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*HC Larsen*
*DE Slot*
*C Van Zoelen*
*DS Barendregt*
*GA Van der Weijden*

# The effectiveness of conically shaped compared with cylindrically shaped interdental brushes – a randomized controlled clinical trial

**Authors' affiliations:**
*HC Larsen*, *C Van Zoelen*, *DS Barendregt*, Clinic for Periodontology Rotterdam, Rotterdam, The Netherlands
*HC Larsen*, Dental student: Academic Center for Dentistry Amsterdam (ACTA), University of Amsterdam and VU University, Amsterdam, The Netherlands
*DE Slot*, *GA Van der Weijden*, Department of Periodontology, Academic Center for Dentistry Amsterdam (ACTA), University of Amsterdam and VU University, Amsterdam, The Netherlands

**Corresponding to:**
*Dagmar Else Slot*
Department of Periodontology
Academic Centre for Dentistry Amsterdam (ACTA)
University of Amsterdam and VU University Amsterdam
Gustav Mahlerlaan 3004
1081 LA Amsterdam
The Netherlands
Tel.: +31 20 59 80 179
E-mail: d.slot@acta.nl

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Larsen HC, Slot DE, Van Zoelen C, Barendregt DS, Van der Weijden GA. The effectiveness of conically shaped compared with cylindrically shaped interdental brushes – a randomized controlled clinical trial.



**Abstract:** *Aim:* The purpose of this study was to compare the effectiveness of conically shaped versus cylindrically shaped interdental brushes (IDB) in patients receiving supportive periodontal therapy. *Materials and methods:* Periodontal maintenance patients volunteered to be enrolled into this randomized controlled examiner-blind parallel study. At baseline and after 3 months, plaque scores, bleeding upon pocket probing scores and probing pocket depth (PPD) were assessed. The type of IDB (conical or cylindrical) was randomly assigned to each patient and individual instruction was provided regarding the method of use and the appropriate size. Only those approximal sites that had sufficient space for the IDB were eligible, and for those sites the data were analysed separately. Analyses were performed for all eligible approximal surfaces and a sub-analysis was performed for vestibular and lingual surfaces. *Results:* In total, 51 participants attended the baseline and the 3-month clinical appointments. Overall, there was no difference between conical and cylindrical IDBs. However, the conical IDB showed significantly higher plaque and bleeding scores at the lingual approximal sites. The cause of this difference was an increase in plaque and bleeding scores compared with baseline. With respect to the PPD, no difference between the IDBs was observed. *Conclusion:* Within the limitations of this experiment, the conical IDBs are less effective than cylindrical IDBs with respect to lingual approximal plaque removal. Thus, in patients receiving supportive periodontal therapy, the cylindrical shape should be the first choice of IDB to obtain and maintain gingival health around natural teeth.

**Key words:** bleeding upon probing; interdental brush; plaque index; probing pocket depth

## Introduction

Effective personal oral hygiene performed on a daily basis is not as simple as it may seem. Toothbrushing alone is not enough to prevent gingival inflammation. A meta-analysis by Slot *et al.* (1) showed that based on a synthesis of data from over 10 000 participants, initial plaque scores are reduced by only 42% on average when using a manual toothbrush. More recently, Rosema *et al.* (2) published a study with a similar design involving the synthesis of the effect of a power toothbrush following a single brushing exercise. The authors found a 46% reduction in mean plaque

score. Both papers concluded that there is room for improvement in self-performed plaque control, as toothbrushing fails to provide complete plaque removal. Additionally, Van der Weijden & Slot (3) indicated that plaque removal by toothbrushing alone is insufficient to reach the interproximal areas of teeth. Manufacturers offer several interdental oral hygiene devices, such as dental floss, wood sticks and interdental brushes (IDB), which are often recommended in daily practice.

In a systematic review of the effect of IDB on plaque scores, it was concluded that in combination with toothbrushing, IDB removed more plaque than toothbrushing alone. In addition, IDBs were more effective in removing interdental plaque than dental floss or wood sticks (4). Consequently, for larger interdental spaces, especially those with gingival recession and root exposure, dental floss is not recommended. Instead, the use of an IDB is more appropriate. In a recent meta-review, Sälzer *et al.* (5) summarized and appraised the available evidence in the form of systematic reviews with respect to the efficacy of various interdental devices for mechanical plaque control in managing gingivitis. Moderate evidence was available for the efficacy of IDBs in addition to toothbrushing compared with toothbrushing alone. This corresponded with a 34% reduction in gingivitis and a 32% reduction in plaque scores when standardizing the results retrieved from the use of different indices (6). Currently, the two most common forms of IDBs are cylindrical and conical in shape. Considering that the conically shaped IDB has a smaller volume at the outer end, it is possible that when used only from the buccal side, the lingual side of the approximal areas will receive less mechanical friction to remove the plaque. Few studies have compared these two basic IDB shapes on plaque removal efficacy. However, the outcome would be of substantial interest in everyday practice, where these interdental oral hygiene devices are recommended by the dental care professional. So far, only one study has performed such a comparison (7). In a split-mouth design and a single-use approach, the cleaning ability of the cylindrically and conically shaped IDB was evaluated. The outcome showed no significant difference in the plaque-removing capability of the two IDB shapes in periodontal maintenance care patients.

While IDBs are frequently used by periodontal patients, no long-term studies that specifically evaluated the use of IDBs in individuals attending a supportive periodontal maintenance programme are available. The efficacy of plaque removal and the influence on the maintenance of periodontal health should be assessed in this specific population. Subsequently, the purpose of the present study was to test two basic IDB geometrical shapes (cylindrical or conical) for their plaque removal efficacy and control of periodontal inflammation on buccal and lingual approximal surfaces in periodontal maintenance patients. The hypothesis is that the cylindrical-shaped IDB removes more plaque and better controls the periodontal condition on the buccal and lingual approximal surfaces than a conical-shaped IDB.

## Materials and methods

### Ethical procedures

The study was registered in the Dutch trial register (NTR = 2683). Subject participation in this study was voluntary. Before enrolment, all participants were given oral and written instructions containing information on the products and a description of the purpose of the study. Study duration and possible benefits or possible harms of study participation were also discussed. All participating subjects signed an informed consent form prior to undergoing the study procedures. The study was performed at the Clinic for Periodontology, Rotterdam, The Netherlands. Allocation concealment was managed by the study coordinator.

### Participants

Patients receiving supportive periodontal therapy at the clinic were invited to participate in this study, out of which 60 subjects volunteered. All had been initially treated for periodontitis and had been under a periodontal maintenance care programme (PMC) for at least 1 year. All subjects were ≥18 years old and systemically healthy. Subjects were not allowed to participate in other oral health-related studies during this project.

### Design and clinical procedures

The study was designed as a randomized controlled parallel study. The examiner (HCL) was blinded to the assigned products. All participants were scheduled for three appointments (Fig. 1). The first appointment consisted of a regular PMC performed by a trained and experienced dental hygienist examiner (HCL). During this first appointment, a periodontal examination was performed, which included plaque scores (PS), probing pocket depth (PPD) and bleeding upon probing (BOP) (8). All assessments were performed at six locations around each tooth: disto-vestibular, vestibular, mesio-vestibular, disto-lingual, lingual and mesio-lingual. In the upper and lower jaws separately, the vestibular surfaces were first probed and scored, followed by the lingual surface. Plaque was scored as either present or absent (9). For registration of the plaque score, all teeth were disclosed with G.U.M.® dental disclosing solution d&c red #28 1.5% w/w (Chicago IL). The PPD was measured manually with a conventional Hu-Friedy® pqw probe with Williams markings (Hu-Friedy inc., Leimen, Germany). Additional individualized oral hygiene instructions were given if needed. All teeth received PMC sub- and supragingivally with hand instruments (H6/7, SM 17/18, 1/2, 12/13 11/14 Hu-Friedy® Hu-Friedy inc., Leimen, Germany) and an ultrasonic scaler Satelec® (Merignac, FR) with scaler tips 10z and/or tk1-1s.

After 4 weeks, the second appointment was scheduled, and the type of IDB (conical or cylindrical) was randomly assigned.

The randomization sequence was obtained from true random numbers as generated by www.random.org.

All participants were instructed on the use of their assigned IDBs by the same experienced dental hygienist and were given a brochure explaining IDB use in detail. The English version of this is available in Jan Lindhe's textbook (10). Based on the randomization, the appropriate size IDB was used from the buccal side. Proper use of the IDB was described as six backward and forward motions in each interdental space. Location and suitable size of IDBs were noted for individual instruction on a dental diagram (online appendix S1) and a copy was retained for the study analysis. The sub-

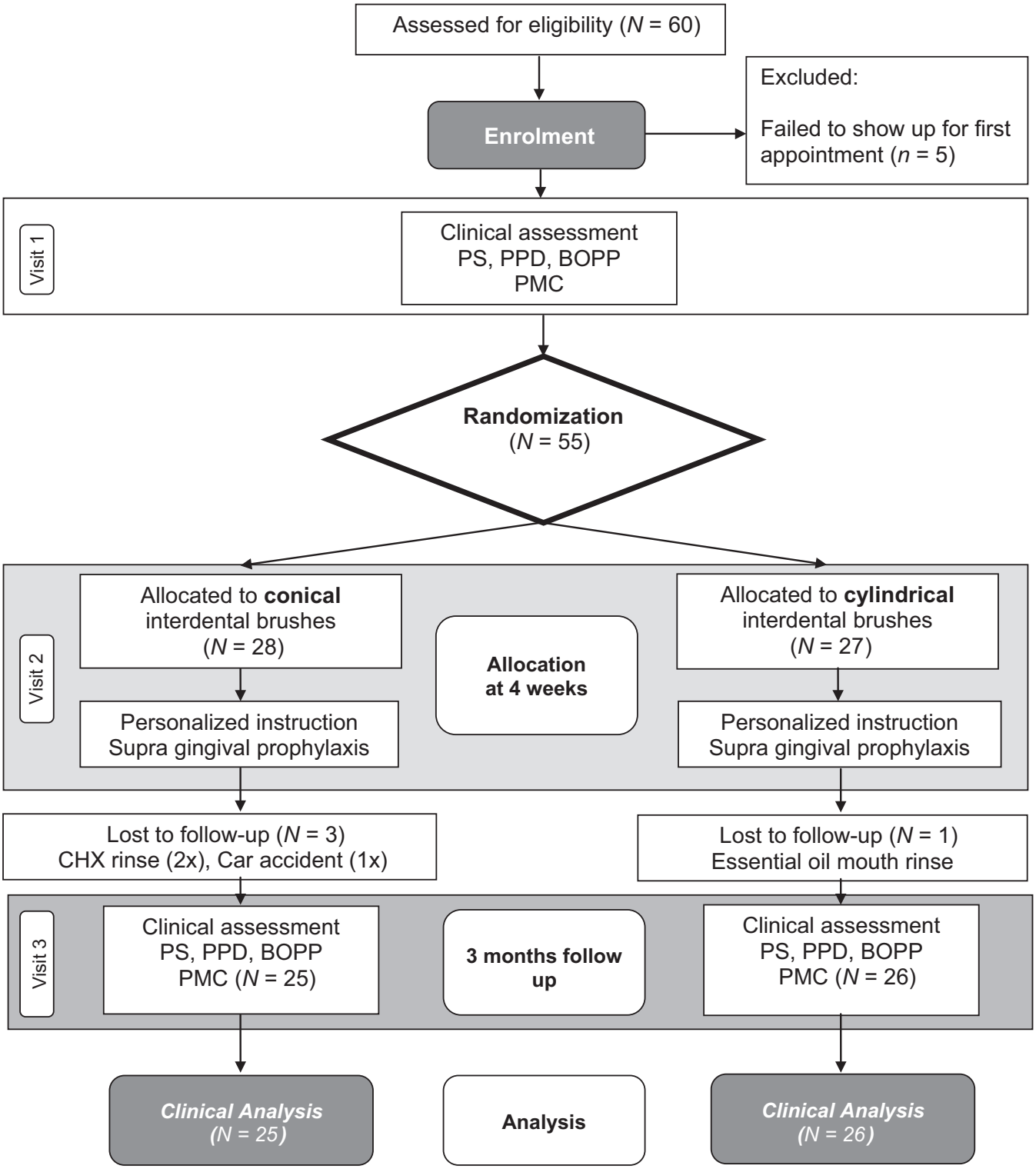


*Fig. 1.* Flow chart depicting subject enrolment and measurements.

jects were instructed to use the IDB for a maximum of 5 days and to replace them earlier if deemed necessary. All subjects received a sufficient number of IDB to last for the study period. Concerning other mechanical oral hygiene measures, the subjects were instructed to continue these according to their regular toothbrushing habits. The additional use of antimicrobial mouth rinses was not allowed during the trial period. After the IDB instruction, the participants received a professional prophylaxis. Participants were instructed not to give any information on their assigned IDB (brushes ranged from 2.5 mm to 12 mm). After 3 months, the subjects returned for their scheduled recall. At this appointment, the same clinical assessments as those conducted during the first visit were repeated by the same blinded examiner (HCL), who was unaware of previous records.

#### Data analysis

The statistical software package SPSS version 22.0 was used to perform the statistical analyses. The individual measurements (six sites per tooth) were summarized within each individual and then analysed. Data from interdental spaces at dental implants were excluded from the analysis. For each group, the mean overall score for plaque, BOP and PPD were calculated and tested among groups at each assessment using the Mann–Whitney U test. Wilcoxon tests were used to determine whether there were significant differences within groups during the study regarding plaque and bleeding scores, and for PPD, paired *t*-tests were used. In addition, analyses were performed for those approximal sites that were found to be accessible to the IDBs. Sub-analyses were performed for approximal surfaces as scored from the buccal and lingual aspects separately. *P*-values ≤0.05 were considered statistically significant.

## Results

Figure 1 presents a flow chart of the outline of this study. Five of the 60 eligible participants failed to show up for their first appointment; subsequently 55 subjects were enrolled. In total, 54 participants completed the study. One subject had to prematurely end the trial after the second appointment due to the complications following a car accident. Three subjects were excluded from the analysis because of protocol violations. Of these, one subject was excluded for using an essential oil mouth rinse and two for using chlorhexidine during the trial period. Table 1 provides the demographics of the subjects such as the mean age, gender distribution, left/right handedness and the prevalence of the use of a power/manual toothbrush. All variables were not significantly different between the groups.

Table 2 shows the mean plaque scores for both groups. The overall effect of the combined use of toothbrushes and interdental cleaning devices depicted in this table as 'ALL' showed no significant difference between groups. This indicates that, on average, a comparable level of overall plaque control was performed by the participants in both groups. Focusing on the approximal surfaces that were suitable for the IDB, no difference between the two groups was found. However, for approximal lingual sites within the conically shaped IDB group (ConIDB), a significant increase was found from baseline to end. In contrast, in the cylindrically shaped IDB group (CylIDB), a significant reduction was found for the approximal lingual surfaces between the baseline and end assessments. Consequently, at the 3-month assessment, there was a significant difference between the groups for the incremental change between baseline and the end of the trial at the approximal lingual sites ($P = 0.004$).

Table 1. **Demographics of participants included in the analysis**

| | | Interdental brushes | | |
|---|---|---|---|---|
| | | Cylindrical, $n = 26$ | Conical, $n = 25$ | *P*-value |
| # Participants baseline (end) | | 27 (26) | 28 (25) | |
| ♀ Female | | 11 | 10 | 0.867* |
| ♂ Male | | 15 | 15 | |
| Age mean year (SD) | | 55.1 (6.7) | 55.7 (6.9) | 0.769† |
| Age range year | | 41–69 | 37–66 | |
| Mean number of suitable interdental spaces for IDB | | 22.12 (3,8) | 19.84 (3,1) | 0.571† |
| Preferred hand | Left | 3 | 5 | 0.406* |
| | Right | 23 | 20 | |
| Toothbrush | Hand | 1 | 0 | 0.322* |
| | Power | 25 | 25 | |

*$Chi^2$ test.
†Independent *T*-Test.

Table 2. **Mean baseline and end trial plaque scores (standard deviation in parenthesis) presented from all tooth surfaces (disto-vestibular, vestibular, mesio-vestibular, disto-lingual, lingual, mesio-lingual) and for those approximal surfaces with sufficient space to allow the use of an IDB, which were separated into vestibular and lingual approximal surfaces. Plaque was scored after disclosing as absent (0) or present (1)**

| Groups | | Baseline | End | Difference |
|---|---|---|---|---|
| (conical) $n = 25$ | All | 0.34 (0.19) | 0.30 (0.14) | −0.05 (0.17) |
| | Approx | 0.44 (0.23) | 0.40 (0.16) | −0.04 (0.20) |
| | Approx vest | 0.41 (0.24) | 0.23 (0.17)* | −0.18 (0.21) |
| | Approx ling | 0.47 (0.24) | 0.57 (0.21)* | +0.09 (0.24)** |
| (cylindrical) $n = 26$ | All | 0.30 (0.17) | 0.21 (0.15)* | −0.09 (0.17) |
| | Approx | 0.41 (0.22) | 0.27 (0.21)* | −0.14 (0.24) |
| | Approx vest | 0.36 (0.23) | 0.23 (0.17) | −0.14 (0.29) |
| | Approx ling | 0.45 (0.24) | 0.31 (0.27)* | −0.14 (0.29)** |

*Significant base-end (within groups) Wilcoxon test ($P < 0.05$).
**Significant difference (between groups) Mann–Whitney *U* test ($P < 0.05$).

Table 3 presents the mean BOP scores for both groups. A significant change between baseline and end was found in approximal surfaces that were suitable for the IDB, and a significant increase of bleeding tendency was observed on approximal lingual sites. No such effect was found for the CylIDB group. This resulted in a significant difference between baseline and end assessments between the groups at the approximal lingual sites.

Mean PPD measurements are presented in Table 4. Neither group exhibited a significant change in time nor were there any significant differences at the baseline and end assessments between the ConIDB and CylIDB groups.

## Discussion

Patient acceptance of daily toothbrushing is high; however, toothbrushes are unable to penetrate intact interdental areas, where periodontal disease is prevalent (11, 12). This necessitates the use of an interdental cleaning device (13). Interdental brushess have been identified as a potential interdental cleansing device.

The ideal geometrical construction of IDB for optimal plaque control is of interest. Therefore, the purpose of this study was to compare the ConIDB versus the CylIDB with respect to the cleansing capacity and the effect on parameters of disease in periodontal maintenance patients. The results showed that the overall plaque removal between the two IDB groups was not significantly reduced between the baseline and end assessments, and as such implied that the overall efficacy of mechanical plaque control (including the use of toothbrushes and interdental oral hygiene devices) was not reduced. The observed difference of the incremental changes between the baseline and end assessments at the approximal lingual surfaces can therefore be attributed to the geometric differences in the shape of the IDB. Within the limitations of this experiment, with respect to approximal lingual plaque removal, ConIDBs are significantly less effective than CylIDBs (incremental difference in plaque score of 23% ($P = 0.004$). Moreover, BOP scores for ConIDBs were significantly increased from baseline (12%), particularly at the lingual aspect of approximal sites. No difference was observed on the vestibular approximal surfaces. The clinical relevance of the observed effect with respect to maintaining periodontal health should be the subject of future long-term studies.

Only one study has also evaluated the efficacy of plaque removal of ConIDBs versus CylIDBs (7). The primary aim was to compare IDB with dental floss. Although significant plaque removal from baseline was documented using both IDB, there were no significant differences between the two different IDB geometric designs. This indicates that both the ConIDB and the CylIDB may have satisfactory cleansing efficacy (7). However, no sub-analyses were performed regarding approximal sites only or separately between the approximal lingual or buccal sites. This statistical methodology may explain why a different outcome was observed when compared with the present study. Additionally, Rösing *et al.* (7) used a split-mouth design, while the present study used a parallel design with a 3-month follow-up. One more important difference was the instruction and the method of use by the participants. The Rösing *et al.* (7) study gave instruction in less than 1 min and stated that no more than 1 min was to be spent on using the devices (for three approximal sites). As presented in the flow chart for the present study (Fig. 1), all subjects received approximately 15 min of personalized instruction, including an individual chart that depicted where to use the IDB, including the diameter of the brush (online appendix S1).

In the past, IDB were available only in large diameters and were thus only suitable for spaces with open embrasures. Most interproximal spaces in anterior teeth are small. Premolars and molars have larger interproximal spaces and are accessible by IDB. The most appropriate IDB must be selected for each individual patient, which is mostly dependent on the size and

Table 3. **Mean baseline and end trial bleeding on probing (BOP) scores (standard deviation in parenthesis) presented from all tooth surfaces (disto-vestibular, vestibular, mesio-vestibular, disto-lingual, lingual, mesio-lingual) and for those approximal surfaces with sufficient space to allow the use of an IDB, which were separated into vestibular and lingual approximal surfaces. BOP was scored as absent (0) or present (1)**

| Groups | | Baseline | End | Difference |
|---|---|---|---|---|
| conical | All | 0.12 (0.10) | 0.15 (0.07) | +0.03 (0.11)** |
| $n = 25$ | Approx | 0.16 (0.14) | 0.21 (010) | +0.05 (0.14)** |
| | Approx vest | 0.12 (0.10) | 0.09 (0.07) | −0.03 (0.10) |
| | Approx ling | 0.21 (0.19) | 0.33 (0.16)* | +0.12 (0.22)** |
| cylindrical | All | 0.16 (0.12) | 0.12 (0.08) | −0.04 (0.12)** |
| $n = 26$ | Approx | 0.20 (0.15) | 0.16 (0.11) | −0.04 (0.15)** |
| | Approx vest | 0.15 (0.12) | 0.10 (0.10) | −0.06 (0.14) |
| | Approx ling | 0.26 (0.19) | 0.22 (0.14) | −0.03 (0.17)** |

*Significant base-end (within groups) Wilcoxon test ($P < 0.05$).
**Significant difference (between groups) Mann–Whitney $U$ test ($P < 0.05$).

Table 4. **Mean baseline and end trial probing pocket depth (PPD) (SD in parenthesis) presented from all tooth surfaces (disto-vestibular, vestibular, mesio-vestibular, disto-lingual, lingual, mesio-lingual) and for those approximal surfaces with sufficient space to allow the use of an IDB, which were separated into vestibular and lingual approximal surfaces**

| Groups | | Baseline | End | Difference |
|---|---|---|---|---|
| cylindrical | All | 2.37 (0.38) | 2.14 (0.24)* | −0.23 (0.36) |
| $n = 25$ | Approx | 2.55 (0.42) | 2.28 (0.27)* | −0.27 (0.40) |
| | Approx vest | 2.48 (0.43) | 2.20 (0.26)* | −0.28 (0.44) |
| | Approx ling | 2.63 (0.44) | 2.37 (0.30)* | −0.26 (0.39) |
| conical | All | 2.40 (0.36) | 2.20 (0.29)* | −0.20 (0.24) |
| $n = 26$ | Approx | 2.60 (0.41) | 2.37 (0.33)* | −0.23 (0.28) |
| | Approx vest | 2.57 (0.38) | 2.34 (0.33)* | −0.23 (0.31) |
| | Approx ling | 2.62 (0.47) | 2.39 (0.35)* | −0.24 (0.29) |

*Significant base-end (within groups) paired $t$-test ($P < 0.05$).

shape of the interdental space as well as the morphology of the proximal tooth surface. Patients require IDBs of various sizes (14). The newer IDBs are available in diameters that can accommodate most embrasures. Interdental brushess are offered on the market with a brush diameter from 1.9 mm up to 14 mm. Therefore, when oral hygiene instruction is given, IDBs should be considered as the product of choice and implemented where possible. Särner *et al.* (15) evaluated the recommendations relating to the use of approximal cleaning aids given by dental hygienists and dentists in a Swedish population. The results revealed that compared with dentists, dental hygienists gave more detailed information about a majority of the aspects that are related to the use of approximal cleaning aids. The use of different approximal cleaning aids on a daily basis varied with respect to age group. Dental floss dominated in the younger age groups and IDB in the two oldest groups. In evaluating the effectiveness of IDBs, they were observed to remove 10% more plaque interdentally then dental floss and toothpicks. In a systematic review, Slot *et al.* (4) found that the majority of retrieved studies presented a positive significant difference in the plaque index when using the IDB compared with floss. The effectives of the IDB was also confirmed in a more recent review (16), in which plaque outcomes were analysed using seven studies, with the IDB demonstrating statistically significant differences to dental floss. Interdental brushess were also found to perform significantly better than floss in reducing interproximal bleeding.

The therapeutic goals for PMC have been described by the AAP (17) in *Parameters on Periodontal Maintenance*, which can be used as a guideline. According to this position paper, the primary goal of PMC is to minimize the recurrence and progression of periodontal disease in patients who have been previously treated for gingivitis and periodontitis. The assessment of personal oral hygiene status is the basis for further treatment. Information that is lacking in making an evidence-based decision is the level of plaque infection that is compatible with the maintenance of periodontal health. Lang & Tonetti (18) suggested that a percentage of tooth surfaces covered by 20–40% of visible plaque might be tolerable in most patients. Patients in a PMC programme in general are patients at risk of periodontal disease, which would indicate that the lower estimate of plaque coverage is possibly the maximum limit for this group. Theilade *et al.* (19) evaluated specific areas or surfaces separately, which showed that the interproximal areas had the highest plaque and gingivitis scores. As a consequence, periodontal disease most commonly develops in interproximal areas (20, 21). Additionally, it was recognized that patients at risk for periodontal disease have a higher prevalence of gingivitis and periodontitis in this interdental area (22). Consequently, in periodontal maintenance patients, the interdental space needs special attention during daily oral hygiene, and it is necessary to use interdental cleaning devices to reach these areas. Oral hygiene reinstruction is a part of PMC and numerous studies have shown that recurrent periodontitis can be prevented or limited by optimal personal oral hygiene. Patients who maintain regular PMC intervals experience less attachment loss and lose fewer teeth than patients who receive less frequent PMC or none at all (23). This indicates that personalized and regular instruction can be important to stabilize periodontal health in periodontally compromised patients. Repeated oral hygiene instruction improves the implementation and adoption of both brushing technique and sequence, thus leading to longer brushing times (24). Recently, Zingler *et al.* (25) noted that patients brushed significantly longer if they used a combination of manual and interdental toothbrushes compared with solely using a manual toothbrush. The interdental brush was used for approximately 50 s.

The original IDBs were developed in a cylindrical shape. Based on this earliest model, new modifications are on the market, such as conical, triangular and diabolo shapes. Inconsistency between the triangular shape of the interdental space between teeth and the IDB results in clotting of the IDB filaments, which prevents the brush from passing through the proximal area smoothly. It was suggested that insertion could be facilitated by using a *triangular-shaped IDB* (26). Such an IDB is basically round, but has three lines of longer bristles. The interdental use of a triangular IDB has only been evaluated *'in vitro'* on extracted human teeth. Compared with a CylIDB, no statistically significant differences were found regarding relative cleaning. However, triangular-shaped IDBs showed significantly lower resistance to insertion values (27). Similar to the diabolo form, a *waist-shaped IDB* exhibits a diameter at the base and tip than in the middle. It has been suggested that it may result in more contact with the teeth at the lingual and buccal line angles when passing through the interproximal area. When retrieved, the bristles might drag out more biofilm at the tooth angles, resulting in a better cleansing effect than that of regular IDB (28). The application of the waist-shaped IDB resulted in significantly lower plaque scores than the use of a straight IDB. This was predominantly due to the greater cleansing effect of the waist-shaped IDB on the buccal and lingual line angles (28). Jordan *et al.* (29) investigated interproximal plaque reduction with an angled IDB compared with a straight interdental brush. Although no significant differences were found in anterior teeth, straight IDB were significantly more effective in posterior teeth when used on vestibular and lingual tooth surfaces. Hotta *et al.* (30) investigated the cyclic fatigue life of the stem of IDBs and showed that angled IDBs had decreased fracture resistance when compared with straight-type IDB. The analysis, which was based on fracture resistance to a bending and loading stress in the interdental brush stem, showed the importance of the mechanical characteristics of the stainless steel wire.

Interdental brushes have been evaluated for effectiveness in interproximal plaque removal. However, limited information about these brushes themselves, such as their physical properties, exists. In addition to the geometric shape, the brush filaments themselves may contribute to the performance of the IDB. However, based on an *'in vitro'* experiment on human teeth, it was concluded that the cleaning efficacy values of soft and hard IDB showed no statistically significant difference (27).The same authors showed that in small, medium and large interdental spaces, increasing brush diameters did result in

higher cleaning efficacy (27). Scanning electron microscopic study of the filaments of fourteen IDB showed that all products had an insufficient finish on the bristle ends. It was suggested that besides having a beneficial effect, IDB may have the potential to damage the periodontal tissues. However, this has not been shown *'in vivo'* (31). Jared *et al.* (32) evaluated the adjunctive effect of a chemical agent with the IDB for plaque and gingivitis reduction and compared this with standard interproximal cleaning devices. The 0.05% cetylpyridinium gel-releasing IDB system did not appear to confer a consistently independent incremental benefit. Recently, Schmidt & Jentsch (33) evaluated a 0.3% CPC-gel, which was applied onto an IDB. The adjunctive use of the gel did not improve plaque scores, indicating that the mechanical action of the IDB is the determining factor in this respect. A small benefit of 3% for marginal bleeding tendency was observed for the CPC-gel. The clinical significance of this deserves further evaluation.

Several limitations can be attributed to the present study design, such as:

**1** This study does not evaluate the effect of IDBs *per se*, but the outcome at the approximal surfaces is the effect of toothbrushing supplemented with the use of IDBs.
**2** Only one brand of IDBs was used.
**3** This study included well-motivated patients regularly attending a periodontal maintenance care programme for at least 1 year.
**4** The IDB were only used from the buccal site while it is also possible that IDBs are used from the oral site.
**5** The participants were instructed to replace the IDBs after 5 days uses or earlier at their convenience. No data were collected in this respect. Neither was the wear of the IDBs scored.

## Conclusion

Within the limitations of this 3-month study, the conical IDBs were less effective than cylindrical IDBs with respect to approximal lingual plaque removal. This resulted in an increase of periodontal inflammation as assessed by BOP and PPD. Thus, in patients receiving supportive periodontal therapy, the cylindrical form should be considered as the first choice of IDB to obtain and maintain gingival health around natural teeth.

## Clinical relevance

### Scientific rationale for the study

For daily interdental cleaning, interdental brushes (IDB) are commonly used and available in different shapes and sizes. The original shape of the IDB was cylindrical; more recently, conically shaped brushes have been introduced.

### Principal findings

There was no difference between cylindrical and conical IDB on overall approximal plaque scores. The cylindrical IDB was more effective on lingual approximal sites regarding plaque and bleeding scores.

### Practical implications

Advising and instructing patients on the use of cylindrical IDBs for daily self-care appears to be the best strategy for cleaning natural teeth in patients undergoing periodontal maintenance care.

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## Conflict of interest and source of funding statement

The authors declare that they have no conflicts of interest. This study was prepared as a part of the obligation of the first author to fulfil the requirements of the ACTA Master's degree programme and was self-funded by the authors and their institutions.

Lactona Europe B.V. provided the products, but had no say in the design or execution of this clinical experiment. They did not have an influence on the reporting and publishing of the findings of this trial.

G.A. van der Weijden is the owner of Jardin B.V., which is the owner of www.ragershop.com, a webshop selling various brands of IDB.

H.C. Larsen and D.S. Barendregt are owners of the Clinic for Periodontology Rotterdam. Their website also has a shop for interdental brushes.

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## Supporting information

Additional supporting information may be found in the online version of this article:

**Appendix S1.** Individual instruction dental diagram for IDBs.