teeth, TAP

INTRODUCTION

In both animal models and human investigations, the part played by microorganisms in the emergence and maintenance of pulp and periapical disorders has been amply documented.^[1] The presence of microorganisms in the root canal system is unmistakably linked to the onset and evolution of an endodontically generated periapical lesion.^[2] Bacteria can invade and live deeply within dentin and in cementum surrounding the periapex when they are present in diseased root canals and peri radicular tissues. Endodontic treatment is to get rid of the bacteria in the affected root canal and stop infection.^[3] The root canal infection is regarded as a polymicrobial infection that includes both aerobic and anaerobic microorganisms. It is doubtful that a single antibiotic could effectively sterilise the canal due to the complexity of the root canal. To deal with the varied flora encountered, a mix would probably be required. For the first time in endodontics in 1951, Grossman used a poly – antibiotic formula known as PBSC, a combination of "penicillin, bacitracin, streptomycin, and caprylate sodium" in a silicon medium in a paste form.^[4] Gram-positive bacteria were treated with penicillin, penicillin-resistant bacteria were treated with bacitracin, gram-negative bacteria were treated with streptomycin, and yeasts were treated with sodium caprylate. Despite the fact that PBSC's clinical examination demonstrated positive therapeutic effects, anaerobic bacteria, which are crucial to endodontic problems, were unaffected by the formula. As a result, the US Food and Drug Administration outlawed the use of PBSC for endodontic procedures in 1975, noting the possibility of sensitization and penicillin allergy. An article on the use of antibiotics to manage root canal bacteria, which are thought to play a role in the aetiology and progression of pulpitis, was published by the American Association of Endodontics in 2006. TAP is an antibiotic combination that was created specifically to aid in the process of rejuvenation. After doing studies on its efficiency in clearing out the bacteria from the root canal, Hoshino and colleagues introduced it. As a powerful antimicrobial agent, this mixture is utilised to treat necrotic pulp in open apex teeth and has numerous other uses in the field of endodontics.^[5] This review aims to discuss properties of TAP, its composition, its various applications and indications.

TAP

TAP is an "intra-canal medicament" that includes the three antibiotics metronidazole, ciprofloxacin, and minocycline in a precise ratio of 1:1:1 to provide effective outcomes. TAP is used in order to get the greatest outcomes and effectively clean the area because one antibiotic is insufficiently powerful to eradicate all polymicrobial flora. TAP offers potent antibacterial effects in endodontic regeneration procedures since it is a mixture of three antibiotics. Since there is a large decrease in the likelihood of microbial resistance, the combined action of the three drugs in one mixture is very beneficial.^[6]

Composition and Preparation

According to Hoshino et al⁸ Mixing ciprofloxacin, metronidazole, and minocycline in a proportion of 1:1:1, that is ciprofloxacin 33%, metronidazole 33%, and Minocycline 34%, with macrogol and propylene glycol paste concentrated at 0.1-1.0 mg/ml; or Mixing

ciprofloxacin, metronidazole, and minocycline in a proportion of 1:3:3.

Application of TAP

Intra-canal Medicament

The root canal microbiome is multi-microbial and contains actinomycetes, aerobic and anaerobic bacteria, as well as other bacteria that are antibiotic-resistant. Due to the prevalence of antibiotic resistance, various antibiotics were needed to treat the polymicrobes and overcome the resistance.^[7] TAP is now the most successful pharmacological combination for overcoming bacterial strain resistance.

Ca (OH)₂ and TAP's effects were investigated by Pai et al. (2014).^[8] They discovered that 3 of 20 patients with 15% Ca (OH)₂ experienced flare-ups between appointments. However, none of them experienced flare-ups between appointments in relation to the TAP. In a different investigation, it was discovered that TAP demonstrated superior disinfection abilities in comparison to Ca (OH)₂.^[9]

In a different trial, the effectiveness of TAP in combination with other antibiotics was assessed, including amoxicillin and metronidazole, amoxicillin and clavulanic acid and metronidazole, amoxicillin and clavulanic acid and metronidazole, and amoxicillin and cloxacillin and metronidazole. In comparison to other formulations, they discovered that the TAP displayed the largest bacterial inhibitory zone.^[10] Researchers looked at the antibacterial effectiveness of TAP and Ca (OH)₂ in conjunction with 2% chlorhexidine against *E. faecalis*. They discovered that Ca (OH)₂ combined with 2% chlorhexidine is more effective against *E. faecalis* than TAP. TAP could remove germs from the dentin up to a depth of 400 µm, but Ca (OH)₂ could only do so up to a depth of 200 µm.^[11]

Regenerative Endodontics

A growing specialty called regenerative endodontics focuses on restoring the traumatised and unhealthy pulp tissue in these teeth. Utilising stem cells to replace missing tissues could restore such tissues to their preloss condition. Dentin, pulp, cementum, and periodontal tissues that are damaged can be healed with regenerative endodontics.^[12] Vital pulp cells still present at the apical end of the root canal, multipotent dental pulp stem cells, periodontal ligament stem cells, and stem cells from the apical papilla or bone marrow can all contribute to regeneration.^[13] Growth factors are abundant in the blood clot itself. It has long been believed that revascularization of the pulp space in a tooth with necrotic infected pulp tissue and apical periodontitis is not conceivable.^[1]

Nygaard-Ost by and Hjortdal successfully regenerated pulps after vital pulp removal in immature teeth, but were unsuccessful when the pulp space was infected. Thus, if the canal is effectively disinfected, revascularization should occur similar to that in an avulsed immature tooth.^[14]

Treatment of Root Fracture

According to several clinical studies and case reports on teeth with horizontal root fractures and their corresponding treatment with TAP as the intracanal medication and MTA as the coronal obturating material, the fractured root has been repaired radiographically, and tooth symptoms have disappeared after a 12-month period. It is thought that the cleaning and microbe removal by the TAP, which results in acceptable healing between the shattered fragments, is what gives rise to the success of such nonsurgical endodontic care.^[15] Studies have shown that *Streptococcus mutans* and *Lactobacillus casei* respond well to glass ionomer cement (GIC) that contains TAP. Yesilyurt et al. showed that the physical and bonding characteristics, compressive strength, and bonding strength to dentine are not altered and remain ideal when 1.5% TAP is added to GIC.^[16]

Lesion Sterilisation and Tissue Repair

A new approach that is less invasive and time-consuming treatment could be a ray of hope for the patient and the practitioner in the modern era. In these therapeutic situations, the LSTR-claims its significance. The LSTR therapy concept was created by Hoshino at the Niigata University School of Dentistry in 1990, and Takushige popularised it. The LSTR is an endodontic method that includes no or little instrumentation, followed by the administration of an antibiotic solution in a propylene glycol vehicle to clean the periapical lesions and root canal systems. LSTR's fundamental is "do not remove or touch and leave it." Caries, pulpitis, and root canal infections are all treated and medicated by it.

The idea behind LSTR is that the host's natural defence mechanisms can restore the damage. Bacterial burden can be reduced by using medications to sterilise the canals and pulp chamber.

DISCUSSION

Systematic antibiotic treatment necessitates bio absorption and bio modulation in the liver, followed by circulation in a circular system that transports the bio modulated medication to the affected location in the root canal system. Local drug application is more effective because the blood supply to the necrotic pulp and infected root canal system is impeded, and the bio Modulated drug also experiences this impediment at the infected site, rendering the drug ineffective in the enclosed canals. This is dependent on the type of drug and the method of local drug delivery system.^[17]

In 1990, Hoshino et al. combined antibiotics in a 1:1:1 ratio, including metronidazole 500 mg, ciprofloxacin 200 mg, and minocycline 100 mg. In 1998, Takushige et al. utilised a 1:3:3 ratio of the aforementioned antibiotics.^[18] The nitroimidazole group compound metronidazole binds to DNA and inhibits the growth of both gramme positive and gramme negative anaerobes. The fluoroquinolone group of drugs includes ciprofloxacin, which inhibits DNA gyrase and aids in the eradication of gram-negative bacteria. The broad range antibiotic Minocycline works by preventing the production of new proteins, collagenases, and matrix metalloproteinases. It eliminates both gram-positive and gram - negative bacteria, as well as Spirochetes.

The usage of TAP leads to the development of crown discoloration, bacterial resistance, and hypersensitivity reactions.

CONCLUSION

The cautious and thorough removal of pathogenic bacteria from the diseased root canal space is absolutely necessary for the effectiveness of the endo dontic treat ment. Despite the fact that mechanical preparation is the initial stage, it is insufficient to completely cleanse the area. It is important to consider non-instrumentation app roaches like tooth repair and ways to maintain a condition that is conducive to pulp regeneration and revascularization, especially when local drug administration, particularly antibiotic local administration, has been demonstrated to be unsuccessful. TAP has been found to be the most successful of all. TAP, a combination of three distinct antibiotics, has excellent outcomes and works well against many microbes. Additionally, the combined effects of three distinct antibiotics help lessen the likelihood of germ resistance. The finest antimicrobial agent must be chosen because there are numerous benefits and drawbacks related to the different antimicrobial agents that are accessible. TAP has unquestionably shown to deliver positive outcomes

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