Influence of local anesthesia on the outcomes of non-surgical periodontal treatment

Shu-Wen Shi¹, Jian Jiao², Li Zhang¹, Rui-Fang Lu¹, Huan-Xin Meng¹, Zhan-Qiang Cao³, Dong Shi¹, Yi Song⁴,⁵

¹Department of Periodontology, Peking University School and Hospital of Stomatology, Beijing 100081, China; ²Department of Periodontology, Peking University Hospital of Stomatology First Clinic Division, Beijing 100034, China; ³Information Center, Peking University School and Hospital of Stomatology, Beijing 100081, China; ⁴Institute of Child and Adolescent Health, School of Public Health, Peking University, Beijing 100191, China; ⁵Department of Clinical Sciences, Social Medicine and Global Health, Lund University, Malmö 20213, Sweden.

Abstract

Background: There is limited evidence of the effects of local anesthesia (LA) on outcomes of non-surgical periodontal treatment (NSPT), in particular among the Chinese. This retrospective cohort study aimed to evaluate the effects of LA on short-term treatment outcomes of NSPT and to determine under what circumstances LA should be prescribed to improve these outcomes.

Methods: Data from periodontal examinations of 3980 patients were used. The data were from 3-month re-evaluation records of an electronic periodontal charting record system in the Department of Periodontology of Peking University School and Hospital of Stomatology from June 2008 to January 2015. Descriptive analyses included changes in probing depth (PD) and the Mazza bleeding index (BI). Two-level (patient and tooth) logistic regression models and three-level (patient, tooth, and site) linear regression models were constructed to analyze the influence of LA on PD for all teeth/sites and teeth/sites with an initial PD ≥ 5 mm. Decreases in PD and BI at sites under LA using the initial PD were also compared.

Results: A significantly higher mean decrease in PD after NSPT was found in the LA group than in the no local anesthesia (NLA) group (0.98 vs. 0.54 mm, t = 24.12, P < 0.001). A significantly higher probability of decreases was found in the LA group in BI (percentages of teeth with BI > 1 and BI > 2) for all teeth (16.7% vs. 13.8%, t = 3.75, P < 0.001; 34.7% vs. 28.1%, t = 6.73, P < 0.001) and PD for teeth with PD ≥ 5 mm (32.3% vs. 17.3%, t = 28.48, P < 0.001). The difference in PD between the LA and NLA groups increased as the initial PD increased. The difference between the two groups was 0.12 to 0.22 mm for sites with a baseline PD < 7 mm; however, it increased to 0.41 to 1.37 mm for sites with a baseline PD ≥ 7 mm.

Conclusions: LA improved the decrease in PD after NSPT. Root debridement at sites with initial PD ≥ 7 mm should be performed under routine LA.

Keywords: Local anesthesia; Periodontitis; Periodontal debridement

Introduction

Periodontal disease, one of the most common and chronic infectious oral diseases in the world, represents a major public health problem.¹ As periodontal disease is a plaque-induced infection,² thorough removal of the biofilm and calculus from contaminated root surfaces by non-surgical periodontal therapy (NSPT) is the basis of treatment.³⁴ An electronic periodontal charting record system (EPCRS) has been used since 2007 to collect and store data in the Department of Periodontology, Peking University School and Hospital of Stomatology (PKUSS). A more favorable response to NSPT was found in patients who received treatment with local anesthesia (LA) than in those who did not.

Pain control is a safe and important measure of successful periodontal therapy, and patients who receive LA feel less discomfort or dental anxiety during NSPT as measured on visual analog scales and questionnaires.⁴⁻¹³ However, there is limited evidence of the effects of LA on treatment outcomes of NSPT, in particular among the Chinese. We hypothesized that LA would affect NSPT outcomes. Initially, deep periodontal pockets benefit more from NSPT.¹⁴ Moreover, higher perceived pain is found in

### Access this article online

Quick Response Code: [QR Code Image]

Website: [www.cmj.org](http://www.cmj.org)

DOI: 10.1097/CM9.0000000000000903

---

Shu-Wen Shi and Jian Jiao were contributed equally to this work.

Correspondence to: Prof. Dong Shi, Department of Periodontology, Peking University School and Hospital of Stomatology, Beijing 100081, China; E-Mail: shidong1979@163.com

Copyright © 2020 The Chinese Medical Association, produced by Wolters Kluwer, Inc. under the CC-BY-NC-ND license. This is an open access article distributed under the terms of the Creative Commons Attribution-Non Commercial-No Derivatives License 4.0 (CCBY-NC-ND), where it is permissible to download and share the work provided it is properly cited. The work cannot be changed in any way or used commercially without permission from the journal.

Chinese Medical Journal 2020;133(16) Received: 30-02-2020 Edited by: Ning-Ning Wang
deep pockets than shallow ones during periodontal probing and NSPT. However, it is still unknown whether the initial probing depth (PD) affects LA and NSPT outcomes.

Therefore, we verified the effects of LA on short-term treatment outcomes of NSPT using common clinical parameters such as changes in PD and the Mazza bleeding index (BI). A secondary objective was to determine the circumstances under which LA should be prescribed to improve treatment outcomes.

**Methods**

**Ethical approval**

This study was a retrospective study, and the data involved were no personal privacy. Only the data used for research purposes, such as the patient’s gender, age, and clinical data, were retained, while other private information, such as the patient’s name and contact information, were deleted. This study has been approved by the Ethics Committee of PKUSS (approval No. PKUSSIRB-201310066) before the study started, and there was no need to submit the patients’ informed consent forms.

**Patient selection and data extraction**

Individuals were selected from among all patients who received NSPT and full-mouth periodontal charting at both initial and re-evaluation visits to the Department of Periodontology, PKUSS, from June 2008 to January 2015. The inclusion criteria were being 18 to 80 years old and having an available re-evaluation record within 3 months of active periodontal therapy. The exclusion criteria were systemic disease (eg, acquired immunodeficiency syndrome, diabetes mellitus, nephrosis, hepatopathy, hypertension, neutropenia), pregnancy, periodontal surgery within the past 6 months, or systemic administration of antibiotics within 6 months.

The power value of this retrospective cohort study calculated by the simulation method of statistical efficiency was over 0.99, so test efficiency was good. The patient selection and screening process is shown in Figure 1.

Data for the included patients were extracted from the EPCRS database at the PKUSS Information Center.

The following parameters were extracted: baseline age, sex, LA used during NSPT, periodontal diagnosis (stage and grade of periodontitis) according to the classification proposed at the International Workshop for the Classification of Periodontal Diseases and Conditions in 2017, smoking status (non-smoker vs. smoker), tooth type (non-molar vs. molar), BI score (0–5; the higher BI between the buccal and lingual surfaces of each tooth was recorded as the BI of the tooth), initial PD, and decrease in PD at six sites.

Tooth- and site-level data from the third molars and teeth lost during NSPT were excluded.

**Periodontal examinations and treatments**

Periodontal examinations and treatments were performed by qualified clinical periodontists who had been systemically trained and calibrated in a pre-clinical program. Full-mouth periodontal examinations were performed at the initial visit. Oral hygiene instructions were given, and scaling and root planing (SRP) were performed with piezoelectric and hand instruments with or without lidocaine or articaine. A re-evaluation was performed 1 to 2 months after NSPT.

![Figure 1: Flow chart for patient selection and screening of Chinese with periodontitis in the Department of Periodontology, Peking University School and Hospital of Stomatology (PKUSS) from June 2018 to January 2015.](image)
Statistical analyses

The data were analyzed with SPSS version 20 (IBM, Armonk, NY, USA). At the patient level, we used Chi-square tests to compare age, sex, and smoking status between patients who received LA and those who did not (no local anesthesia [NLA]). Means and standard deviations (SDs) for baseline PD, PD after treatment, and the decrease in PD were determined. Differences in initial decreases in PD after NSPT were compared between the two groups with Student’s t test. Means and SDs for the decreases in PD at the sites were computed. We compared differences in these decreases between the two groups during NSPT using Student’s t test. We used two-way analyses of variance to test the effects of LA using Student’s t test.

To evaluate the effects of LA on the decrease in PD after NSPT, we ran three-level (patient, tooth, and site) linear regression models with seven variables (use of LA, baseline age, sex, smoking status [patient level], BI and tooth type [tooth level], and baseline PD [site level]) for all sites and for sites with PD ≥ 5 mm. Similarly, we ran two-level (patient, tooth) logistic regression models with the same seven variables for all teeth and for teeth with PD ≥ 5 mm to evaluate the effects of LA on the change in BI after NSPT. Significance was tested by Chi-square analyses. P < 0.05 was considered significant.

Results

According to the inclusion and exclusion criteria, 3980 patients were included in the present study. The baseline characteristics of the participants grouped by whether local anesthesia was used (LA) or not (NLA) are presented in Table 1. More than 53% of the patients received NSPT under LA. The distributions of smoking status, stage, and grade of periodontitis in the two groups were significant. There were more smokers in the LA group than in the NLA group. Changes in clinical parameters were more dramatic in the LA group than in the NLA group. The mean decrease in PD after NSPT was significantly higher in the LA group than the NLA group (0.98 vs. 0.54 mm, t = 24.12, P < 0.001). A higher mean decrease in the percentage of sites with PD ≥ 5 mm ([PD ≥ 5mm]%) after treatment was found in the LA group (32.3% vs. 17.3%, t = 28.48, P < 0.001). After we stratified the data by age, sex, and smoking status, we found that the LA group tended to benefit more from NSPT. However, the baseline PD and PD ≥ 5 mm (%) of the two groups differed significantly.

Significantly higher mean decreases in the percentages of teeth with BI > 1 and BI > 2 after treatment were observed in the LA group than the NLA group (16.7% vs. 13.8%, t = 3.75, P < 0.001; 34.7% vs. 28.1%, t = 6.73, P < 0.001). After stratifying the data as before, we found that the LA group tended to benefit more from NSPT. A higher mean decrease in percentage of teeth with BI > 1 was observed in the LA group for patients 40 to 60 years but not for patients 18 to 40 or >60 years. A higher mean decrease in percentage of teeth with BI > 2 was observed in the LA group for patients <60 years but not for patients >60 years. However, the baseline percentages of teeth with BI > 1 and BI > 2 values differed significantly between the two groups.

Given the limited ability of descriptive analyses to compare data with mismatched baseline values, we used multilevel analyses to evaluate the effects of LA on NSPT outcomes. The real effects of LA on changes in periodontal parameters were analyzed after the effects of age, sex, smoking status, tooth type, baseline BI, and baseline PD were adjusted. A total of 9565 teeth and 597,390 sites were included in the multilevel analyses. The three-level linear regression models showed a significantly higher decrease in PD in the LA group for all teeth and for teeth with PD ≥ 5 mm [Figure 2A].

Data from all sites were analyzed to evaluate whether baseline PD influenced the effects of LA on NSPT outcomes. The results showed significantly greater

| Variable          | NLA (n = 1849) | LA (n = 2131) | χ²      | P      |
|-------------------|---------------|--------------|---------|--------|
| Gender            |               |              | 0.88    | 0.183  |
| Male              | 1014 (54.8)   | 1137 (53.4)  |         |        |
| Female            | 835 (45.2)    | 994 (46.6)   |         |        |
| Smoking status    |               |              | 9.71    | <0.001 |
| Non-smoker        | 1566 (84.7)   | 1725 (81.0)  |         |        |
| Smoker            | 283 (15.3)    | 406 (19.1)   |         |        |
| Stage             |               |              | 148.98  | <0.001 |
| I                 | 5 (0.3)       | 0 (0)        |         |        |
| II                | 117 (6.3)     | 48 (2.3)     |         |        |
| III               | 877 (47.4)    | 720 (33.8)   |         |        |
| IV                | 850 (46.0)    | 1363 (64.0)  |         |        |
| Grade             |               |              | 25.99   | <0.001 |
| B                 | 558 (30.2)    | 491 (23.0)   |         |        |
| C                 | 1291 (69.8)   | 1640 (77.0)  |         |        |
| Total             | 1849 (46.5)   | 2131 (53.5)  | NA      | NA     |

NLA: No local anesthesia; LA: Local anesthesia; NA: Not available.
decreases in PD at the LA sites after the data were stratified by baseline PD. The differences between the LA and the NLA groups for sites with various initial PD values are presented in Figure 2A. The difference increased as the initial PD increased. The difference between the two groups was 0.12 to 0.22 mm for sites with a baseline PD < 7 mm; however, it increased to 0.41 to 1.37 mm for sites with a baseline PD ≥ 7 mm [Figure 3A].
The results of the present study show that LA improved NSPT outcomes (reduced PD and BI) at the patient level. However, the results should be interpreted with caution owing to the uneven distribution of age, sex, and smoking status in the sample and the mismatch between baseline PD and BI. Multivariate analyses were used to adjust for other factors that affect NSPT. The multilevel analyses confirmed the benefit of LA for treatment outcomes after NSPT when other factors that might have affected NSPT outcomes were adjusted. A previous study demonstrated that more than 60% of patients might suffer from some degree of pain during periodontal scaling. Perceived pain can hinder the use of ultrasonic or hand instruments in the bottoms of periodontal pockets where dental plaque and calculus collects. Several studies have compared the effects of different pain control regimens during NSPT on treatment outcomes. However, data on whether LA affects NSPT outcomes are still limited. The results of this study demonstrate that LA improves treatment outcomes.

PD and BI are indices of periodontal inflammation. Improving PD and BI depends on removing initiating factors (ie, dental plaque); local stimulating factors, such as calculus and pigments; and systemic promoting factors, such as systemic diseases and hormones. LA effectively eliminates or reduces the pain of patients, which reduces anxiety during treatment and improves cooperation with doctors. Better cooperation is also conducive to a more thorough debridement of the deeper periodontal pockets, the root bifurcated area, and other areas that are difficult to operate on without LA. In addition, epinephrine (bluish blue) is added to local anesthetics used for oral treatment to increase their effects and duration. Epinephrine also has hemostatic effects in local anesthetics, which can help periodontists obtain a better operative field of vision.

The use of LA during mechanical SRP is considered routine in clinical practice and scientific research, as SRP is uncomfortable for most patients. However, some patients choose to undergo procedures without LA because of a fear of injections or an aversion to post-operative numbness. In a survey of students and staff at the University of Washington, more than 25% of adults expressed at least one clinically significant fear of injections. In a multicenter study that evaluated patients’ experiences with probing and NSPT, 33% of primary patients and 64% of recalled patients said that they would rather endure mild to moderate pain during treatment than receive an injection of a local anesthetic. In addition, cross-cultural differences may also affect attitudes toward LA. In a study performed in the United States to explore perceptions of pain from tooth drilling among individuals of different ethnicities, 90% of Chinese patients did not use anesthetic for treatment, which was much higher than Scandinavians (54%) and Anglo-Americans (7%). In the present study, more than 46% of patients underwent NSPT without LA. The relatively low rate of LA may be associated with an increased tolerance for pain in the Chinese population or a fear of needles. The additional expense of LA may be
an another reason why some patients refuse it. A misconception among some Chinese villagers is that LA is harmful to the central nervous system or memory, and this could lead to a lower use of LA during NSPT.

A secondary objective of this study was to identify the circumstances under which LA should be recommended for NSPT. The results of the present study demonstrate that the difference between the LA and NLA sites increased with an increase in baseline PD. An investigation of 638 patients undergoing periodontal maintenance demonstrated that increasing pocket depths accompanied higher perceived pain.9,10 There could be several explanations for this observation. First, a larger area of the inflammatory pocket epithelium with erosion and ulcers in deeper periodontal pockets may be more likely to be irritated by instruments. Second, deeper pockets with more severe inflammation may be less resistant to mechanical forces.17–20 When subgingival debridement is performed in deeper pockets, instruments may extend to a more interior part of the junctional epithelium, and the patient may suffer more pain. Third, deeper pockets may have more exposed dentin, and the patient may be more likely to suffer from dentin hypersensitivity during debridement.

The results of the present study also demonstrated that deep pockets benefited more from LA. Thus, the recommendation is that LA be used in patients with generalized deep periodontal pockets to achieve comfortable and successful NSPT. When the initial PD < 7 mm, the benefit from LA on the NSPT outcomes was relatively small, despite being statistically significant. However, the difference between the LA and NLA groups was almost 0.5 mm when the initial PD reached 7 mm, which suggests that LA can affect NSPT outcomes for patients with deeper periodontal pockets and that LA should be routinely applied.

LA for NSPT is most commonly administered by injection. However, some patients may be reluctant to receive an injection of LA out of fear of the injection and/or postoperative numbness. In one study, more than one-fourth of patients surveyed expressed anxiety about injections, including pain and fear of bodily injury from the injection.21,22 Moreover, 46% of patients who received primary NSPT expressed discomfort with post-treatment numbness due to the LA. Fortunately, some topical anesthetic agents are ideal alternatives to injections for patients who are anxious about injections or bothered by post-injection numbness. The effectiveness and efficacy of topical or intra-pocket anesthesia have been demonstrated in studies.4,6-8,10,12,32,33 In addition, a study that compared treatment outcomes after NSPT using a LA gel or injected LA found competitive outcomes for the two treatment modalities and the same beneficial results for PD and clinical attachment gain.35

Several potential limitations of the present study should be acknowledged. Heterogeneity in demographic characteristics and baseline PD between patients who did and did not receive LA may have distorted the results. Therefore, multilevel analyses were performed to adjust for potential confounding factors. The data in the present study showed that LA benefited NSPT outcomes. Furthermore, the large sample size and the number of factors considered may bolster the findings. In addition, selection bias and information bias are issues because of the retrospective nature of the study. Studies with more evidence, such as randomized controlled clinical trials, are needed to validate the findings. Finally, a reduction in PD, the major concern of the present study, is not the only measure of NSPT outcomes. The effects of LA on attachment loss, postoperative dentin hypersensitivity, and treatment time should be tested in future studies.

Funding
This study was supported by grants from the Peking University School and Hospital of Stomatology (PKUSS20180205 & PKUSS20130201).

Conflicts of interest
None.

References
1. Petersen PE, Ogawa H. The global burden of periodontal disease: towards integration with chronic disease prevention and control. Periodontol 2000;2012;2000:15–39. doi: 10.1111/j.1600-0757.2011.00425.x.
2. Tatakis DN, Kumar PS. Etiology and pathogenesis of periodontal diseases. Dent Clin North Am 2005;49:491–516. doi: 10.1016/j.dcen.2005.03.001.
3. Drisko CL. Periodontal debridement: still the treatment of choice. J Evid Based Dent Pract 2014;14 (Suppl):33–4.1.e1. doi: 10.1016/j.jebdp.2014.02.007.
4. Derman SH, Lowden CE, Kaus P, Noack MJ. Pocket-depths-related effectiveness of an intrapocket anaesthesia gel in periodontal maintenance patients. Int J Dent Hyg 2014;12:141–144. doi: 10.1111/idh.12036.
5. Derman SH, Lowden CE, Hellmich M, Noack MJ. Influence of intra-pocket anaesthesia gel on treatment outcome in periodontal patients: a randomized controlled trial. J Clin Periodontol 2014;41:481–488. doi: 10.1111/jcpe.12239.
6. Stoelenberg JL, Osborn JR, Carlson LJ, Hodges JS, Michalowicz BS. A preliminary study of intrapocket topical versus injected anaesthetic for scaling and root planing. J Clin Periodontol 2007;34:892–896. doi: 10.1111/j.1600-051X.2007.01128.x.
7. Magnusson I, Geurs NC, Harris PA, Hefti AF, Mariotti AJ, Mauriello SM, et al. Intrapocket anesthesia for scaling and root planing in pain-sensitive patients. J Periodontol 2003;74:597–602. doi: 10.1902/jop.2003.74.5.597.
8. Donaldson DJ, Gelkey SC, Landry RG, Matthews DC, Sandhu HS. A placebo-controlled multi-centred evaluation of an anaesthetic gel (Oraqua) for periodontal therapy. J Clin Periodontol 2003;30:171–175. doi: 10.1034/j.1600-051X.2003.00017.x.
9. Canakci V, Orbak R, Tezel A, Canakci CF. Clinical response to experimental forces and non-surgical therapy of teeth with various alveolar bone loss. Dent Traumatol 2002;18:267–274. doi: 10.1034/j.1600-9657.2002.00105.x.
10. Friskopp J, Nilsson M, Isacsson G. The anesthetic onset and duration of a new lidocaine/prilocaine gel intra-pocket anaesthetic (Oraqua) for periodontal scaling/root planing. J Clin Periodontol 2001;28:453–458. doi: 10.1034/j.1600-051X.2001.028000453.x.
11. Wambier LM, de Geus JL, Chibinski AC, Wambier DS, Rego RO, Loguercio AD, et al. Intra-pocket anaesthesia and pain during probing, scaling and root planing: a systematic review and meta-analysis. J Clin Periodontol 2016;43:754–766. doi: 10.1111/jcpe.12565.
12. Jeffcoat MK, Geurs NC, Magnusson I, MacNeill SR, Mickels N, Roberts F, et al. Intrapocket anesthesia for scaling and root planing: results of a double-blind multicenter trial using lidocaine prilocaine dental gel. J Periodontol 2001;72:895–900. doi: 10.1902/jop.2001.72.7.895.
13. Leung WK, Duan YR, Dong XX, Yeung KW, Zhou SY, Corbet EF, et al. Perception of non-surgical periodontal treatment in individuals receiving or not receiving local anaesthesia. Oral Health Prev Dent 2016;14:165–175. doi: 10.3290/j.ohpd.a35001.

14. Tomasi C, Leyland AH, Wennstrom JL. Factors influencing the outcome of non-surgical periodontal treatment: a multilevel approach. J Clin Periodontol 2007;34:682–690. doi: 10.1111/j.1600-051x.2007.01111.x.

15. Armitage GC. Development of a classification system for periodontal diseases and conditions. Ann Periodontol 1999;4:1–6. doi: 10.1902/annals.1999.4.1.1.

16. Mazza JE, Newman MG, Sims TN. Clinical and antimicrobial effect of stannous fluoride on periodontitis. J Clin Periodontol 1981;8:203–212. doi: 10.1111/j.1600-051x.1981.tb02031.x.

17. Svensson P, Arendt-Nielsen L, Bjerring P, Kaaber S. Oral mucosal analgesia quantitatively assessed by argon laser-induced thresholds and single-evoked vertex potentials. Anesth Pain Control Dent 1993;2:134–161. doi: 10.1117/12.725950.

18. Cosgarea R, Juncar R, Heumann C, Tristiu R, Lascu L, Arweiler N, et al. Non-surgical periodontal treatment in conjunction with 3 or 7 days systemic administration of amoxicillin and metronidazole in severe chronic periodontitis patients. A placebo-controlled randomized clinical study. J Clin Periodontol 2016;43:767–777. doi: 10.1111/jcpe.12559.

19. Deas DE, Moritz AJ, Sagun RS Jr, Gruwell SF, Powell CA. Scaling and root planing vs. conservative surgery in the treatment of chronic periodontitis. Periodontol 2000 2000;2000:128–139. doi: 10.1111/prd.12114.

20. Kocak E, Saglam M, Kayis SA, Dundar N, Kebapcilar L, Loos BG, et al. Nonsurgical periodontal therapy with/without diode laser modulates metabolic control of type 2 diabetics with periodontitis: a randomized clinical trial. Lasers Med Sci 2016;31:343–353. doi: 10.1007/s10103-016-1868-0.

21. Loos B, Claffey N, Cregger M. Effects of oral hygiene measures on clinical and microbiological parameters of periodontal disease. J Clin Periodontol 1988;15:211–216. doi: 10.1111/j.1600-051x.1988.tb01742.x.

22. Loos BG, Louwerse PH, Van Winkelhoff AJ, Burger W, Giljarmse M, Hart AA, et al. Use of barrier membranes and systemic antibiotics in the treatment of intrasosseous defects. J Clin Periodontol 2002;29:910–921. doi: 10.1034/j.1600-051x.2002.291006.x.

23. Mdala I, Haffajee AD, Socransky SS, de Blasio BF, Thoresen M, Olsen I, et al. Multilevel analysis of clinical parameters in chronic periodontitis after root planing/scaling, surgery, and systemic and local antibiotics: 2-year results. J Oral Microbiol 2012;4:1753. doi: 10.3402/jom.v4i0.17535.

24. Karadottir H, Leinor L, Barbierato B, Bogle M, Riggs M, Sigurdsson T, et al. Pain experienced by patients during periodontal maintenance treatment. J Periodentol 2002;73:536–542. doi: 10.1902/jop.2002.73.3.536.

25. Moore E, Brodsgaard I, Mao TK, Miller ML, Dworkin SF. Perceived need for local anesthesia in tooth drilling among Anglo-Americans, Chinese, and Scandinavians. Anesth Prog 1999;4:22–28.

26. Page RC, Kornman KS. The pathogenesis of human periodontitis: an introduction. Periodontol 1997;2000:149–211. doi: 10.1111/j.1600-0757.1997.tb00189.x.

27. Sagie R, Johansen JR, Flotra L. The zone of completely and partially destructed periodontal fibres in pathological pockets. J Clin Periodontol 1975;2:198–202. doi: 10.1111/j.1600-051x.1975.tb01742.x.

28. Listgarten MA, Mao R, Robinson PJ. Periodontal probing and the relationship of the probe tip to periodontal tissues. J Periodontol 1976;47:511–513. doi: 10.1902/jop.1976.47.9.511.

29. Armitage GC, Svanberg GK, Loe H. Microscopic evaluation of clinical measurements of connective tissue attachment levels. J Clin Periodontol 1977;4:173–190. doi: 10.1111/j.1600-051x.1977.tb02271.x.

30. Spray JR, Garnick JJ, Doles LR, Klawitter JJ. Microscopic demonstration of the position of periodontal probes. J Periodontol 1978;49:148–152. doi: 10.1902/jop.1978.49.3.148.

31. Milgrom P, Coldwell SE, Getz T, Weinstein P, Ramsay DS. Four dimensions of fear of dental injections. J Am Dent Assoc 1997;128:756–766. doi: 10.14219/jada.archive.1997.0301.

32. DiMatteo A. Efficacy of an intrapocket anesthetic for scaling and root planing procedures: a review of three multiscenter studies. Compend Contin Educ Dent 2005;26 (2 Suppl 1):6–10.

33. Kasaj A, Heib A, Willershhausen B. Effectiveness of a topical salve (Dynexan) on pain sensitivity and early wound healing following nonsurgical periodontal therapy. Eur J Med Res 2007;12:196–199.

How to cite this article: Shi SW, Jiao J, Zhang L, Lu RF, Meng HX, Cao ZQ, Shi D, Song Y. Influence of local anaesthesia on the outcomes of non-surgical periodontal treatment. Chin Med J 2020;133:1908–1914. doi: 10.1097/CM9.0000000000009093