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What's new for the clinician – summaries of recently published papers (November 2023)

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1. Comparative evaluation of four treatments for post-orthodontic white spot lesions: a randomised controlled trial

Orthodontic treatments have enjoyed growing popularity in recent years, and the white chalky spots, also called white spot lesions (WSLs), that appear after treatment are a major aesthetic problem for patients and clinicians.[1] The prevalence of these unsightly lesions varies from 3% to 97%1. In some cases, these demineralisation lesions may be reversible but often, in the case of orthodontic treatments, these lesions of the enamel evolve progressively and become irreversible, leading to carious processes.[1] An increase in the amount of dental plaque containing cariogenic bacteria is the main etiological factor in decalcifying the enamel during orthodontic treatment. This demineralisation of the dental surfaces results in the appearance of WSLs or even caries.

With the development of penetration technology, the clinical application of resin infiltration has achieved encouraging results.[1] The use of resin infiltration can change the optical properties of damaged enamel by resin penetrating into the space of the demineralised enamel, thus improving its aesthetic appearance.

Wang and colleagues (2023)[1] reported on a randomised clinical trial (RCT) that sought to evaluate the efficacy of fluoride toothpaste alone and those of the adjunctive use of resin infiltration, CPP-ACP and fluoride varnish in the treatment of WSLs. The null hypothesis tested was that there was no difference in the effectiveness of the four treatments in reducing the size of WSLs.

MATERIALS AND METHODS

The study was a prospective, randomised, double-blind, multicentre clinical trial done in China. Assuming on average one patient had 4 lesions and anticipating a 20% drop-out rate, at least 18 patients in each group were targeted for recruitment at baseline.

Seventy-nine patients were recruited from four hospitals. The inclusion criteria were patients who (1) were between 12 and 25 years old; (2) could participate in clinical trials for a period of 24 months; (3) were generally healthy; and (4) had two or more WSLs in the buccal surface of the anterior teeth with significant visual changes in enamel and/or local enamel breakdown and no clinical visual signs of dentin involvement [International Caries System Detection and Assessment System (ICDAS code 2)]. The exclusion criteria were patients who (1) were pregnant or breastfeeding women; (2) had a smoking history; (3) had a systemic disease or syndrome; and (4) were confirmed or suspected to have allergies to fluoride or milk protein and/or to benzoic acid preservatives (components of CPP-ACP products). Baseline examinations were conducted by four calibrated and specially trained dentists.

In this study, stratified randomisation was adopted, which was stratified by centre and then randomised within each centre. Each patient received a randomly assigned sequence of treatments, and the results were placed in sequential, sealed, light-tight envelopes. The envelope would only be opened when eligible patients agreed to enter the trial, and the patients would receive the treatment according to the allocation result. The first unblinding was performed after data collection, and the second unblinding was performed after the statistical analysis report was completed. For teeth with lesions not included in this study and with treatment need, parents were advised to take their children to the dentist for timely treatment.

In this study, a double-blind method was used, in which both the participants and the image processor were unaware of the study group assignments. There were four groups in this study. In the fluoride varnish group, the WSLs received 5% sodium fluoride varnish (Duraphat) every 6 months. In the CPP-ACP group, the lesions received fluorine-free CPP-ACP mousse (GC Tooth Mousse) every 6 months. In the resin infiltration group, the lesions received resin infiltration (Icon infiltration resin) treatment at baseline, and placebo was applied to the lesions every 6 months from the second visit. The control group was coated with fluoride toothpaste (containing 1400ppm fluoride) every 6 months. All the participants in the study were asked to use designated toothbrushes and fluoride toothpaste (Colgate containing 1400ppm fluoride) to brush their teeth twice a day. At each follow-up examination, oral health instructions were given to the patients, and they were asked to use pea-sized toothpaste while brushing teeth.

For the participants in the fluoride varnish, CPP-ACP, and control group, the study agent was applied on the WSLs using a microbrush by trained dentists according to their group allocation at each visit. The study participants were instructed not to drink or eat in the next half an hour after the interventions and to avoid hard food in the next four hours.

At baseline, for the participants in the resin infiltration group, the teeth with WSLs were cleaned, and the operation area was isolated by a rubberdam. The lesions were etched with 15% hydrochloric acid gel for 2 min and rinsed with a large amount of water under pressure. The enamel surface after etching showed a chalky white colour. To dry the tooth surface, the following steps were taken: 99% ethanol was injected onto the lesion for 30 sec, then the operation area was blown dry, infiltration resin was applied for 30 sec, and teeth were left for 3 min. The excess resin

on the interproximal surface was cleaned with floss and light cure was applied for 40 sec. Without further acid etching, the resin infiltration was repeated and left for 1 min. Then, the teeth were cleaned and light cure was applied for 40 sec. The tooth surface was polished after removing the rubberdam.

A modified validated questionnaire was used at baseline to study the patients' oral health-related behaviours and socioeconomic backgrounds. The content included parental educational level, snacking habits, daily tooth brushing habits, use of floss, use of fluoride toothpaste and smoking history.

The area of WSLs was measured by ImageJ Image analysis software and the changes in the lesion area in the four groups were compared.

All intraoral photographs were taken under the same condition. ImageJ software was used to analyse and process the images. The combination of photos and Image J software is considered a reliable measurement method which is easy to operate, economical, fast, intuitive and highly acceptable to patients. By measuring photos, the extent of tooth damage can be directly analysed and the appearance and colour of teeth can be evaluated, better meeting human aesthetic standards and improving patient satisfaction. For the teeth identified as WSLs with ICDAS code 2, the researcher first drew the outline of the whole tooth and calculated the area with ImageJ software on the same computer screen, and then outlined the WSLs on the surface of the corresponding tooth and analysed its area. After determining the values for total tooth area and lesion area, the percentage of the affected area surface was calculated by dividing the area of WSLs by the total tooth area. The percentage of WSLs for each tooth surface provides a relative value to control for the effect of differences in magnification of digital photographs. The reference for measuring the area of WSLs by ImageJ software was calibrated based on ruler photographs obtained at a fixed focal length. To evaluate the method error, the digital oral photograph images of 10 participants were randomly selected among all participants, and the same data analyst measured the digital photographs again after 1 week to perform a consistency test; the intraclass correlation coefficient (ICC) was required to be above 0.9 to ensure the repeatability of the measurement results.

RESULTS

At baseline, 136 patients were screened and 79 patients (31 male, 48 female) with a total of 356 teeth with WSLs meeting the inclusion criteria were randomly allocated into the four study groups. There were 20, 20, 20 and 19 participants in the fluoride varnish, CPP-ACP, resin infiltration group and control group, respectively.

Participants were mainly adolescents, with a mean (±SD) age of 15.9 (±2.8) years (median 15 years, minimum 12, maximum 25 years). Most of them brushed their teeth daily but rarely flossed their teeth and ate sweets or drank sugary drinks at least once a week. More than half of the parents had a university degree or higher level of education. There were no significant differences in oral health-related behaviours or sociodemographic characteristics between the four groups at baseline.

At baseline, a descriptive statistical analysis of oral examination indicators was performed. According to the results of the normality test, the data in the table were skewed, so the form of [median (upper quartile, lower quartile), M (Q1, Q3)] was used for statistical description. After 12 months, 68 (86%) patients remained in the study, with 18, 19, 16 and 15 patients in the fluoride varnish, CPP-ACP, resin infiltration group and control group, respectively.

The dropout rates among the four groups were similar (χ^2 test, $p > 0.05$). There were no significant differences in the mean scores of DMFT, decayed teeth (DT), filled teeth (FT), PI and BOP between the participants who remained and those who were lost to follow-up. No significant differences were found in the tooth brushing habit and snacking habit among the four groups at baseline and at the 1-year follow-up. After 12 months, the percentage of the WSLs area in each group was significantly different from the baseline, and different degrees of reduction in the area of WSLs were observed in all four groups. The percentage of lesion area reduction in WSLs in the resin infiltration group was 46.62%, which was significantly higher than that in the fluoride varnish group (26.57%), CPP-ACP group (28.64%) and control group (29.75%), and the differences were statistically significant ($p < 0.001$). Further pairwise comparison showed that the resin infiltration group had significant differences from the fluoride varnish, CPP-ACP and control group. In the resin infiltration group, the baseline WSL area before treatment (baseline area B) was 26.24 ± 10.78 (mean ± SD), the area immediately after treatment was 17.38 ± 9.87 (mean ± SD) and the area after 12 months was 13.55 ± 7.24 (mean ± SD), indicating that the area of WSLs continued to decrease between baseline and 12 months after treatment. No adverse events were reported in any of the groups.

To investigate the influence of various factors on the results and to account for the clustering effect of the data, multiple linear regression analysis was used. There was a significant difference between receiving resin infiltration treatment and a decrease in WSLs. The treatment effect for this intervention was greater than observed for the other three interventions. Liner regression also showed that as the PI (plaque index) increased, the oral hygiene worsened and the treatment effect decreased.

CONCLUSIONS

This study showed that after a 1-year follow-up period, the use of resin infiltration significantly reduced the area of WSLs. Fluoride toothpaste, with or without the adjunctive use of CPP-ACP and fluoride varnish, also has therapeutic effects to some extent. When conditions permit, resin infiltration would be the best treatment strategy for WSLs.

IMPLICATIONS FOR PRACTICE

Resin infiltration techniques seem to offer significantly better clinical outcomes when used for treating WSLs when compared to other treatment modalities. However, it is important to focus on maintaining good oral hygiene as this trial has shown that poor oral hygiene is associated with smaller treatment gains.

REFERENCE

1. Wang Q, Zhou Y, Cui T, Li J, Lo EC, Hao G, Zhi Q. Comparative evaluation of four treatments for postorthodontic white spot lesions: a randomized controlled trial. Clinical Oral Investigations. 2023 Oct;27(10):5957-68

2. Combining short-onset (lidocaine) and long-acting local anaesthetics(ropivacaine) for better pain outcomes in third molar surgery: a randomised controlled trial

Extraction of mandibular third molars is a common procedure in oral surgery which triggers a cascade of inflammatory events including swelling, redness, functional disability such as trismus and pain.[1] Since pain control has a significant impact on a patient's quality of life, effective analgesia both during and after the operation is crucial to ensure patient comfort. Many third molar surgeries are done in the dental chair without sedation using only local anaesthetic (LA).[1] Although 2% lidocaine with epinephrine is usually the preferred LA for dental procedures, adequate intraoperative anaesthesia and prolonged postoperative analgesia can be achieved by using long-acting LAs such as ropivacaine.1 However, long-acting LAs are known for their slower onset of action. To compensate for this, a mixture of short-onset (eg lidocaine) and long-acting LAs is often used clinically in other types of surgery to block the sciatic nerve and brachial plexus.1 However, the efficacy of such an anaesthetic cocktail has not been elucidated in the field of oral and maxillofacial surgery. Hemmi and colleagues (2023)1 reported on a trial that sought to investigate the efficacy of a lidocaine-ropivacaine mixture in providing analgesia for the extraction of impacted mandibular third molars.

MATERIALS AND METHODS

This was a prospective, randomised, blinded clinical trial involving two groups of 28 patients in each arm of the study. Patients aged ≥16 years, who had been scheduled for the extraction of a mandibular third molar under local anaesthesia from June 1 2021 to March 22 2022 were included in the trial. Patients with a history of allergic reaction to lidocaine and/or ropivacaine, paraesthesia around the area of innervation of the mandibular nerve, active infectious disease in the oral and maxillofacial region, and haemorrhagic diathesis were excluded from the trial. The participants were blinded to the LA used.

Patient allocation was stratified by a combination of two factors, sex and age, and block randomised (block size = 4) in each stratum. Sequentially numbered containers were used for random allocation, which was performed by a statistical specialist.

The primary outcome was the onset of anaesthetic effect. The secondary outcomes were anaesthesia success rate, duration of operation, duration of anaesthetic effect and pain intensity during and after extraction determined using the numerical rating scale (NRS).

The inferior alveolar nerve block (IANB) was given to each patient using a standardised technique. In this technique, the needle was inserted from the medial side of the mandibular ramus and lateral to the pterygomandibular raphe, at the level of the coronoid notch on the anterior border of the ramus. A 3.0mL disposable syringe and 31-gauge 12mm needle were used. Either 2.7mL of 2% lidocaine with epinephrine (lidocaine group) or an equal volume of a 1:1 mixture of 2% lidocaine with epinephrine and 0.75% ropivacaine (mixture group) was used as the LA.

Numbness of the lower lip, tongue and buccal mucosa is considered to indicate the onset of anaesthesia. After confirming the onset of anaesthesia, 0.9mL of 2% lidocaine with epinephrine was infiltrated around the mandibular third molar to reduce bleeding during extraction. If the procedure was completed without the need for additional administration of the LA, local anaesthesia was considered successful. The need for re-administration of LA was noted, and such patients were excluded from postoperative evaluation. All the nerve blocks and extractions were performed by a single oral surgeon using a consistent protocol. All patients were instructed to take 60mg loxoprofen sodium hydrate 8 hourly for 1 week and 250mg amoxicillin 6 hourly for 3 days after the extraction.

The onset of anaesthetic effect, anaesthesia success rate, duration of operation and pain intensity during extraction were recorded on the day of operation. As this study included patients who underwent the procedures in an outpatient setting, the interval between the end of operation and awareness of pain/first intake of analgesic and postoperative pain intensity were recorded using a questionnaire, which was filled in at home.

RESULTS

Of the 56 patients recruited, 52 patients completed the trial. No significant differences were observed in sex and age between the two groups, which indicated uniform randomisation. Also, no significant differences were observed between the groups in clinical features including onset of anaesthetic effect and success rate ($P = 0.59$ and 1.00, respectively).

Since two patients in each group dropped out of the study (one patient in the mixture group was lost to follow-up and one patient in the mixture and two patients in the lidocaine group required additional LA administration due to insufficient anaesthetic effect), 26 patients in each group (total 52) were included in the following statistical analysis. For three patients with insufficient anaesthetic effect, infiltration anaesthesia with lidocaine was added, and the procedure was completed in all patients.

In the mixture group, both duration of anaesthetic effect and time to first intake of analgesic was significantly longer than that in the lidocaine group ($P < 0.01$).

Surgical pain during extraction and 1- and 7-days post-extraction was recorded to compare analgesic efficacy. In the mixture group, maximum NRS scores at each time point were lesser than in the lidocaine group, though the differences were statistically significant only for NRS scores 7 days after extraction.

No significant complication or adverse effect was observed in any group.

CONCLUSION

The Inferior alveolar nerve block (IANB) using a lidocaine-ropivacaine mixture can provide prolonged postoperative anaesthesia and pain control with extraction of mandibular third molars.

IMPLICATIONS FOR PRACTICE

The combination of a short onset and a long acting LA can result in longer-term pain control for patients undergoing third molar surgery without sedation.

REFERENCE

1. Hemmi T, Sasahara N, Yusa K, Ishikawa S, Kobayashi T, Iino M. Analgesic effect of a lidocaine-ropivacaine mixture for extraction of impacted mandibular third molars: a randomized controlled trial. Clinical Oral Investigations. 2023 Oct;27(10):5969-75