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What's new for the clinician?
- Excerpts from and summaries of recently published papers

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Compiled and edited by V Yengopal

1. 0.5% versus 3% sodium hypochlorite (NaOCl) in root canal treatment: A quasi-randomized controlled trial

C Ulin, M Magunacelaya-Barria, G Dahlén, T Kvist. Immediate clinical and microbiological evaluation of the effectiveness of 0.5% versus 3% sodium hypochlorite in root canal treatment: A quasi-randomized controlled trial. International Endodontic Journal 2020; 53(5): 591-603.

ABSTRACT

The aim of root canal treatment is to eliminate bacteria from, and prevent their further entry to the root canal system. Successful root canal therapy depends on thorough chemomechanical debridement of pulpal tissue, dentin debris, and infective microorganisms.[1]

Irrigants can augment mechanical debridement by flushing out debris, dissolving tissue, and disinfecting the root canal system. Chemical debridement is especially needed for teeth with complex internal anatomy such as fins or other irregularities that might be missed by instrumentation.

A large number of substances have been used as root canal irrigants, including acids (citric and phosphoric), chelating agents (ethylene diaminetetraacetic acid EDTA), proteolytic enzymes, alkaline solutions (sodium hypochlorite, sodium hydroxide, urea, and potassium hydroxide), oxidative agents (hydrogen peroxide), etc.

Sodium hypochlorite (NaOCl) in a variety of strengths has been used by dentists for many years, but concerns have been raised about its toxicity and the occasional report of pain when higher concentrations are used.[1]

Chlorhexidine, an antimicrobial, has also been used in a variety of concentrations as either a solution or gel. Combinations of antibiotic and a detergent (MTAD) have been recently developed and are being used increasingly.

Ulin and colleagues (2020)[1] reported on a trail that sought to test the hypothesis that in a daily routine setting, root canal preparation with irrigation using 3.0% NaOCl will result in fewer postoperative root canal samples with cultivable bacteria prior to root filling than irrigation with 0.5% buffered NaOCl but, at the same time, will not result in a higher frequency of postoperative pain.

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MATERIALS AND METHODS

The study was designed as a single-blind quasi-randomized control trial. Patients who required endodontic treatment after screening (n=298) were considered for inclusion.

Exclusion criteria were severe systemic disease, no endodontic diagnosis, the need for a language interpreter, the decision to postpone the treatment decision (wait and see), the decision to not perform any treatment, extraction or endodontic surgery treatment selected.

If a patient was referred for more than one tooth, only the first treated tooth was included in the study. After informed consent was obtained, the patient was randomly assigned to have the root canal treatment performed with 0.5% or 3% NaOCl irrigation during canal preparation.

If the patient's first visit was on an even-numbered date, the concentration was 0.5%; if the visit was on an odd-numbered date, the concentration of the irrigant was 3%.

The patients and those assessing outcomes were blinded after assignment to the intervention. After entering the study, preoperative factors such as gender, age, jaw, tooth, diagnosis and preoperative symptoms were recorded.

From the patient records, the data concerning which treatment was carried out, who made the treatment and the number of treatment sessions until the treatment was completed were retrieved.

Root canal treatment was standardized but the treatments were not restricted to a single protocol. However, the following procedures were common for all cases:

An operating microscope was available and used during all the treatment procedures. After the removal of the temporary or defective restoration or crown and, if necessary, excavation of caries, each tooth was isolated with a rubber dam, ensuring the absence of saliva leakage, and the operative field was disinfected with 30% hydrogen peroxide following by 10% tincture of iodine.

Pulp chamber access preparation was performed, and working length was established using an electronic apex locator. The working length determination was confirmed radiographically with a diagnostic file. The working length was ideally determined as equal to or slightly shorter (usually 0.5 mm shorter) than the root apex tip.

Canal shaping was performed with rotary instruments, and the technique was chosen by the operator. The instruments available for use included K-flex files, Hedström files, the rotatory ProTaper instrument system, the WaveOne instrument system and the BioRace instrument system which meant that operators could choose any system that suited the clinical case that they had to complete.

The recommended minimum apical size of canal preparation was size 25. All the operators were asked to perform the root canal treatment as they would normally.

The only variation during treatment was the concentration of the NaOCl solution for irrigation of the root canal. One group was irrigated with buffered sodium hypochlorite 0.5%, and the other group was irrigated with NaOCl 3%.

The operators were free to choose any additional irrigant as perceived necessary clinically. The irrigants available were 15% ethylenediaminetetraacetic acid (EDTA) and 5% iodine-potassium-iodide (IPI) used as a short-duration antimicrobial agent and intracanal medication for 10 minutes.

Calcium hydroxide was the standard inter-appointment medication. The inter-appointment medicament was removed prior to root filling using irrigation with 15% EDTA and 0.5% or 3% NaOCl, depending on which group the case had been allocated to.

Passive ultrasonic activation was optional. After the sampling procedures, gutta-percha and AH plus were used for root filling. The access cavity was filled with IRM after each appointment. A permanent restoration was placed by the referring dentist.

Root canal bacterial sampling was taken immediately before the root filling. The sodium hypochlorite solution and iodine-potassium-iodide were inactivated with 5% sodium thiosulfate solution for 30s. The canals were then filled with a sterile solution and dentinal shavings were produced with size 25 H-files.

The entire canal content was absorbed using sterile paper points and was transferred to sterile solution. The samples were processed at the laboratory and were transferred onto growth media and these were checked daily for 14 days or until the signs of microbial growth.

To evaluate postoperative pain and swelling, each patient was instructed to complete a questionnaire after each treatment. The questionnaire contained seven identical visual analogue scales (VAS) to assess the pain daily for seven consecutive days postoperatively.

The VAS was constructed as a 10-cm line with endpoints 0 and 10, where 0 was set to no pain and 10 the worst imaginable pain. The patients were also asked to register whether swelling had occurred during the treatment period.

RESULTS

Of the 298 patients enrolled, one hundred fifty-three patients were allocated to receive root canal treatment with 0.5% NaOCl irrigation, and 145 were allocated to receive root canal treatment with 3% NaOCl irrigation.

The patients allocated to the 3.0% NaOCl group reported preoperative symptoms more frequently than the patients in the 0.5% NaOCl group but the difference was not statically significant (P=0.067).

In the respective groups, 139 (90.8%) and 132 (91.0%) received the allocated intervention. During the follow-up and analysis, the lost to follow-up varied amongst different outcome measures.

For the microbiological samples and cultures, the analysis was available from 134 teeth (96.4%) in the 0.5% group and from 129 (97.7%) teeth in the 3% group. To evaluate postoperative pain, 106 (76.2%) patient questionnaires in the 0.5% group and 105 (79.5%) in the 3% group were available.

Regarding the analysis of postoperative swelling, the data were available from 98 (70.5%) and 101 (76.5%) of patients in each group, respectively.

Eighteen (13.4%) of the root canal samples were positive in the 0.5% NaOCl group, and 24 (18.6%) were positive in the 3% NaOCl group. The mean difference –5.2% (95% confidence interval (CI): –14.8 to 4.4) was not significant (P=0.33).

Fifty-seven (53.8%) patients reported some pain in the 0.5% NaOCl group, and 56 (53.3%) reported some pain in the 3% group. The mean difference 0.4 (95% CI: –14.0 to 14.8) was not statistically significant (P=1.0).

No significant difference was detected between the two groups when comparing the maximum postoperative pain or amount of pain over all days.

In the 0.5% NaOCl group, 5 (5.1%) patients reported swelling; in the 3% NaOCl group, the corresponding number was 18 (17.8%) of patients. The mean difference was 12.7 (95% CI: 3.1–22.4), which was significant (P=0.0084). The RR was found to be 3.49 (95% CI: 1.35–9.04).

It was found that preoperative symptoms (OR=3.73; P=0.021) and the diagnoses of symptomatic apical periodontitis (OR=2.86; P=0.021) were significantly positive predictors of postoperative swelling, whilst the pre-operative diagnosis of asymptomatic apical periodontitis tended to be a negative predictor (OR=0.42; P=0.064)

CONCLUSION

The authors concluded that replacing 0.5% NaOCl irrigation with a 3.0% NaOCl solution did not result in fewer postoperative samples with cultivable bacteria nor higher frequency or magnitude of postoperative pain. However, the number of patients reporting postoperative swelling was significantly higher in the 3% NaOCl group.

Implications for practice

This trial has provided evidence of the safety and efficacy of lower concentration 0.5% NaOCl used as a root canal irrigant compared to the stronger 5.0% NaOCl concentrate.

There were additional benefits of significantly less postoperative swelling associated with the use of the lower concentration NaOCl solution.

Reference

1. Ulin C, Magunacelaya-Barria M, Dahlén G, Kvist T. Immediate clinical and microbiological evaluation of the effectiveness of 0.5% versus 3% sodium hypochlorite in root canal treatment: A quasi-randomized controlled trial. International Endodontic Journal 2020; 53(5): 591-603.

2. The effect of an intraorifice barrier and base under coronal restorations on the healing of apical periodontitis: A randomized controlled trial

G Kumar, S Tewari, P Sangwan, J Duhan, S Mittal. The effect of an intraorifice barrier and base under coronal restorations on the healing of apical periodontitis: A randomized controlled trial. International Endodontic Journal 2020; 53 (4): 298-307.

ABSTRACT

Clinical assessment of both root canal treatment and coronal restoration is fundamental when evaluating endodontic treatment. There is a large body of published evidence that has evaluated factors that can affect the outcomes of the endodontic treatment procedure.

These include variables such as short filled (>2 mm), long filling (extruded beyond apex), flush filled root fillings, voids in the root filling materials, issues around cleaning efficacy of canals, etc. However, there is still some controversy when it comes to the level of impact of the coronal restoration on the success rate of the endodontic treatment.

Much is known about the effect of permanent coronal restoration on the treatment outcome. Some studies, including reviews have reported a link between the quality of the coronal restoration and the overall success of the endodontic procedure for that particular tooth whilst others have reported no association.

Some studies have reported that the quality of the root canal procedure (the sealing of the root system) was more important determinant of overall success than the placement of the coronal restoration.

Kumar and colleagues from India (2020)[1] reported on a trial that sought to evaluate the effects of an additional orifice barrier, the coronal extent of root filling and periodontal status on the healing of Apical periodontitis after root canal treatment. The primary objective of this study was to assess the effect of an additional coronal barrier on endodontic success. The null hypothesis was that there is no difference in periapical healing with or without additional coronal barriers.

MATERIALS AND METHODS

Patients who met the following inclusion criteria were invited to participate in this trial: permanent mandibular first or second molars with pulp necrosis and periapical radiolucency on radiographs were selected. Both occlusal and proximal cavities were included.

Exclusion criteria comprised the following: pregnant women and patients with diabetes, immunocompromising conditions, positive history of antibiotic intake in past 1 month, unrestorable teeth, teeth with apicomarginal defect, pocket depth > 6 mm, previously initiated root canal treatment, root filling or procedural errors.

The patients were randomly assigned to one of the three groups: intraorifice barrier (GIC filling placed in coronal part of root canal and at the base of the restoration), base (root canal filled and sealed off at base of pulp chamber and then GIC placed as a base for the restoration) and control (root canal filled and sealed off at base of pulp chamber and then restoration placed over this [no base]).

For randomization, equal proportion allocation ratio was followed. Opaque envelopes with concealed assignment codes were handed sequentially to all the participants. Envelopes were opened by the primary investigator only after filling of the root canals.

Endodontic procedures in all the teeth were performed by a single operator using a standardized approach. After preparation, the root canals were irrigated with 5 ml of 17% EDTA for 1 min followed by final irrigation with 5 mL 5% NaOCl. The root canals were dried using paper points and filled with laterally condensed gutta-percha and zinc oxide eugenol sealer 0-2 mm short of

the radiographic apex. The access cavity was restored with a resin-reinforced ZOE cement (Kalzinol). In the next visit after 48 h, the intermediate restoration was removed from the coronal access. The sealed envelope containing the concealed assignment code was opened by the operator, and the access cavity was restored accordingly as per group assignment.

For the Intraorifice barrier group: after removal of 3 mm of gutta-percha from the coronal portion of the root canals using a heated plugger, excess root canal sealer was removed with sterilized alcohol-wet cotton pellets.

The entire surface was conditioned using Ketac Molar liquid for 30 s, rinsed with water and air-dried. GIC (Ketac Molar) powder and liquid were dispensed in the ratio of 3:1 on the paper pad and mixed with plastic cement spatula for 45 s. GIC was then placed inside the orifice and condensed with the plugger over the root filling.

A 2-mm-thick uniform base of the same material was applied on the floor of the pulp chamber and condensed with the plastic instrument. A final composite resin (Tetric EvoCeram) restoration was placed in increments of 2 mm according to the manufacturer's instructions. Finishing was done with fine diamond points.

For the Base group, gutta-percha was left at the level of orifice. A 2-mm-thick GIC base was placed on the pulp chamber floor and the cavity restored with composite following the same procedure described above. In the Control group, only composite resin was used to seal the access cavity leaving gutta-percha up to the orifice.

The adequacy of coronal restoration and extent of canal filling was verified radiographically. Additional periodontal therapy was administered to patients with compromised periodontal health. Clinical and radiographic follow-up was done at 3, 6, 9 and 12 months. All radiographs were obtained at standard exposure parameters.

The primary treatment outcome was healing, evaluated using clinical and radiographic findings. The coronal portions of the teeth in radiograph were masked to ensure blinding of the observers. In case of disagreement, two observers sat together and discussed until a mutual consensus was achieved.

The radiographic scores at 12 months were further dichotomized into healed and nonhealed. Criteria for clinical success were the absence of pain, sinus or any swelling, tenderness to palpation/percussion, tooth mobility and increased periodontal probing depth.

A calibrated examiner masked to the treatment provided recorded probing depth (PD) and bleeding on probing (BOP) using a periodontal probe (UNC-15). Clinically, periodontal parameters were recorded at six sites in every tooth (mesial, median, and distal points at the buccal and lingual aspect per tooth).

For calculation of marginal bone height, the vertical distance between the cementoenamel junction and most coronal bone level was measured using the ImageJ® software.

RESULTS

Out of 120 patients enrolled in the study, 10 patients (2, 5 and 3 patients from the intraorifice barrier, base and control groups, respectively) were lost to follow-up. Therefore, 110 patients were included in the final analysis. There was a non-significant difference in age or gender between the groups.

There was no significant difference in radiographic scores at any interval between the groups ($P>0.05$). All the groups were associated with a significant improvement in radiographic score at all time intervals ($P<0.05$). Following dichotomization, the base group exhibited the greatest percentage of healing (97.1%) followed by the intraorifice barrier (92.1%) and control groups (83.8%); however, the differences were nonsignificant ($P=0.136$). None of the patients examined at any follow-up stage had signs or symptoms of clinical failure.

When the teeth were classified into positive (gutta-percha coronal to marginal bone) ($n=59$) and negative (gutta-percha apical to marginal bone) ($n=51$) root filling groups based on the coronal extent of the root filling, a non-significant difference in healing between both the groups was observed ($P=0.672$).

The patients were further subdivided into 2 groups based on the periodontal bone level: periodontally healthy (alveolar crest within 2 mm from the cementoenamel junction) and periodontally compromised. The average initial pocket depth of periodontally compromised patients was 3.63 mm.

Healing rate was higher in periodontally healthy patients (92.9%) than periodontally compromised patients (88.9%), but the difference was non-significant ($P=0.547$). The chi-square test was also used to compare healing between Class I (88.6%) and Class II (92.4%) cavities, and the difference was found to be nonsignificant ($P=0.498$). None of the factors (age, gender, type of cavity, type of coronal restoration, marginal bone height at baseline and radiographic score at baseline) analysed had a significant effect on outcome in the regression analysis.

CONCLUSION

The authors concluded that the use of additional barrier under permanent restorations did not significantly improve the outcome of primary root canal treatment in posterior teeth up to 12 months.

Implications for practice

The results suggest that there was no need to place a base cement on the floor of the pulp chamber before placement of permanent restoration. However, longer term follow up studies (greater than one year) will need to confirm longer term outcomes.

Reference

1. Kumar G, Tewari S, Sangwan P, Tewari S, Duhan J, Mittal S. The effect of an intraorifice barrier and base under coronal restorations on the healing of apical periodontitis: A randomized controlled trial. International Endodontic Journal 2020; 53(4): 298-307.