

# Oral health knowledge and practice among orthodontic clients in China and New Zealand

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## ABSTRACT

**Background:** The oral hygiene habits of clients wearing fixed orthodontic appliances is poorly understood. Assessment of oral hygiene behavioural patterns is essential for understanding clients' oral health care needs. The aim of this study was to investigate orthodontic clients' oral hygiene behaviours, brushing techniques, and oral hygiene awareness. **Methods:** A total of 200 orthodontic clients wearing fixed orthodontic appliances were consecutively recruited from the Sichuan Provincial Hospital, Chengdu, China, and the Faculty of Dentistry, University of Otago, Dunedin, New Zealand. A 47-item questionnaire was used to survey study participants. **Results:** The survey had a 92% response rate, with 67.5% of respondents being female and 32.5% male. Most were non-smokers (94.2%) and the majority (80.0%) brushed their teeth twice daily. Most (80.4%) brushed their teeth for 1 to 2 minutes, and 68.7% positioned their toothbrush both horizontally and vertically, with horizontal being the preferred direction of motion. One-third (33.5%) did not use any auxiliary oral hygiene aids; most snacked between meals; only 31.4% received professional tooth cleaning during orthodontic treatment; and 56.8% experienced an increased level of halitosis after appliance placement. Most respondents (79.4%) thought their oral hygiene was good, but 51.0% reported bleeding gums during tooth brushing, 31.4% found they rarely bled, and only 17.6% reported no bleeding. Most respondents agreed that good oral health was very important for orthodontic treatment and that their own efforts were the most important factors. **Conclusions:** Client awareness of the importance of oral hygiene during orthodontic treatment requires improvement. Clinician reinforcement of oral hygiene should become a priority for orthodontic clients.

## RÉSUMÉ

**Contexte :** Les habitudes d'hygiène buccodentaire des clients qui portent des appareils orthodontiques fixes sont mal comprises. L'évaluation des modèles de comportement en matière d'hygiène dentaire est essentielle pour comprendre les besoins en soins de santé buccodentaire des clients. L'objectif de cette étude était d'étudier les comportements d'hygiène buccodentaire des clients orthodontiques, leurs techniques de brossage, et leurs connaissances en matière d'hygiène buccodentaire. **Méthodologie :** Un total de 200 clients orthodontiques portant des appareils orthodontiques fixes ont été recrutés consécutivement à l'Hôpital Sichuan Provincial, à Chengdu en Chine et à la Faculté de dentisterie de l'Université d'Otago, à Dunedin en Nouvelle-Zélande. Un questionnaire de 47 éléments a été utilisé pour sonder les participants à l'étude. **Résultats :** Le sondage avait un taux de réponse de 92 %; 67,5 % des répondants étaient des femmes et 32,5 % étaient des hommes. La plupart parmi eux étaient des non-fumeurs (94,2 %) et la majorité (80,0 %) se brossait les dents 2 fois par jour. Pour la plupart (80,4 %), le brossage durait entre 1 et 2 minutes, et 68,7 % plaçaient leur brosse à dents horizontalement et verticalement; la position horizontale étant la direction de mouvement préférée. Un tiers (33,5 %) des répondants n'utilisaient pas d'aides-auxiliaires d'hygiène buccodentaire, la plupart mangeaient une collation entre les repas, seulement 31,4 % ont obtenu un nettoyage dentaire professionnel au cours de leur traitement orthodontique, et 56,8 % ont connu une augmentation du niveau d'halitose après la pose d'un appareil. La plupart des répondants (79,4 %) pensaient avoir une bonne hygiène buccodentaire, mais 51,0 % parmi eux ont déclaré avoir des saignements de gencives pendant le brossage des dents, 31,4 % ont trouvé qu'ils saignaient rarement, et seulement 17,6 % ont déclaré ne pas saigner. La plupart des répondants ont convenu qu'une bonne santé buccodentaire était très importante pour le traitement orthodontique et que leurs propres efforts étaient les facteurs les plus importants. **Conclusions :** La sensibilisation des clients à l'importance de l'hygiène buccodentaire pendant le traitement orthodontique exige une amélioration. Le renforcement de l'hygiène buccodentaire par les cliniciens devrait devenir une priorité pour les clients orthodontiques.

**Keywords:** braces; fixed appliances; oral hygiene; orthodontics

**CDHA Research Agenda category:** risk assessment and management

## PRACTICAL IMPLICATIONS OF THIS RESEARCH

- Oral hygiene is important for dental health during orthodontic treatment.
- Orthodontic clients in this study brushed their teeth twice daily but were not fully aware of their oral hygiene status.
- Clinicians should improve their clients' awareness of their oral hygiene and offer oral hygiene instruction during orthodontic treatment.

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## INTRODUCTION

It is important for clients to maintain good oral hygiene during orthodontic treatment because poor oral hygiene can cause side effects, such as enamel demineralization, gingival inflammation, and halitosis, negatively affecting their quality of life.<sup>1</sup> The placement of orthodontic appliances not only promotes biofilm accumulation but also increases the level of cariogenic bacteria within the dental biofilm, resulting in an increased risk of biofilm-related side effects (e.g., enamel demineralization).<sup>2</sup> Even though the majority of clients report daily oral hygiene, the prevalence of biofilm-related oral diseases still remains high among orthodontic clients.<sup>1,3</sup>

It has been shown that oral hygiene behaviour and compliance play an important role in the prevention of biofilm formation.<sup>4,5</sup> For example, the modified Bass technique is often recommended by oral health professionals and in numerous textbooks. However, there is wide variation in the toothbrushing techniques used by the population, with most people brushing their teeth using simple horizontal and circular strokes.<sup>6-10</sup> In a video observation study of toothbrushing and flossing behaviour in young adults, a significant neglect of brushing oral surfaces and insufficient use of floss was reported.<sup>6</sup> A Swedish study demonstrated that clients' attitudes towards and behaviours relating to fluoride toothpaste use and toothbrushing habits were significantly inadequate even after 2 years of toothpaste intervention. The majority of study subjects indicated "fresh breath" as their prime motivation for performing oral hygiene. Dental professionals could perhaps appeal to this motivating factor during health promotion efforts.<sup>11</sup> However, these studies were performed on subjects without orthodontic appliances. To date, no specific information could be found for orthodontic clients.

The oral hygiene behaviour of clients wearing fixed orthodontic appliances is not well documented and thus poorly understood. An assessment of behavioural patterns in oral hygiene practices among orthodontic clients is essential for understanding their oral health care needs.<sup>12</sup> Therefore, the aim of this study was to investigate the oral hygiene behaviours, brushing techniques, and oral hygiene awareness of clients wearing fixed orthodontic appliances.

## MATERIALS AND METHODS

This study was designed as a 2-centre cross-sectional survey and approved by the Sichuan Provincial People's Hospital Ethics Committee and the University of Otago Human Ethics Committee (17/101). Verbal consent was obtained from each study participant over 16 years of age or their parent for those under 16 years. A total of 200 orthodontic clients were consecutively recruited from the Sichuan Provincial People's Hospital ( $n = 120$ ) and University of Otago ( $n = 80$ ). The determination of sample size was based on previous cross-sectional studies<sup>13,14</sup> by

setting type I error at 0.05 and type II error at 0.20 (80% power). To account for possible dropouts during the study, we aimed to recruit 200 participants. The inclusion criteria were clients wearing full, fixed orthodontic appliances for at least 1 month in upper and lower dental arches, and willingness to participate in the study. The exclusion criteria were individuals wearing lingual fixed appliances, those with extensive dental restorations, active periodontal disease, craniofacial syndromes, hypodontia, oligodontia or cleft lip/palate syndromes.

A hard copy of a 47-item questionnaire was distributed in person to each client or parent to survey the client's oral hygiene behaviours, brushing techniques, and oral hygiene awareness (i.e., the client's attitude towards and knowledge of oral hygiene). The initial version of this questionnaire was designed in consultation with senior orthodontic and public health academics and researchers at the Faculty of Dentistry, University of Otago.<sup>15,16</sup> After an initial pilot interview, the data were analysed and necessary modifications were made to generate the final version of survey questions (Appendix).

## Statistical analysis

Descriptive statistics were analysed using the Statistical Package for the Social Sciences (version 23.0; SPSS Inc, Chicago IL). Continuous variables were expressed as the mean  $\pm$  standard deviation (SD) if normally distributed, or as the median and quartiles if they had a skewed distribution. Categorical variables were described as counts and percentages and compared using the Chi-square test.

## RESULTS

A total of 184 participants completed the questionnaire, yielding a response rate of 92%. The mean age of clients included in the study was  $16.2 \pm 4.3$  years (67.5% female and 32.5% male). Most participants were studying in secondary schools (63.5%) and were non-smokers (94.2%).

## Oral hygiene behaviour

The majority of study participants (85.1%) used a manual toothbrush; 14.9% used an electric toothbrush ( $p = 0.016$ ) (Figure 1). More than half of the participants (60.2%) preferred a toothbrush with soft bristles, 21.0% preferred a toothbrush with hard bristles, and 18.8% preferred a toothbrush with medium bristles ( $p = 0.023$ ). About half of the participants (49.7%) changed their toothbrushes every 3 months, 21.2% changed their toothbrushes monthly, and 29.1% changed their toothbrushes every 6 months. Most participants (88.6%) used fluoridated toothpaste, 2.8% used non-fluoridated toothpaste, and the rest of the participants (8.6%) were not sure ( $p = 0.011$ ). The majority of the participants (80.0%) brushed their teeth twice daily, while 9.0% brushed more than twice daily ( $p = 0.037$ ). Most of the participants (80.4%) brushed their teeth for 1 to 2 minutes. Only 19.2% of the participants performed tongue cleaning while brushing their teeth.

Only a small number of study participants used interdental brushes (15.3%), dental floss (10.2%), and mouth rinse (35.0%) during their daily oral hygiene ( $p = 0.016$ ). About one-third of participants (33.5%) did not use any auxiliary cleaning tool (i.e., interdental brush or floss) apart from a toothbrush. Less than one-third of participants (31.4%) received professional tooth cleaning during their orthodontic treatment. A majority of participants snacked between meals, with 31.5% snacking more than twice daily, 40.2% twice daily, and 28.3% once daily ( $p = 0.045$ ) (Figure 1).

### Brushing techniques

Insofar as brushing techniques were concerned, 33.3% of the participants chose a random area to start toothbrushing, 68.7% positioned their toothbrush both horizontally and vertically, 29.3% and 2.0% used them horizontally or vertically, respectively ( $p = 0.029$ ) (Figure 2). Most participants (60.8%) brushed their teeth with a combination of repetitive small and large strokes, 27.5% and 11.7% used only small repetitive strokes or large strokes, respectively ( $p = 0.043$ ). Horizontal motion was the most preferred movement ( $p = 0.002$ ) on all teeth surfaces except for the inner surface of the front teeth, where 16.8% preferred a vertical motion and 12.6% preferred a circling motion (Figure 2). More than half (54.9%) of the study participants preferred to rinse and spit after toothbrushing, while the rest (45.1%) preferred to spit only ( $p = 0.252$ ). Lower posterior teeth were considered the most difficult to clean (58.9%), followed by upper posterior teeth (37.3%) ( $p = 0.041$ ).

### Oral hygiene awareness

Most of the participants (79.4%) described their oral hygiene as good; only 2.0% described their oral hygiene as poor ( $p = 0.024$ ) (Figure 3). Fifty-six percent (56.0%) of participants considered their knowledge of oral health to be fair; only 19.7% reported that their knowledge of

oral health was quite poor. Close to three-quarters (72.5%) of the participants agreed that good oral health was very important for orthodontic treatment. About half (51.0%) of the participants reported their gum sometimes bled during toothbrushing, 31.4% found they rarely bled, and only 17.6% reported never bleeding. A majority of participants (84.3%) believed the most important factor for their oral health was their own efforts, and 11.8% considered both their own efforts and professional dental services to be important ( $p = 0.011$ ).

About half of the participants (51.2%) claimed that their oral hygiene improved after orthodontic treatment, while 31.4% reported that their oral hygiene was the same, and 17.4% reported that their oral hygiene was worse after orthodontic treatment ( $p = 0.043$ ). About half of the participants (56.8%) reported an increased level of halitosis after the placement of orthodontic appliances ( $p = 0.033$ ) (Figure 3).

### DISCUSSION

Some studies have reported that the placement of fixed appliances impedes toothbrushing and promotes biofilm formation in orthodontic clients.<sup>2,3</sup> Baseline information of clients' oral hygiene behaviours is useful for the oral hygiene management and prevention of caries during orthodontic treatment. This study found that most participants used manual toothbrushes and brushed their teeth at least twice daily with fluoridated toothpastes. The majority of participants did not use auxiliary cleaning tools (i.e., interdental toothbrushes and floss) during orthodontic treatment although these auxiliary tools were provided to clients for free at their first orthodontic bonding appointment. Preferred brushing techniques included horizontal and vertical motions; a horizontal motion; and a combination of small and large strokes. Most participants reported their oral hygiene as good with a fair amount oral health knowledge. The most important factor that affected

Figure 1. Oral hygiene behaviours

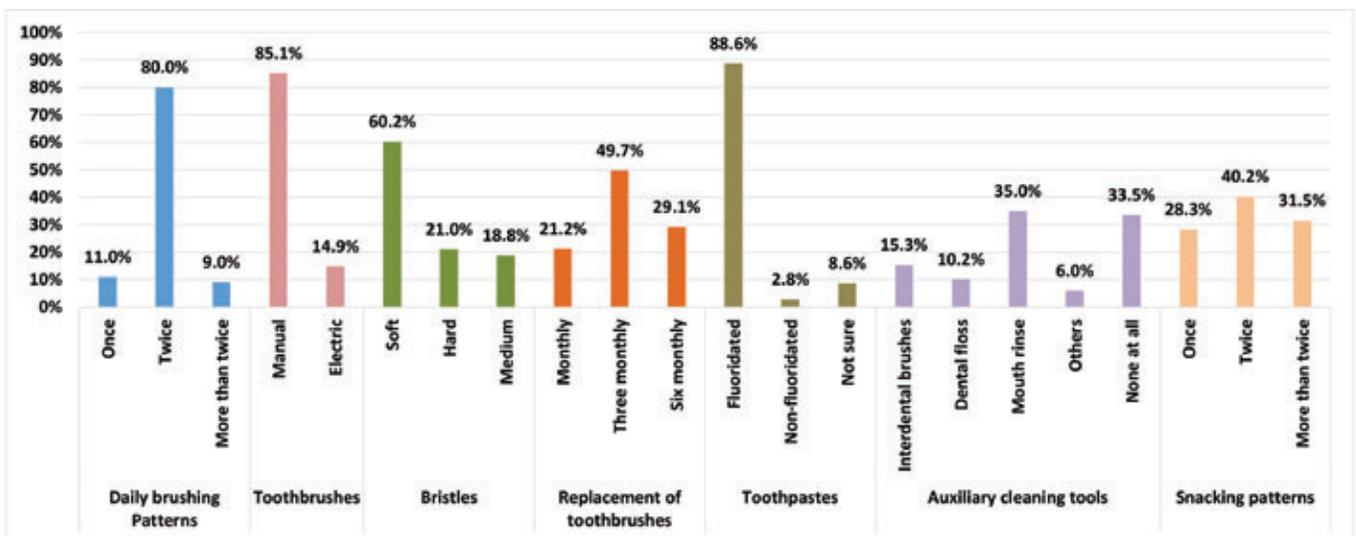
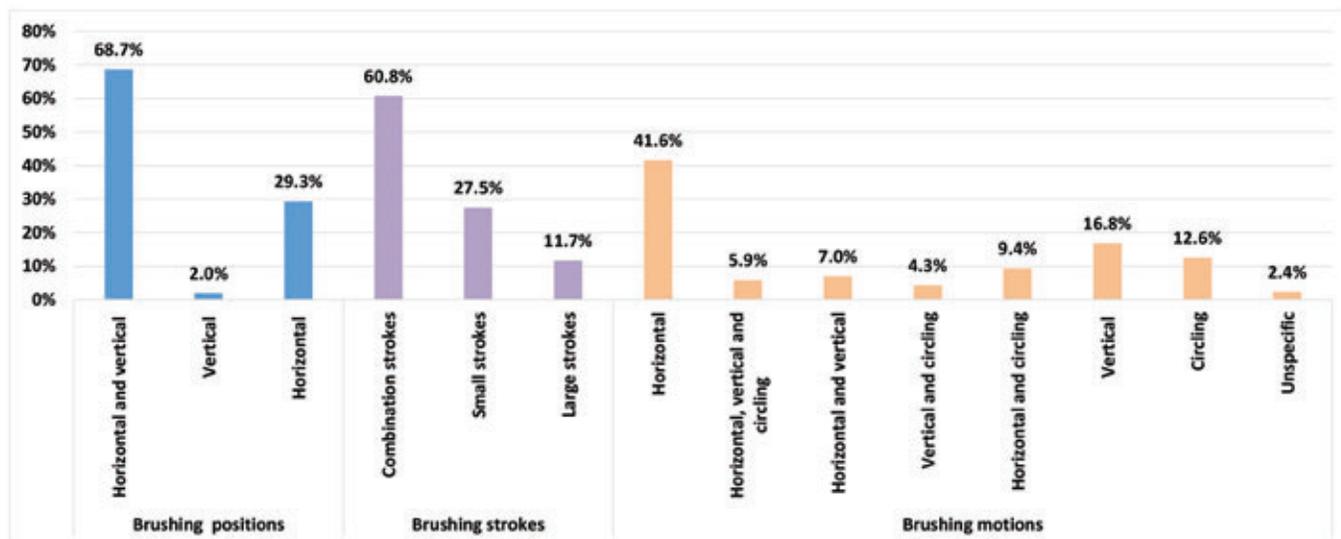


Figure 2. Toothbrushing techniques



their oral health might be their own efforts. Although half of the study participants noticed an improvement in their oral health after orthodontic treatment, no improvement in their halitosis was reported.

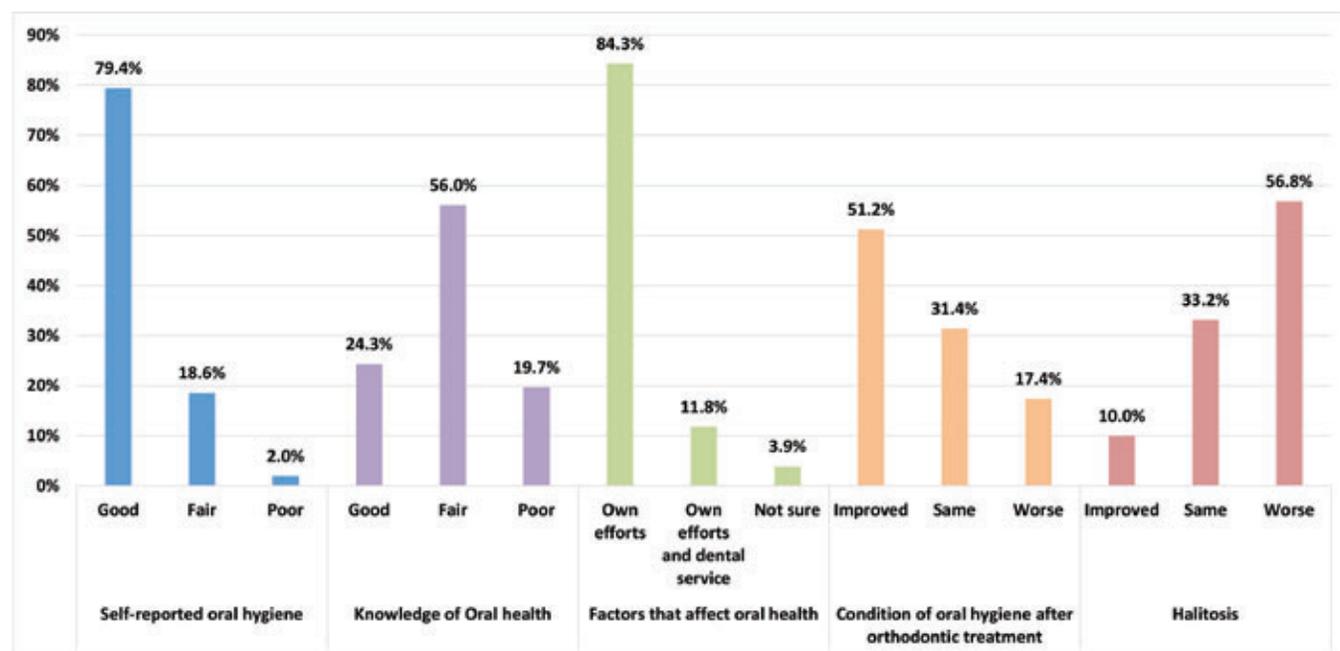
Interestingly, while only 2.0% of the study participants thought their oral hygiene was poor, the majority reported gingival bleeding during tooth brushing. This finding confirms a lack of awareness of their oral hygiene status, which was in fact poor, based on their reported bleeding of their gums.

Most of the participants in the study reported using soft-bristled manual toothbrushes with fluoridated toothpaste. Although hard-bristled toothbrushes have been

shown to remove more dental plaque, they have also been reported to cause more gingival abrasion than soft-bristled toothbrushes.<sup>17,18</sup> The amount of plaque removal, however, is mainly dependent on the toothbrushing technique and time spent on brushing rather than bristle hardness. Most participants brushed twice daily, with a self-reported duration between 60 and 180 seconds, which is similar to findings from other studies.<sup>8,19-21</sup>

Although the use of auxiliary aids such as floss and interdental brushes were reported by only 25% of participants, it was interesting to note that a higher percentage reported using interdental brushes (15.3%) than floss (10.2%). This finding is congruent with results

Figure 3. Oral hygiene awareness



obtained by Da'Ameh et al.<sup>22</sup>, in whose study 14.40% reported using interdental toothbrushes. However, it was lower than in other studies, which reported between 23.30% and 68.6% of subjects using interdental brushes.<sup>20,23</sup>

Findings from the present study revealed a higher number of individuals (35%) reporting a preference for use of mouthrinses as another form of plaque control during orthodontic treatment. Several other studies have reported lower percentages of mouthrinse use, ranging from 25.90% to 32.60%.<sup>20,22,23</sup> In addition, the present study found that a majority of participants snack at least once a day between meals. One disturbing finding was the lack of professional cleanings during orthodontic treatment, which is similar to findings of previous studies.<sup>23,24</sup> As suggested by Lee et al.<sup>23</sup>, lack of awareness, motivation, and a failure to understand the need for dental hygiene therapy could be reasons for poor oral hygiene during orthodontic treatment.

A recent study by Mei et al.<sup>13</sup> investigating the factors affecting the accumulation of oral biofilm in orthodontic clients reported that study subjects were able to clean the occlusal surfaces (in relation to the bracket) of the teeth better than the gingival, mesial, and distal areas. Unfortunately, the most critical sites for biofilm accumulation are the areas cervical to the brackets and underneath the orthodontic archwires (i.e., areas mesial and distal to the brackets).<sup>13</sup> Therefore, clients wearing orthodontic appliances should be instructed to clean these areas in particular. Other aids such as plaque-disclosing agents and other visual methods should be employed to motivate and educate clients.<sup>14</sup> Several studies have also reported success with behaviour change techniques such as motivational interviewing to assist orthodontic clients in achieving better plaque control. Recommended techniques should be based on the client's age and individual case.

Although the modified Bass technique has been the most commonly recommended toothbrushing technique by dental professionals and dental associations,<sup>9,10</sup> neither the Bass toothbrushing technique nor the Modified Bass toothbrushing techniques were observed in a study of uninstructed adults.<sup>25</sup> Circular brushing motion was reported as the most preferred habitual toothbrushing motion.<sup>25</sup> It has been reported that study subjects brushed different areas of the mouth with different types of strokes, predominantly with horizontal and circular strokes on the buccal and labial surfaces, horizontal strokes on posterior teeth, and vertical strokes on anterior teeth in non-orthodontics clients.<sup>6</sup> In the present study, participants reported mostly using horizontal motions to clean their teeth and appliances; this finding may be due to the practical convenience and the limited space between the braces and gingival margin or to a lack of knowledge of other techniques. Although spitting without rinsing after toothbrushing with fluoridated toothpaste has

been shown in studies to preserve fluoride relatively longer in the oral cavity,<sup>26</sup> more than half of the participants in this study did not indicate doing so. The majority of participants in previous studies<sup>13,14</sup> claimed that the oral hygiene instruction given before and during orthodontic treatment was not specific and practical enough, indicating the need to reinforce oral hygiene instruction, especially visually aided approaches, in clients wearing orthodontic appliances. This finding is in agreement with our study findings.

In the present study, participants' awareness of their oral hygiene status was not encouraging as the majority were satisfied with their own oral hygiene, even though more than half of the participants had unsatisfactory oral hygiene according to the literature.<sup>3,13</sup> Our research finding is similar to a previous study from Sweden, in which 90% of subjects were found to have poor oral health knowledge. Despite the subjects' attitude towards their oral hygiene status and their oral hygiene knowledge, they believed their oral hygiene was satisfactory.<sup>27</sup>

### Limitations

There are some limitations to this study. Although the study was carried out in 2 clinical centres, the sample size was small. Future studies could consider broadening the recruitment range to account for potential influences of demographic and socioeconomic factors on participants' oral hygiene behaviour. In addition, the frequency of visiting dental hygienists and dentists may also cause potential bias in reinforcing oral hygiene instruction. Since the course of orthodontic treatment is relatively long, it would be interesting to repeat and compare the questionnaire at the beginning and end of orthodontic treatment to identify whether oral hygiene behaviours change over time. Future studies could also consider both quantitative and qualitative methodologies for data collection and analysis to identify possible results not covered by a survey questionnaire.

### CONCLUSION

Most study participants brushed their teeth twice daily with a soft manual toothbrush and fluoridated toothpaste but were not fully aware of their oral hygiene status. Clinicians should improve their clients' awareness of their oral hygiene during orthodontic treatment. Reinforcement of oral hygiene instruction is recommended in all cases of orthodontic treatment.

### CONFLICTS OF INTEREST

The authors have declared no conflicts of interest.

## APPENDIX: SURVEY QUESTIONNAIRE

## Survey Introduction

We invite you to take part in this survey which covers a wide range of topics relating to the oral hygiene during your orthodontic treatment.

If you are older than 16, you can take the questionnaire on your own; if you are younger than 16, the questionnaire is advised to be completed under your parents'/caregivers' supervision.

All responses are confidential. Data entry and analysis will be done using anonymised data.

## Demographics

1. How old are you? \_\_\_\_\_
  2. Are you a male or female?
    - Male
    - Female
  3. Which one of the followings best describes your ethnicity?
    - NZ Māori
    - NZ European/Pakeha
    - Pacific Islander
    - Asian
    - Other (please specify)
  4. What is the highest degree or level of school you have completed?
    - Primary school (Year 1-6)
    - Intermediate school (Year 7-8)
    - Secondary school (Year 9-13)
    - Tertiary qualifications (diploma, bachelor, PhD, etc.)
    - Other (please specify)
  5. Do you smoke?
    - Yes
    - Yes, e-cigarette
    - No, but I'm an ex-smoker
    - No, I never smoked before
- Oral hygiene practices: General aspects**
6. Do you brush your teeth using a manual toothbrush or an electric toothbrush?
    - Manual toothbrush
    - Electric toothbrush
    - Other (please specify)
  7. What type of toothbrush do you use?
    - Hard
    - Medium
    - Soft
    - Ultrasoft/slim soft
    - I don't know
  8. Does your toothpaste contain fluoride?
    - Yes
    - No
    - I don't know
  9. How regularly do you change your toothbrush?
    - Every month
    - Every three months
    - Every six months
    - Every year
    - Other (please specify)
  10. How often do you brush your teeth?
    - Less than once a day
    - Once a day
    - Twice a day
    - More than twice a day
    - Don't know
  11. When do you brush your teeth? (Tick all that applied)
    - In the morning
    - After breakfast
    - After lunch
    - After dinner
    - At night time before bed
  12. How long does it usually take to brush your teeth?
    - Less than 1 minute
    - 1 to 3 minutes
    - 3 to 5 minutes
    - More than 5 minutes
    - I don't know
  13. Do you clean/brush your tongue?
    - Always
    - Sometimes
    - Rarely
    - Never
  14. Do you usually use interdental brushes (fingernail sized small brushes) to clean behind braces?
    - Yes, always
    - Yes, but only when needed
    - No, never heard of them before
    - No, know what they are but don't have them
    - No, have them but rarely used them
  15. Do you floss?
    - Yes, everyday
    - Yes, but only when needed
    - No, used to floss but now don't know how to floss around braces
    - No, never know how to floss
    - No, I know how to floss but I don't do it
  16. Do you usually use any other cleaning aids to maintain your oral hygiene? (Please tick all that applied)
    - Nothing else
    - Mouth rinse
    - Chewing gum
    - Toothpick
    - Waterpik
    - Fluoride gel/paste/drop/foam/varnish/tablet
    - Tooth mousse (CPP-ACP)
    - Other (please specify)
  17. How often do you use the cleaning aids?
    - Rarely or never
    - Occasionally
    - Once a day
    - After every meal
  18. How often do you eat snack between meals?
    - About 3 times per day
    - About twice a day
    - About once a day
    - Occasionally, not everyday
    - Rarely or never

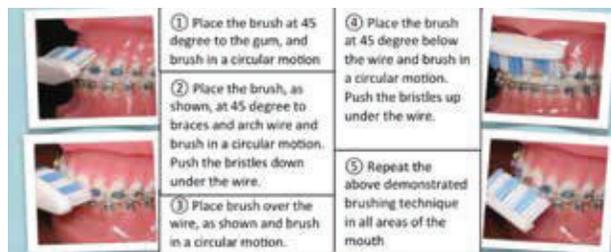
19. Have you received a professional cleaning since you started wearing braces? (A professional cleaning is usually performed by a dental hygienist or a dentist)
- Yes
  - No, never since had braces on
  - No, never had professional cleaning before

**Tooth brushing techniques**

20. Which teeth do you begin to brush?
- Upper right teeth
  - Upper left teeth
  - Lower right teeth
  - Lower left teeth
  - Randomly
21. Are you using your toothbrush
- Horizontally (as shown as photo 1)
  - Vertically (as shown as photo 2)
  - Both
22. Which one of the following brushing techniques do you use while brushing?
- Small repetitive strokes
  - Large strokes
  - Combination of the two
  - Other (please specify)
23. When you brush the OUTER side of BACK teeth (cheek and lip side), which of the following movement(s) do you use? (Please tick all that applied)
- Horizontal (left and right)
  - Vertical (up and down)
  - Circling (like drawing circles)
  - Unspecific movements (please describe)
24. When you brush the INNER side of BACK teeth (tongue side), which of the following movement(s) do you use? (Please tick all that applied)
- Horizontal (left and right)
  - Vertical (up and down)
  - Circling (like drawing circles)
  - Unspecific movements (please describe)
25. When you brush the BITING SURFACE of BACK teeth, which of the following movement(s) do you use? (Please tick all that applied)
- Horizontal (left and right)
  - Vertical (up and down)
  - Circling (like drawing circles)
  - Unspecific movements (please describe)
26. When you brush the OUTER side of FRONT teeth (lips side), which of the following movement(s) do you use? (Please tick all that applied)
- Horizontal (left and right)
  - Vertical (up and down)
  - Circling (like drawing circles)
  - Unspecific movements (please describe)
27. When you brush the INNER side of FRONT teeth (tongue side), which of the following movement(s) do you use? (Please tick all that applied)
- Horizontal (left and right)
  - Vertical (up and down)
  - Circling (like drawing circles)
  - Unspecific movements (please describe)

28. After tooth brushing do you usually
- Just swallow
  - Rinse and swallow
  - Rinse and spit
  - Just spit
  - Don't know
  - Other (please specify)

29. Which of the following instructions are you applying with?



**Oral hygiene practices: Before and after your orthodontic treatment**

30. Were you using electric toothbrush before the orthodontic treatment?
- Yes
  - No
31. Have you received oral hygiene advices before having your braces?
- Yes and it was helpful
  - Yes but I don't remember
  - No
32. After receiving the advices, did you change your tooth brushing techniques?
- Yes
  - No
33. Since you had braces, which area(s) is/are the most difficult to clean? (Tick all that applied)
- Upper front teeth
  - Upper back teeth
  - Lower front teeth
  - Lower back teeth
34. If you compare your oral hygiene before and after having your braces, do you think your oral hygiene?
- Has improved
  - Is more difficult to maintain
  - Is the same
35. Comparing to before and after having braces, do you spend more time to clean/brush your teeth?
- Yes
  - No
  - Same
  - I don't remember
36. Have you had bad breath?
- Before having braces
  - After having braces
  - Both before and after
  - None

**Oral hygiene awareness**

37. How would you describe your oral hygiene?
- Excellent
  - Very good
  - Good
  - Fair
  - Poor
  - Don't know
38. Is your orthodontic practitioner (postgraduate student and/or clinical supervisor) happy with your oral hygiene?
- Yes
  - No
  - I don't know
39. Your knowledge regarding tooth decay and gum disease is:
- Good
  - Fairly good
  - Fair
  - Quite poor
  - Poor
40. How important is it for you to clean your teeth?
- Very important
  - Fairly important
  - Less important
  - Not at all
41. How important is it for you to have healthy oral conditions?
- Very important
  - Fairly important
  - Less important
  - Not at all
42. Do you know the reasons why it is important to maintain a high level of oral hygiene during your orthodontic treatment?
- Yes
  - No
43. Are you aware that oral health is related to systemic (general) health?
- Yes
  - No
44. Does your gum bleed when you brush your teeth?
- Always
  - Sometimes
  - Rarely
  - Never
45. What is the most important factor for your future oral health?
- My own efforts
  - The dental health service
  - Other (please specify)
46. Did your parents/caregiver remind you to brush your teeth?
- Yes
  - No
- Additional comments**
47. Please add any further comments you may have:

## REFERENCES

1. Wishney M. Potential risks of orthodontic therapy: A critical review and conceptual framework. *Aust Dent J.* 2017;62 Suppl 1:86–96.
2. Chang HS, Walsh LJ, Freer TJ. The effect of orthodontic treatment on salivary flow, pH, buffer capacity, and levels of mutans streptococci and lactobacilli. *Aust Orthod J.* 1999;15(4):229–34.
3. Ren Y, Jongsma MA, Mei L, van der Mei HC, Busscher HJ. Orthodontic treatment with fixed appliances and biofilm formation—a potential public health threat? *Clin Oral Investig.* 2014;18(7):1711–1718.
4. Fornell AC, Skold-Larsson K, Hallgren A, Bergstrand F, Twetman S. Effect of a hydrophobic tooth coating on gingival health, mutans streptococci, and enamel demineralization in adolescents with fixed orthodontic appliances. *Acta Odontol Scand.* 2002;60(1):37–41.
5. Karadas M, Cantekin K, Celikoglu M. Effects of orthodontic treatment with a fixed appliance on the caries experience of patients with high and low risk of caries. *J Dent Sci.* 2011;6(4):195–99.
6. Winterfeld T, Schlueter N, Harnacke D, Illig J, Margraf-Stiksrud J, Deinzer R, et al. Toothbrushing and flossing behaviour in young adults—a video observation. *Clin Oral Investig.* 2015;19(4):851–58.
7. Deinzer R, Cordes O, Weber J, Hassebrauck L, Weik U, Norbert Krämer, et al. Toothbrushing behavior in children—an observational study of toothbrushing performance in 12-year-olds. *BMC Oral Health.* 2019;19(1):68.
8. Wainwright J, Sheiham A. An analysis of methods of toothbrushing recommended by dental associations, toothpaste and toothbrush companies and in dental texts. *Br Dent J.* 2014;217:E5.
9. Poyato-Ferrera M, Segura-Egea JJ, Bullón-Fernández P. Comparison of modified Bass technique with normal toothbrushing practices for efficacy in supragingival plaque removal. *Int J Dent Hyg.* 2003;1(2):110–114.
10. Janakiram C, Varghese N, Venkitachalam R, Joseph J, Vineetha K. Comparison of modified Bass, Fones and normal tooth brushing technique for the efficacy of plaque control in young adults: A randomized clinical trial. *J Clin Exp Dent.* 2020;12(2):e123–e129.
11. Nordstrom A, Birkhed D. Attitudes and behavioural factors relating to toothbrushing and the use of fluoride toothpaste among caries-active Swedish adolescents—a questionnaire study. *Acta Odontol Scand.* 2017;75(7):483–87.
12. Ogaard B, Rolla G, Arends J. Orthodontic appliances and enamel demineralization. Part 1. Lesion development. *Am J Orthod Dentofacial Orthop.* 1988;94(1):68–73.
13. Mei L, Chieng J, Wong C, Benic G, Farella M. Factors affecting dental biofilm in patients wearing fixed orthodontic appliances. *Prog Orthod.* 2017;18(1):4–9.
14. Peng Y, Wu R, Qu W, Wu W, Chen J, Fang J, et al. Effect of visual method vs plaque disclosure in enhancing oral hygiene in adolescents and young adults: a single-blind randomized controlled trial. *Am J Orthod Dentofacial Orthop.* 2014;145(3):280–86.
15. Tan A, Bennani F, Thomson WM, Farella F, Mei L. A qualitative study of orthodontic screening and referral practices among dental therapists in New Zealand. *Aust Orthod J.* 2016;32(2):155–64.
16. Soma KJ, Thomson WM, Morgaine KC, Harding WJ. A qualitative investigation of specialist orthodontists in New Zealand. Part I. Orthodontists and orthodontic practice. *Aust Orthod J.* 2012;28:2–16.
17. Zanatta FB, Bergoli AD, Werle SB, Antoniazzi RP. Biofilm removal and gingival abrasion with medium and soft toothbrushes. *Oral Health Prev Dent.* 2011;9(2):177–83.
18. Zimmer S, Öztürk M, Barthel CR, Bizhang M, Jordan RA. Cleaning efficacy and soft tissue trauma after use of manual toothbrushes with different bristle stiffness. *J Periodontol.* 2011;82(2):267–71.
19. Al-Shammari KF, Al-Ansari JM, Al-Khabbaz AK, Dashti A, Honkala EJ. Self-reported oral hygiene habits and oral health problems of Kuwaiti adults. *Med Princ Pract.* 2007;16(1):15–21.
20. Al-Shdeifat N, Al-Alawneh A, Al-Zyood ALI, Al-Maani M. Oral hygiene practices among fixed orthodontic patients in Az-zarqa, Jordan. *Pakistan Oral Dent J.* 2016;36(3):404–407.
21. Hayasaki H, Saitoh I, Nakakura-Ohshima K, Hanasaki M, Nogami Y, Nakajima T, et al. Tooth brushing for oral prophylaxis. *Japanese Dent Sci Rev.* 2014;50(3):69–77.
22. Da'Ameh DA, Al-Shorman I, Al-Shdeifat N, Fnaish M. Oral hygiene measures in orthodontic treatment in northern Jordan. *Pakistan Oral Dent J.* 2011;31(2):336–39.
23. Lee J, Asma A, Nurul Y. Oral hygiene practices among fixed orthodontic patients in a university dental setting. *Int J Oral Dent Health.* 2016;2:22–27.
24. Atassi F, Awartani F. Oral hygiene status among orthodontic patients. *J Contemp Dent Pract.* 2010;11(4):E025–32.
25. Ganss C, Schlueter N, Preiss S, Klimek J. Tooth brushing habits in uninstructed adults—Frequency, technique, duration and force. *Clin Oral Investig.* 2009;13(2):203–208.
26. Pitts N, Duckworth RM, Marsh P, Mutti B, Parnell C, Zero D. Post-brushing rinsing for the control of dental caries: Exploration of the available evidence to establish what advice we should give our patients. *Br Dent J.* 2012;212(7):315–20.
27. Ericsson JS, Ostberg AL, Wennstrom JL, Abrahamsson KH. Oral health-related perceptions, attitudes, and behavior in relation to oral hygiene conditions in an adolescent population. *Eur J Oral Sci.* 2012;120(4):335–41.