

A comparative assessment of failures and periodontal health between 2 mandibular lingual retainers in orthodontic patients. A 2-year follow-up, single practice-based randomized trial

Ewa Węgródzka,^a Katarzyna Kornatowska,^a Nikolaos Pandis,^b and Piotr S. Fudalej^c

Warsaw and Kraków, Poland, Bern, Switzerland, and Olomouc, Czech Republic

Introduction: The objective of this study was to compare the survival rates and periodontal health in patients with 3-strand round twisted (RT) vs 8-strand rectangular braided (RB) fixed retainers bonded to all 6 anterior teeth in the mandible. **Methods:** A total of 133 patients completing orthodontic treatment (median age, 24.6 years; 25th percentile, 17.2 years; 75th percentile, 32.4 years; minimum, 15.1 years; maximum, 49.8 years) were randomly allocated in a 1:1 ratio to receive either an RT or RB wire retainer. Inclusion criteria were all mandibular permanent incisors and canines present, no active caries, no restorations, no fractures on the mandibular incisors and canines, no periodontal disease. Patients with poor oral hygiene before debonding were excluded from the trial. The primary outcome was any first-time retainer failure. Secondary outcomes were periodontal index, bleeding on probing, plaque index, gingival index, and probing depth. Randomization was accomplished with random permuted blocks of size 4, 6, or 8 with allocation concealed in sequentially numbered, opaque, sealed envelopes. Blinding was not possible in this trial. Patients were evaluated at baseline, 3, 6, 12, 18, and 24 months after placement of the retainer. Retainer survival was assessed using Cox regression. Periodontal parameters were reported at each time point and generalised estimating equations were used to assess the effect of treatment, time, tooth and treatment X time interaction on the indices. **Results:** Baseline characteristics were similar between groups; in 1 patient, the intervention was discontinued. During 2-year follow-up 37 of 66 (56.1%, RT group) and 32 of 66 (48.5%, RB group) retainers failed at least once (log-rank test, $P = 0.55$). The adjusted hazard ratio was 0.69 (95% confidence interval, 0.42-1.12; $P = 0.13$). Neither age nor gender was a predictor of failure. All periodontal parameters (periodontal index, bleeding on probing, plaque index, gingival index, and pocket depth) were comparable between groups and remained relatively stable during follow-up. **Conclusions:** The overall risk for first-time failure was high and amounted to 52.3% (56.1% in the RT group and 48.5% in the RB group). There was no difference in terms of survival or periodontal health between the examined retainers. (Am J Orthod Dentofacial Orthop 2021; ■: ■-■)

^aPrivate practice, Warsaw, Poland.

^bDepartment of Orthodontics and Dentofacial Orthopedics, School of Dental Medicine, University of Bern, Bern, Switzerland.

^cDepartment of Orthodontics and Dentofacial Orthopedics, School of Dental Medicine, University of Bern, Bern, Switzerland; Institute of Dentistry and Oral Sciences, Faculty of Medicine and Dentistry, Palacky University Olomouc, Olomouc, Czech Republic; Department of Orthodontics, Institute of Dentistry, Jagiellonian University, Kraków, Poland.

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Address correspondence to: Piotr S. Fudalej, ul. Montelupich 4, 31-155 Kraków, Poland; e-mail, piotr.fudalej@uj.edu.pl or piotr.fudalej@zmk.unibe.ch.

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Irrespective of the type and severity of malocclusion and treatment strategy, dental arch alterations are expected over time. Moreover, the degree of relapse is unpredictable, and no useful predictor for relapse has been identified.¹ A recent systematic review reported that posttreatment changes in mandibular anterior dental alignment were limited with no association with pretreatment irregularity, the clinical setting, retention type, and adjunctive procedures.² However, the limited increase in irregularity may be attributed to the adherence to retention protocols in the included studies.

Several randomized clinical trials (RCTs) evaluated the success^{3,4} and cost⁵ of different retention strategies, patient compliance,⁶ and retainer acceptance.⁷

A comparison of the effectiveness among various combinations of vacuum-formed retainer, stripping, positioner, and retainers bonded to canines only,^{3,4,8,9} despite some variability, on average revealed no significant differences in maintaining alignment.⁹ Fixed retainers (FR) bonded to all 6 anterior teeth seem to be more effective than FR bonded to 3's only¹⁰ and are a sensible alternative when even small increases in incisor irregularity are unacceptable. Such FRs are more effective at maintaining mandibular labial segment alignment but have a higher failure rate in comparison with vacuum-formed retainers.¹¹

FRs bonded to all 6 anterior mandibular teeth come in variable cross-sectional dimensions, the number of strands, type of alloy or structure (twisted vs braided), and are widely used by orthodontists.¹²⁻¹⁴ Following the recommendations of Dahl and Zachrisson,¹⁵ it is plausible that many clinicians still use a round multistranded wire to fabricate FRs. There is evidence that in the Netherlands¹³ that a significant proportion of orthodontists use FRs made of square or rectangular wire, a choice that seems to be influenced by reports of dental arch alterations when round wires had been used.^{16,17} Recently, Kocher et al^{18,19} studied the long-term clinical performance of a 0.016-in \times 0.022-in braided stainless-steel retainer bonded to all 6 anterior mandibular teeth and found that this type of retainer was effective in maintaining dental alignment. However, these studies were retrospective, and no direct comparison between the rectangular retainer and a round twisted (RT) retainer was made.

To our knowledge, the clinical performance of the FR made of rectangular wire has never been tested in a methodologically rigorous trial. Therefore, this study aimed to compare a 0.0215-in 3-strand RT with a 0.0265-in \times 0.0106-in 8-strand rectangular braided (RB) in terms of their survival and periodontal health over 24 months. Our research hypothesis was that there were no differences between the 2 FRs.

MATERIAL AND METHODS

The Ethical Committee of Warsaw Medical Chamber approved the study protocol (no. KB/956/14; October 23, 2014). Written informed consent was given by each participant (and legal guardian if a participant was underage). The trial was not registered.

Design, participants, eligibility criteria, and setting

It was a single-center 2-arm parallel-group randomized controlled trial with a 1:1 allocation ratio. Participants were recruited from December 2014 to April 2018 from a single orthodontic private practice of the last author (P.S.F). The following inclusion criteria were

applied: aged 15–50 years at debonding; all mandibular permanent incisors and canines present; no active caries, no restorations, no fractures on the mandibular incisors and canines, no periodontal disease; and retention plan including only retainers bonded from 3 to 3. Exclusion criteria were inadequate hygiene, need for restorative or surgical treatment, active periodontal disease, or removable retainer as an adjunct to a bonded retainer. Each eligible patient was approached 2 months before planned debonding and provided information about the trial, its aims, and methodology. Then the patient was asked if he or she would be willing to participate in the trial. If extra time before making a decision was requested, several days for consideration were offered. Those patients who consented to participate underwent the procedure described in the Interventions section.

Sample size

Sample size was calculated with the following assumptions: ability to detect a clinically relevant 25% difference in the risk of first-time failure (primary outcome) between the 2 trial arms (50% vs 25%) with $\alpha = 0.05$ and $\beta = 0.8$ (power = 80%). The assumptions were based on findings of Pandis et al,²⁰ who detected an almost 50% first-time failure rate within 2 years after debonding. The minimum sample size was 58 participants per arm (group).

Randomization

Randomization was done using a random number generator provided by www.sealedenvelope.com online service. Random permuted blocks of 4, 6, or 8 patients were created to ensure equal allocation to the 2 arms. Allocation concealment was achieved with sequentially numbered, opaque, sealed envelopes prepared before the trial. The study coordinator (practice manager) was responsible for opening the next envelope in sequence and implementing the randomization process.

Interventions

One month before debonding, an alginate impression of the mandibular dental arch was taken and sent to the laboratory within 24 hours along with the information on the requested type of the retainer (ie, either 0.0215-in stainless-steel 3-strand RT wire retainer [Ortho Organizers, Lindenberg, Germany] or 0.0265-in \times 0.0106-in 8-strand Bond-a-Braid wire retainer [Reliance Orthodontic Products, Itasca, Ill]). Then, approximately 2 weeks before debonding, a study participant was scheduled for scaling and tooth cleaning provided by an experienced hygienist.

The bonding procedure comprised the following steps: placement of cheek retractor, cleaning of lingual surfaces of the 6 anterior teeth, 37% phosphoric acid etching, rinsing and drying, placement of 3 pieces of dental floss to hold the retainer in place during bonding, application of primer (Transbond XT adhesive primer; 3M Unitek, 3M Dental Products, Monrovia, Calif) on etched surfaces of the teeth, application of light-cured composite (Transbond Supreme LV; 3M Unitek), setting the composite with light. All efforts were made to avoid moisturizing lingual surfaces of the teeth with saliva. All retainers were bonded by the same orthodontic assistant who had more than 15 years of experience with this procedure.

Outcomes

There were 2 types of outcomes assessed in this study: retainer survival (ie, any first-time failure of the retainer [primary outcome]) and periodontal outcomes (secondary outcomes) comprising periodontal index (PDI) by Russel,²¹ bleeding on probing (BOP), plaque index (PI) by Loe and Silness,²² gingival index (GI), and pocket depth (PD). The stability of the dental arch and patients' satisfaction will be reported in a separate study.

Data collection

Data were collected at 6-time points: baseline, at debonding and retainer placement; 3 months after retainer placement; 6 months after retainer placement; 12 months after retainer placement; 18 months after retainer placement; and 24 months after retainer placement by the same assessor (E.W. -orthodontist with more than 10 years of clinical experience). In case of retainer failure, study participants were requested to contact the practice as soon as possible. At the end of the visit, the subsequent appointment was scheduled in advance to ensure regular follow-up.

During each data collection appointment, first, the retainer was checked visually for any sign of failure (eg, discoloration of the adhesive, loss of adhesive, etc), followed by manual control of bond quality between the wire and each of the 6 teeth. In case of failure, type (debonding, breakage, and complete loss of retainer) and location (ie, on which tooth [teeth]) of failure were noted. For example, when debonding occurred, the adhesive remnant index was used to categorize debonding into 1 of 4 categories: no bond on tooth surface, <50% bond on tooth surface, >50% bond on tooth surface, and 100% bond on the tooth surface.

After the assessment of the retainer integrity, the following periodontal indexes were recorded. The PDI

was calculated as a mean score of individual scores of 6 anterior teeth using the following scale: 0, healthy periodontium; 8, advanced periodontal destruction. BOP was calculated as a proportion of points bleeding within 10 seconds after probing of dental pockets on 6 sites of each of 6 anterior teeth; PI was calculated as a mean score of individual scores of 6 anterior teeth on the following scale: 0, no dental plaque; 3, abundant dental plaque. GI was determined for each of the 6 teeth on the following scale: 0, no inflammation; 3, severe inflammation present. PD was measured with a periodontal probe on the lingual surfaces of 6 anterior teeth. All determinations were made by the same assessor who evaluated retainer integrity (E.W).

Blinding

Blinding was not possible because the retainer type—3-wire RT or 8-wire RB—could not be masked during clinical assessments.

Statistical analysis

Descriptive statistics were calculated at baseline per treatment group and for the different time points (3 months after retainer placement, 6 months after retainer placement, 12 months after retainer placement, 18 months after retainer placement, and 24 months after retainer placement).

For the survival analysis, the effect of retainer type on failure was examined using a Cox model adjusted for gender and age. In addition, the proportional hazard assumption was examined via the Schoenfeld residuals.

For the periodontal indexes population average generalized estimating equation models were fit. Because of the skewed distributions and the low number of observations for some outcome levels, some of the outcomes were converted to binary considering clinical relevance as follows: GI (0, >0), PD (≤ 1 , >1), and PDI (0, >0). For those outcomes, logit models were fitted with treatment time, tooth, and treatment \times time interaction as predictors using empirical standard errors and independent correlation structures. For PI, a Gaussian model was fitted with empirical standard errors and an exchangeable correlation structure. For BOP, the number of events was calculated, and a Poisson population average model was fitted with empirical standard errors and an independent correlation structure. Missing data analysis included the chained equations approach fully conditional specification²³ with 20 burn-in iterations, and 40 imputations were applied using a logit, Gaussian, or a Poisson model depending on the outcome. The previous generalized estimating equation models were

fitted in the complete dataset to assess the robustness of our results. All analyses were conducted in Stata (version 16.1; StataCorp, College Station, Tex), SAS (version 9.4; SAS, Cary, NC), and R software (version 3.6.1; R Foundation for Statistical Computing, Vienna, Austria).

RESULTS

Participants

A total of 133 participants (42 males and 91 females), with a median age of 24.6 years (25th percentile, 17.2 years; 75th percentile, 32.4 years; minimum, 15.1 years; maximum, 49.8 years) were randomized to receive a 3-strand RT wire retainer (RT group; 65 participants: 22 males and 43 females) or 8-strand RB wire retainer (RB group; 66 participants: 19 males and 47

females) bonded to 6 anterior teeth in the mandible. The Consolidated Standards of Reporting Trials flow-chart (Fig 1) demonstrates participant flow. A total of 132 participants received the allocated treatment. One participant intervention was discontinued because the patient demanded retreatment for displaced premolar and was excluded from the analyses. Furthermore, 4 participants who missed 1-3 data collection appointments were included in the analysis.

Baseline data

Both groups were comparable regarding baseline characteristics, and periodontal health parameters at baseline (debonding) indicated good periodontal health at the start of the trial (Table 1).

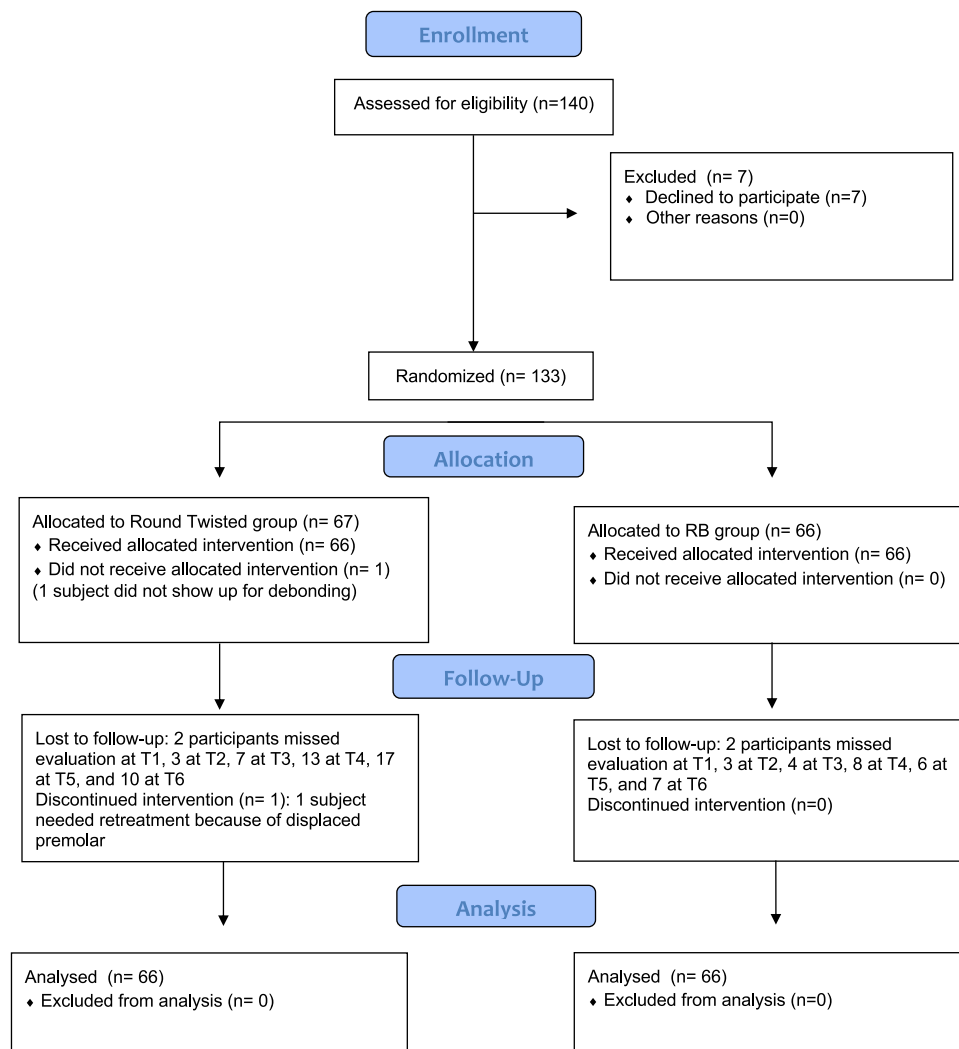


Fig 1. Consolidated Standards of Reporting Trials flow chart showing patient flow during the trial.

Survival analysis

Thirty-seven out of 66 participants (56.1%) from the RT group and 32 out of 66 participants (48.5%) from the RB group had ≥ 1 retainer failure during 2 years after retainer placement.

The proportion of the number of teeth with failures to the number of teeth in subjects in whom the first-time failure occurred (Table II)—25.2% in the RT group and 21.9% in the RB group—implies that retainers in some participants failed at multiple sites. In addition, 2 participants from the RT group lost their retainers completely, whereas no participants from the RB group lost the retainer. Nevertheless, most failures were limited to a single tooth, mainly the central or lateral incisor (Supplementary Table I). Failures on the canines were rare.

The proportional hazards assumption was satisfied; the Kaplan-Meier survival plots with patients at risk as a function of time for 2 types of retainers are presented in Figure 2. No difference in failures was observed between intervention groups (log-rank test, $P = 0.55$). The hazard ratio (HR) was 0.69 (95% confidence interval [CI], 0.42–1.12; $P = 0.13$). No evidence indicating that age (HR, 1.01; 95% CI, 0.98–1.04; $P = 0.52$) or gender (HR, 0.67; 95% CI, 0.39–1.15; $P = 0.15$) might be significant predictors of retainer failure was found (Table III).

Periodontal health

Supplementary Table II shows the missing values for the periodontal indexes. Missing data was around 10% and was considered to be missing at random.

Overall, all periodontal parameters indicated favorable periodontal conditions during a 2-year observation period (Fig 3; Table IV). At baseline, mean values of the PDI, BOP, PI, and GI were <0.5 , which was equivalent to (very) good periodontal health at the moment of debonding. Over time, PDI and BOP demonstrated a slight trend to decrease, whereas PI increased. The GI index remained stable in RT groups, whereas it decreased in the RB group. The PD had the greatest value at baseline, then decreased (Table IV). The results of the statistical analyses are shown in Table V. Treatment \times time interaction was not significant for all the periodontal indexes indicating similar evolution between treatment arms over time. For all indexes, there was no evidence of association with the type of retainer and a significant association between all indexes and time. No evidence of an association between the GI and tooth type was observed, whereas tooth type was a significant predictor for PD. The analysis of the complete dataset after multiple imputations did not alter the conclusions.

Table I. Baseline characteristics of the groups

Characteristics	RT	RB
Age	23.9 (17.0–31.6)	27.2 (17.5–33.2)
Sex, % males	34.3%	28.8%
PDI	0 (0–1)	0 (0–1)
BOP	0.2 (0.1–0.3)	0.2 (0.1–0.3)
PI	0.3 (0.1–0.5)	0.3 (0.2–0.5)
GI	0 (0–0.5)	0 (0–0.5)
PD	1.5 (1–2)	1.5 (1–2)

Note. Values are median (25th percentile–75th percentile).

Table II. Types of failures in groups

Variable	Retainer type		P value*
	RT	RB	
No. of teeth in subjects in whom the first-time failure occurred	222	192	
No. of teeth with failures (%)	56 (25.2%)	42 (21.9%)	
Adhesive remnant index			0.17
Debonding, no bond on the tooth surface	13	12	
Debonding, $<50\%$ bond on the tooth surface	13	5	
Debonding, $>50\%$ bond on the tooth surface	13	20	
Debonding, 100% bond left on tooth surface	2	2	
Breakage	0	1	
Loss of retainer	12	0	
Undetermined	3	2	0.03

*Determined by Fisher exact test.

DISCUSSION

In this trial, we evaluated survival and the condition of periodontal tissues after 2 types of retainers were bonded to all 6 anterior teeth (canine to canine) in the mandible. Our research hypothesis was that there was no difference between groups for any of the outcomes.

The failure rate over 2 years was high ($\sim 50\%$) for first-time failures irrespective of retainer type. The majority of failures were retainer detachments, whereas retainer breakages and complete retainer loss were infrequent. The values of the adhesive remnants index indicated a similar pattern of detachments in both intervention groups—approximately in one third of all detachments, there was no bond on the tooth surface, whereas in approximately two thirds of detachments, some adhesive remnants were present on the tooth surface. No bond on the tooth surface suggests that the adhesive-enamel interface was weakened, possibly by moisture contamination during the bonding procedure,

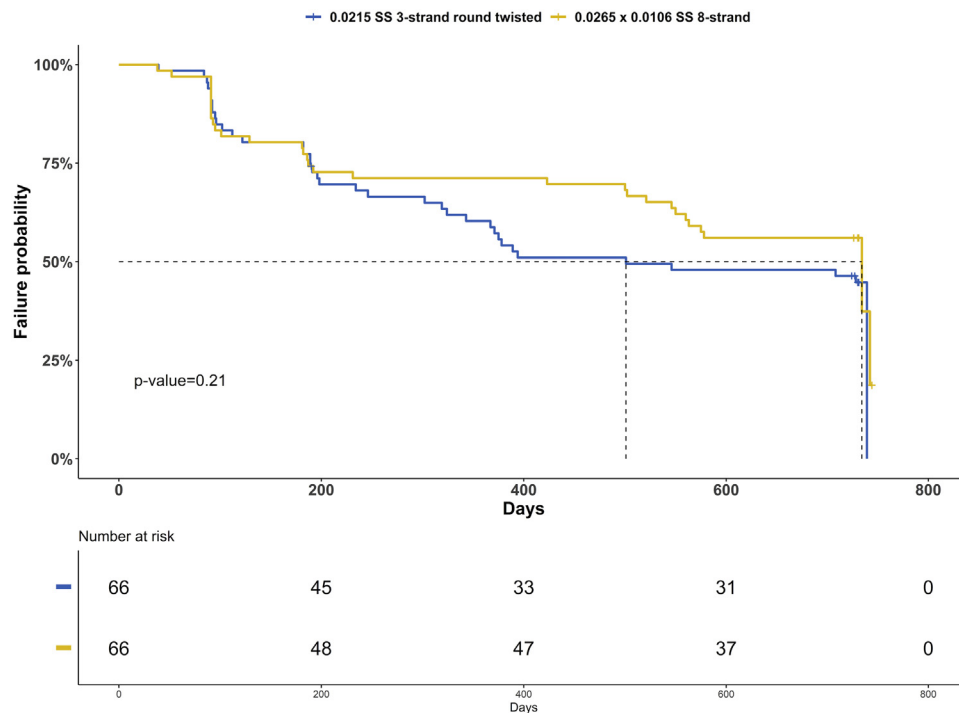


Fig 2. Kaplan-Meier survival plots by type of retainer.

Table III. HRs from Cox regression for the type of retainer using imputed data for unobserved failures from losses to follow-up and censoring for unobserved failures

Variables	HR (95% CI)	P value
Retainer type		
RT	Referent	
RB	0.69 (0.42-1.12)	0.13
Gender		
Female	Referent	
Male	0.69 (0.39-1.15)	0.15
Age, y, per unit	1.01 (0.98-1.04)	0.64

whereas the presence of the bond remnants at the debonding site implies that other factors (eg, mechanical, inadequate bond polymerization, or inadequate bond quality) led to detachment. Unfortunately, identification of the exact causes of failures was not possible in this study. Iliadi et al²⁴ reported in the systematic review that bond failures in the retainers attached to all 6 anterior teeth of the mandibular arch were found in up to 57% of patients. The relatively high prevalence of retainer failures was demonstrated in several RCTs published after the review by Iliadi et al. It seems possible that the nature of the RCTs in which meticulous evaluations are made at preplanned time points allows for a more realistic estimation of the prevalence of first-time

retainer failure than in retrospective studies. Therefore, our survival data are compatible with the findings of most RCTs reporting on the survival of mandibular retainer bonded to 6 anterior teeth.

A recent systematic review¹⁰ suggested a lower failure rate when the retainer is attached to the canines only, and thus bonding the retainer only to canines could reduce the risk of failure. As shown in this study, failures at mandibular canines were rare. However, bonding only on canines is likely to come at the cost of lower stability of the anterior alignment of the mandibular.^{10,19}

FRs in the mandible are maintained for prolonged periods, even for life.¹⁴ Growing popularity and extended use can be associated with unwanted sequelae such as the development of decalcification or caries or the presence of gingival or periodontal inflammation.¹ Both phenomena result directly from the increased capacity to retain dental plaque and the difficulty to clean. Our findings do not confirm concerns that the presence of the mandibular retainer bonded to 6 anterior teeth leads to periodontal problems. In contrast, they seem to agree with a recent systematic review that concluded that “orthodontic fixed retainers seem to be a retention strategy rather compatible with periodontal health, or at least not related to severe detrimental effects on the periodontium.”²⁵ Nevertheless, it should be kept in mind

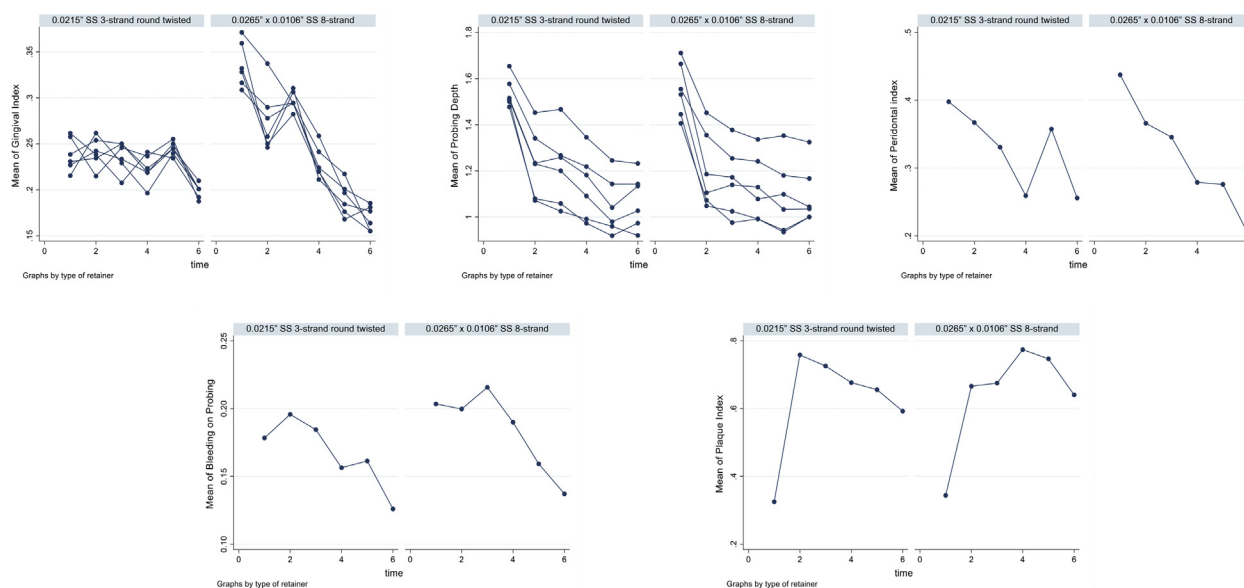


Fig 3. Evolution of periodontal indexes per tooth (only for GI and PD) and treatment over time.

that participants of this study likely maintained above-average dental hygiene during orthodontic treatment and in the retention phase and that the follow-up period is relatively short. Those with inadequate hygiene were excluded. Comparable inclusion and exclusion criteria were used in most RCTs assessed by Arn et al.²⁵ Of the 11 RCTs included in the review, good oral hygiene was an inclusion criterion in 5 trials, 1 trial did not list hygiene or periodontal health as an inclusion/criterion,²⁶ unclear in 2 trials, and we were unable to assess inclusion and exclusion criteria in the 3 remaining RCTs. As a result, the cautious statement that bonded retention and periodontal health are compatible might be limited to patients who can maintain good or very good hygiene in the retention phase. In those who cannot maintain ideal oral hygiene, the presence of fixed retention may be conducive to periodontal health deterioration, as observed by Torkan et al.²⁶ Provided that not all patients can maintain ideal oral hygiene for life, regular follow-ups are mandatory for patients with bonded lingual retainers.

There is evidence that in patients with mandibular FRs, unwanted tooth movements, even without bond failure or wire breakage, can occur.¹⁶ Those side effects have been attributed to unexpected torque changes between the adjacent mandibular incisors or opposite inclinations of contralateral mandibular canines.^{17,27} Although the exact cause of this phenomenon is not clear, it was suggested that the retainer could become active and move the retained teeth to unwanted positions. The risk for the retainer to become active seems

to be associated with retainers made from several single stainless-steel filaments twisted into a round wire. After mechanical deformation during biting, the wire could untwist and lead to complications. The increasing popularity of rectangular wire for the fabrication of mandibular retainers^{14,16} implies that the strategy to use nontwisted, nonround wires for retainer fabrication was meant to prevent such complications. In addition, a recent study¹⁸ demonstrated that patients wearing the RB retainer in the mandible for >10 years had no complications attributed to the active retainer. Although the selection of wires tested in this trial was influenced by reports on active retainers, unwanted tooth movements were not assessed because they usually develop after 2 years of retention.²⁷ However, we plan to recall the participants 5 years after debonding, and at that time point, we will also record the presence of any unwanted tooth movement.

Limitations

The main limitation of this trial is the possibility of bias because of the lack of blinding during outcome assessment. The stability of the dental arch, as well as patients' satisfaction with the retention scheme, was not assessed in this study. We plan to report on it in the next part. The study protocol was not registered before the trial commencement. However, all a priori selected outcomes have been reported, and the reported outcomes are common and expected in such trials, which suggests no selective outcome reporting.

Table IV. Periodontal parameters in both groups during follow-up

Variable	T1		T2		T3		T4		T5		T6	
	RT	RB	RT	RB	RT	RB	RT	RB	RT	RB	RT	RB
PDI	0 (0-1)	0 (0-1)	0 (0-1)	0 (0-1)	0 (0-1)	0 (0-0.67)	0.11 (0.06-0.22)	0 (0-0.67)	0 (0-1)	0 (0-0.5)	0 (0-0.5)	0 (0-0.17)
BOP	0.2 (0.1-0.3)	0.2 (0.1-0.3)	0.17 (0.1-0.31)	0.17 (0.8-0.33)	0.17 (0.08-0.3)	0.17 (0.08-0.28)	0.11 (0.06-0.22)	0.13 (0.06-0.28)	0.14 (0.04-0.24)	0.11 (0.06-0.19)	0.08 (0.04-0.17)	0.11 (0.03-0.19)
PI	0.3 (0.1-0.5)	0.3 (0.2-0.5)	0.67 (0.38-1.04)	0.63 (0.33-0.96)	0.73 (0.38-1)	0.52 (0.3-0.92)	0.61 (0.4-1)	0.54 (0.42-1)	0.58 (0.33-1)	0.65 (0.38-1)	0.58 (0.33-0.83)	0.58 (0.25-0.83)
GI	0 (0-0.5)	0 (0-0.5)	0 (0-0.5)	0 (0-0.5)	0 (0-0.5)	0 (0-0.5)	0 (0-0.5)	0 (0-0.5)	0 (0-0.5)	0 (0-0.5)	0 (0-0.3)	0 (0-0)
PD	1.5 (1-2)	1.5 (1-2)	1 (1-1.5)	1 (1-1.5)	1 (1-1.5)	1 (1-1.5)	1 (1-1.5)	1 (1-1.5)	1 (1-1.5)	1 (1-1.5)	1 (1-1)	1 (1-1.5)

Note. Values are median (25th percentile-75th percentile).

T1, baseline, at debonding and retainer placement; T2, 3 mo after retainer placement; T3, 6 mo after retainer placement; T4, 12 mo after retainer placement; T5, 18 mo after retainer placement; T6, 24 mo after retainer placement.

Table V. Effects of retainer type (treatment), time, and tooth on periodontal parameters

Index	Treatment*	Time	Tooth	P value
	P values for complete case analysis/after multiple imputation			Treatment × time
PDI	0.78/0.74	0.003/<0.01	Not applicable	0.89
BOP	0.40/0.33	<0.001/0.001	Not applicable	0.66
PI	1/0.56	<0.001/<0.001	Not applicable	0.44
GI	0.85/0.86	0.01/0.01	0.37/0.74	0.90
PD	0.78/0.85	<0.001/<0.001	<0.001/<0.001	0.44

*Treatment refers to retainer type (RT vs RB).

Generalizability

This study was performed in a medium-size private practice with the participation of experienced operators. All retainers were bonded by a single experienced orthodontic assistant. It is possible that the failure rate could be different if a less experienced operator bonded retainers. Furthermore, because of logistical reasons, periodontal assessments were performed by a single orthodontist, not by a periodontist. Therefore, it cannot be ruled out that the results of evaluations made by a specialist in periodontics might have been somewhat different. However, the indexes used in this trial were not difficult to apply by a nonperiodontist. In our practice, patients cover all the costs of treatment (no coverage by insurance), and a high proportion of patients undergo rather complicated treatment. Therefore, our results can be generalized to similar setting(s), but they can differ from the outcome obtained, for example, by postgraduate students working in a university clinic.

CONCLUSIONS

Our research hypothesis that there was no difference in the risk of the first-time failure within 2 years after retainer bonding to the 6 anterior mandibular teeth was not rejected. However, the overall first-time risk of failure was high.

In healthy patients with good oral hygiene, the presence of a mandibular fixed retainer does not seem to negatively affect periodontal tissues in the short term.

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SUPPLEMENTARY DATA

Supplementary data associated with this article can be found, in the online version, at <https://doi.org/10.1016/j.ajodo.2021.02.015>.

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Supplementary Table I. Distribution of failures by type of tooth

<i>Variable</i>	<i>Retainer type</i>	
	<i>RT</i>	<i>RB</i>
No. of teeth with failures	56	42
No. of central incisors with failures (%)	26 (46.4%)	22 (52.4%)
No. of lateral incisors with failures (%)	23 (41.1%)	20 (47.6%)
No. of canines with failures (%)	7 (12.5%)	0

Supplementary Table II. Missing values for the periodontal indexes

<i>Variable</i>	<i>Missing</i>	<i>Total</i>
PDI	498	4788
BOP	540	4788
PI	552	4788
GI	499	4788
PD	522	4788