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Original Article

Evaluation of LSTR 3 Mix MP Therapy for Healing of Periapical Pathosis of Nonvital Teeth

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Abstract

Context: LSTR 3 Mix MP therapy is one of the procedures for the management of nonvital tooth with periapical lesion. The principle of this therapy is the complete sterilization of the total pulp canal space, thereby healing of the periradicular lesion.

Objectives: To assess the clinical and radiological outcome of 'Lesion sterilization and Tissue Repair' (LSTR) for endodontic treatment of nonvital teeth with periapical lesion.

Materials and Methods: This descriptive, observational study allocated 40 nonvital teeth with periapical lesion treated by LSTR 3 Mix MP Therapy. In study subjects, a mixture of Metronidazole, Ciprofloxacin and Minocycline (3 Mix) in a proportion of 1:1:1 in ointment (Macrogol mixed with propylene glycol: MP) was placed at the orifice of the root canal or the bottom of pulp chamber after gaining access in the pulp chamber and removal of necrotic pulp, then sealed with Glass Ionomer cement and further reinforced by composite resin. The protocols for follow up examination were 3, 6 and 12 months post operatively. At the time of follow up examination a standard follow up chart was maintained.

Results: Out of 40 cases, in 29 cases had good responses both clinically and radiologically and 8 patients came back with some complications. Out of these 8 patients, 6 patients had uncertain outcome and in 2 patients it was unacceptable.

Conclusion: LSTR 3 mix MP therapy reduced clinical signs and symptoms successfully in teeth with periapical lesion and radiological improvement of the periapical index was also noted.

Key words: LSTR 3 mix MP therapy, periapical pathosis, nonvital teeth.

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Introduction

Periapical lesions of endodontic origin are due to an inflammatory response at the root apices of teeth with nonvital pulps.[1] The root canal system becomes increasingly susceptible to colonization by the microorganisms after pulp necrosis.[2] Necrotic pulps harbor pathogenic bacteria, which provide nutritional supply for bacteria which leads to the development of periapical lesion.[3] Due to close pathophysiological relationship between the pulp and the periapical region, bacteria, fungi, and their cell components may trigger an inflammatory process in periapical tissues, progressively affecting them through the resorption

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phenomenon.[4] Subsequently, immunopathological mechanisms lead to the formation of abscesses, granulomas, and periapical cysts[5]. Most periapical lesions (>90%) can be classified as dental granulomas, radicular cysts or abscesses.[5] As one of the main causes of periapical pathosis is bacterial infection of the periradicular tissues, bacteria present in root canals can be removed by filing or by chemical irrigation during conventional root canal treatment.[6] However, bacteria in the deeper layers of infected root dentine may sometimes remain even after conventional root canal treatment.[7] and can cause periapical complications. Such bacteria should be eliminated to ensure a successful outcome. Various medicaments, including non-specific antiseptics and antibiotics, have been used in root canal treatment.[7] The application of antibacterial drugs may represent one method of eradicating bacteria in root canal treatment.[6] The periapical status was assessed using the PAI score.[8] The aim of the present study was to observe the healing of periapical pathosis after LSTR 3 Mix MP Therapy and to evaluate clinically and radiologically for 12 months for follow up.

Materials and Methods

This descriptive, observational study was carried out for a period of 24 months from January 2018 to December 2019 in the Department of Conservative Dentistry and Endodontic Rajshshi Medical College, Faculty of Dentistry, Rajshahi Medical University, Rajshahi in Bangladesh. Forty patients with periapical lesion of teeth was selected requiring endodontic treatment along with a preoperative intra oral periapical radiograph considering excluding criteria like tooth with perforated pulpal floor, radiographic evidence of excessive internal resorption , excessive bone loss in the furcation area, non-restorable tooth, tooth having grade III mobility the. Inclusion criteria of patient selection were include both male and female patient of any age, patient willing to give consent to take part in the study, nonvital tooth with spontaneous pain, tender to percussion, swelling and sinus, nonvital tooth with periradicular radiolucency and endodontically treated failed tooth. After collection of data, these were screened by checking consistency, edited and were finally analyzed by software SPSS methods. The non-randomization procedure allocated 40 nonvital teeth with periapical lesion treated by LSTR 3 Mix MP Therapy. A mixture of Metronidazole, Ciprofloxacin and Minocycline (3 Mix) in a proportion of 1:1:1 in ointment (Macrogol mixed with propylene glycol in a ratio of 1:1 by volume: MP) was placed at the orifice of the root canal or the bottom of pulp chamber after gaining access in the pulp chamber and removal of necrotic pulp, then sealed with Glass Ionomer cement and further reinforced by composite resin. On the initial evaluation the patients were examined clinically for percussion pain, swelling and discharging sinus by present or absent and radiologically for widening of the periodontal ligament space by present or absent and periradicular radiolucency by same, increased, decreased and absent. The patients were evaluated at 3, 6, and 12 months post operatively by maintaining a standard follow up chart.

Evaluation:

For clinical evaluation, the preoperative and post-operative status was compared based on the presence or absence of pain, tenderness to palpation or percussion, mobility or presence/absence of any sinus tract. The comparative clinical outcomes were graded according to clinical endodontic guideline as follows[9]: i) Clinically Success: Absence of any pain or absence of tenderness to palpation or percussion, no sinus tract with normal physiological mobility. ii) Clinically Uncertain: Low grade discomfort after percussion or palpation with sporadic vague pain and/or persistent mobility. iii) Clinically Failure: Any signs or symptoms of persistent pain, predictable discomfort to percussion or palpation, recurrent sinus tract or excessive mobility. For radiological evaluation, two examiners assessed the pre-treatment and post-treatment radiographs in a dark room using a magnifier. The apical area of

involved tooth was scored with the Periapical Index (PAI) which was categorized as[8]: i) Normal periapical structure ii) Small changes in bone structures iii) Changes in bone structure with some mineral loss iv) Periodontitis with well-defined radiolucent area v) Severe periodontitis with exacerbating feature. The diameter of the lesion size was measured with a millimeter ruler. The pre-operative and the post-operative status were compared and the success or failure was graded as follows on the basis of the changes of size of the lesion and/or score of the PAI.[10] Pre- and postoperative findings at the initial examination and at the recall appointments the following clinical findings were recorded: history of pain indicating symptomatic periapical periodontitis, presence of a swelling, presence of a fistula, and tenderness to axial percussion, periodontal probing depths, and mobility. Radiographically, signs of periapical pathosis were recorded. The preoperative size of the periapical lesion was evaluated by averaging its largest diameter and its smallest one which were measured to the nearest 0.5 mm. The clinical findings recorded at the last follow-up and the comparison of the preoperative diagnostic radiograph with that of the last follow-up were the basis for evaluating the outcome of the endodontic therapy. The radiographs were judged by both dentists involved in the study (RW and RR) by using a magnifying glass and a light box. The operators did not know whether the tooth belonged to the one-visit or the two-visit group. In case of disagreement, a joint decision was made. All the patients were evaluated clinically and radiologically for success and failure by the Evaluation Guideline given by American Dental Association[9] for Evaluation and also evaluated radiologically as per periapical index (PAI) Evaluation Guideline given by Kirkevang et al. 2001.[11] The criteria for success or failure were the following (according to American Dental Association Evaluation Guideline)[9]: i) Complete Healing (Acceptable): No clinical signs and symptoms and; radiographically a periodontal ligament space of normal width. ii) Incomplete Healing (Uncertain): No clinical signs and symptoms and; radiographically a reduction of the lesion in size or an unchanged lesion within a observation time of 12 months. iii) No Healing (Unacceptable): Clinical signs and symptoms indicating an acute phase of apical periodontitis and/or radiographically a persisting lesion after a follow-up time of 12 months. A score >2 (PAI > 2) was considered to be a sign of periapical pathology.[8] Thus, a PAI score of 3, 4 or 5 defined AP including periapical cysts and periapical granulomas.[11] The periapical status on all appraised teeth was assessed.

Results

Total 40 non vital teeth with Periapical pathology were subjected to this study were treated with LSTR 3 Mix MP Therapy. The preoperative and 12 months clinical follow up data have shown a significant success rate of 94.6% (Table V). The variables for the clinical evaluation are shown at Table I. Nearly half (45%) of the lesion were small-sized (less than 4 mm), and size of the lesions were shown at Table II and 12 months radiological follow up data have shown that the size of the lesion became absent and decreased were 48.7% and 29.7% respectively (Table VI). According to Radiological outcome after 12th months follow up according to ADA guideline 29 (78.4%) cases were acceptable, 6 (16.2%) cases were uncertain and 2 (5.4%) cases were unacceptable (Table VII) and variables for the radiological evaluation are shown at Table VI. The PAI scores of the preoperative and after 12th months radiological follow up 32 (86.5%) patients of the study population had PAI score less than 3 and treated as healed as per Evaluation Guideline given by Kirkevang et al. 2001[11] (Table VIII).

Table I: Distribution of the study patients according to clinical presentation (n=40).

Clinical presentation	**Frequency**	**Percentage**
Pain	40	100
Percussion pain	40	100
Swelling	14	35
Sinus	6	15

Table I shows the clinical presentation of the study patients and observed that, pain and percussion pain was present in all of the study patients. However, out of 40 study patients, swelling and sinus was found 14 (35.0%) and 6 (15.0%) patients respectively.

Table II: Distribution of the study patients according to the size of the lesion (n=40).

Size of the lesion (mm)	**Frequency**	**Percentage**
<4	18	45
4-8	15	37.5
>8	7	17.5

Table II shows nearly half (45%) of the lesion were small-sized (less than 4 mm), 37.5% medium sized (4 mm-8 mm) and the rest (17.5%) were large sized (more than 8 mm)

Table III: Distribution of the study patients according to the radiological presentation (n=40).

Radiological presentation	**Frequency**	**Percentage**
Periradicular radiolucency	40	100
Widening of the periodontal membrane space	40	100

Table III shows 100% of the study population had periradicular radiolucency and widening of the periodontal membrane space

Table IV: Distribution of the study patients according to the periapical index (PAI) more than 2

Evaluation parameter	**Frequency**	**Percentage**
≤ PAI 2	00	00
>PAI 2	40	100

Table IV shows 100% of the study population had periapical index (PAI) more than 2

Table V: Distribution of the study patients according to clinical follow up (n=40).

Clinical Parameters	After 3 months(n=40)			After 6 months(n-38)			After 12 months(n=37)		
	Sign/ symptoms	n	%	Sign/ symptoms	n	%	Sign/ symptoms	n	%
Pain	Present	6	15	Present	3	7.9	Present	2	5.4
	Absent	34	85	Absent	35	92.1	Absent	35	94.6
Percussion pain	Present	6	15	Present	3	7.9	Present	2	5.4
	Absent	34	85	Absent	35	92.1	Absent	35	94.6
Swelling	Present	0	00	Present	0	00	Present	0	00
	Absent	40	100	Absent	38	100	Absent	37	100
Sinus	Present	1	2.3	Present	1	2.6	Present	1	2.7
	Absent	39	97.5	Absent	37	97.4	Absent	36	97.3

Table V shows pain and percussion pain was observed in 6 patients after 3rd months follow up and in 2 patients after 6th and 12th months follow up period. Presence of swelling was not observed during 3rd, 6th and 12th months follow ups. Sinus was observed in one patient during 3rd, 6th, and 12th months follow up period.

Table VI: Distribution of the study patients according to periapical radiolucency (n=40)

Size of radiolucency	After 3 months(40)		After 6 months(n=38)		After 12 months(n=37)	
	n	%	n	%	n	%
Increased	2	5	2	5.2	2	5.4
Same	20	52.6	8	21	6	16.2
Decreased	18	47.3	18	47.3	11	29.7
Absent	0	00	10	26.3	18	48.7

Table VI shows: at 12 months radiological follow up and after 3 months of root canal therapy periradicular lesion remain increased in 2 (5%), same in 20 (52.6%), decreased in 18 (47.3%) cases. After 6 months the lesion remain increased in 2 (5.2%), same in 8 (21%), decreased in 18 (47.3%) and absent in 10 (26.3%) cases. After 12 months the lesion remain increased in 2(5.4), same in 6 (16.2%), decreased in 11 (29.7%) and absent in 18 (48.7%) cases.

Table VII: Distribution of the study patients according to clinical outcome after 12th months follow up according to ADA guideline (n=37)

Evaluation parameter	**Frequency**	**Percentage**
Acceptable	35	94.6
Uncertain	0	00.0
Unacceptable	2	5.4

Table VII shows: at 12 months clinical follow up, 35 (94.6%) patients of the study population was treated as acceptable as per evaluation guideline given by American Dental Association and Only 5.4% study population was treated as unacceptable after 12th months clinical follow up.

Table VIII: Distribution of the study patients according to radiological outcome after 12th months follows up (n=37)

Evaluation parameter	Frequency	Percentage
Acceptable	29	78.4
Uncertain	6	16.2
Unacceptable	2	5.4

Table VIII shows 12th months radiological follow up 29 (78.4%) patients of the study population was treated as Acceptable as per Evaluation Guideline given by American Dental Association. 16.2% cases of the study population was treated as uncertain and only 5.4% study population was treated as unacceptable after 2nd months radiological follow up.

Table IX: Distribution of the study patients according to Periapical Index (PAI) radiological outcome after 12th months follows up (n=37)

Evaluation parameter	Frequency	Percentage
≤ PAI 2 (Healed)	32	78.4
>PAI 2 (Not Healed)	8	21.6

Table IX shows 12th months radiological follow up 29 (78.4%) patients of the study population had PAI score less than 3 and treated as Healed as per Evaluation Guideline given by Kirkevang et al. 2001[11]. 21.6% cases of the study population had the PAI score 3 or more than 3 and was treated as not healed.

Discussion

The root canal treated tooth become brittle in long run because lack of nutrition supply from the surrounding living tissue. In LSTR 3 Mix MP therapy the nutrition supply of the tooth are tried in keep in normal and the tooth structure as well as the canal wall need not to make wide. So the teeth having therapy remain stronger in comparison with root canal therapy.[6,12] In endodontic diseases, bacteria may invade not only dentine but also cementum. Such bacteria are reported to be obligate anaerobes and are sensitive to LSTR therapy. It appears to be difficult to eliminate these bacteria using conventional root canal treatment because it is not usually possible to reach the antibiotics up to the dentine cementum junction or long run of the dentinal tubules. It was clearly demonstrated in this study that the use of 3 Mix drugs for sterilization of endodontic lesions gave excellent results.[6] As mentioned above the present therapy apparently depends on the elimination of bacteria from the lesion but not on mechanical procedures. Therefore, the clinical procedures are simple and does not require long chair-side time or multiple visit. The excellent clinical results of LSTR 3 mix MP therapy in the treatment of nonvital teeth with periapical lesion may be ascribed by the bactericidal efficacy of the mixture of the drugs (3 Mix)[12]. Previous studies have clearly demonstrated that 3 Mix is capable of eliminating bacteria from infected dental tissue.[12,13,14] It also demonstrated in situ that the drug mixture could be carried quickly and efficiently by propylene glycol and thus penetrated into the periapical lesion and killed all the cultivable bacteria within one day, including that lesion can be sterilized by application of 3 mix drugs.[15,16,17] In this study, the clinical and radiological outcome was assessed at 3, 6, 9 and 12 months. At least radiographic review is recommended every 3 months following completion of treatment to identify changes in the periapical area. The PAI score was used to

evaluate the periapical health and the healing process because it was considered as the most appropriate of all the evaluation techniques validated in endodontic. 100% of the study population had periradicular radiolucency and widening of periodontal membrane space and periapical index (PAI) more than 2 (Table III & Table IV). In this study after 12 months radiological follow up the lesion remain increased in 2(5.4), same in 6 (16.2%), decreased in 11 (29.7%) and absent in 18 (48.7%) cases (Table VI). 29 (78.4%) patients of the study population had PAI score less than 3 and treated as healed as per evaluation guideline given by Kirkevang et al. 2001.[11] 21.6% cases of the study population had the PAI score 3 or more than 3 and was treated as not healed (Table IX). At 12 months follow up as per evaluation guideline given by American Dental Association (ADA) 35 (94.6%) patients of the study population was clinically acceptable(Table VII) and 29 (78.4%) patients of the study population was treated as acceptable radiological (table VIII). In similar type of study Takushiget et al found reduction of radiolucency or absent in 93% cases (Endodontic retreatment using 3 Mix MP without removal of previous canal obturation) treated with LSTR 3 Mix MP therapy.[18,19]

Conclusion

In conclusion, the present study has shown that LSTR 3 Mix MP therapy is an effective nonsurgical procedure for management of nonvital teeth with periapical lesion. It may be a suitable replacement for conventional root canal treatment for the management of teeth with periapical pathosis. However, further clinical studies with larger study population are recommended.

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