Christian Graetz, Pia Westphal, Miriam Cyris, Johanna Rabe, Antje Geiken, Christof E. Dörfer, Sonja Sälzer

# Instruction on interdental cleaning – a survey among dental professionals

**Introduction:** Instruction on interdental cleaning at home (IC) is daily routine in the dental practice and mostly performed by dental professionals (DP). Recently published S3-guidelines (AWMF: 083–022/083–043) describe, among other things, the need and extent of patient-specific instructions on IC. However, since little evidence is available up to date regarding the DP's recommendations to patients on IC or data on the level of knowledge of German DPs about IC, an exploratory survey study was initiated.

**Methods:** At 2 evaluation time points in 2018 and 2021 (during and after the publication of guideline AWMF: 083–022/083–043), dental professionals with (DP+) and without (DP–) certified education in dental hygiene were surveyed at 3 German dental training institutes using an anonymized and validated online questionnaire (unipark.com, Tivian XI GmbH, Cologne, Germany). The probands answered 11 questions regarding personal details (including age, professional degree/experience, personal IC habits), the recommendations according to IC (including devices such as interdental brush/floss and additional use of toothpaste or interdental gel together with the IC devices), and the basis for their recommendations. The results were analyzed mainly descriptively.

**Results:** In total, 89 DPs participated in 2018 (DP–/DP+: 68/21) and 109 DPs in 2021 (DP–/DP+: 59/50), 2021 with a higher DP+ rate (p = 0.006). At both evaluation times, DP+ were more likely (2018/2021: 62 %/64 %) to report following scientific recommendations than DP– (2018/2021: 27 %/41 %). At the first evaluation date, 78 % of all DPs (2021: 73 %) reported recommending IC devices they themselves perceived as effective. Patient preferences were considered by DP+ 24 % in 2018 and 36 % in 2021. DP– considered patient preferences in 54 % (2018) and 39 % (2021). DPs predominantly reported to use interdental brushes (2018/2021: 75 %/77 %) and floss (2018/2021: 78 %/84 %) as their personal IC devices. A majority of DPs also recommended both devices in 2018/2021 with 99 %/95 % for interdental brushes and 75 %/78 % for floss.

**Discussion:** Despite the small number and special selection of DPs, the results of the exploratory survey study suggest that a basic knowledge of IC is present in all groups of DPs. The DPs surveyed were more likely to consider the self-perceived efficacy of IC devices than patient preferences or evidence-based recommendations, regardless of their level of certification.

**Conclusion:** The results suggest that there is a need for more intensive coaching of DPs regarding evidence-based and patient-specific instruction on IC at home.

**Keywords:** dental hygienist; dental professional; instruction; interdental cleaning at home

Clinic of Conservative Dentistry and Periodontology, University hospital Schleswig-Holstein, Kiel, Germany: Prof. Dr. Christian Graetz*, Pia Westphal*, Dr. Miriam Cyris, Johanna Rabe, Dr. Antje Geiken, Prof. Dr. Christof E. Dörfer, Dr. Sonja Sälzer
* Joint authorship
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## Introduction

The Fifth German Oral Health Survey (DMS V) shows that awareness of one's own teeth and oral hygiene has evolved among younger adults (35- to 44-year-olds) and younger seniors (65- to 74-year-olds), and the use of home oral hygiene products has steadily increased since 1997 [9]. On the other hand, half (52%) of younger adults and 65% of younger seniors have periodontal diseases. Based on scientific studies, it can be suspected that especially interdental tooth surfaces are predisposed to caries and periodontitis and are not adequately cleaned by the single use of a toothbrush [11]. Therefore, various complementary aids and techniques have been described in addition to brushing teeth with a toothbrush alone, ranging from simple toothpicks with a triangular cross-section to complex oral irrigators with a pulsating cleaning jet [13]. According to a systematic research, dental floss and various forms of interdental brushes (IDB) have the highest prevalence worldwide [11]. In contrast, national DMS V data show that younger adults are predominantly using floss (48.7%) and only 16.5% are using IDBs. In the younger senior age group, 29.1% are more likely to use ID brushes than floss (23.1%) [9]. Based on this difference in the usage behavior of the 2 age groups, it can already be seen that the instruction of the interdental cleaning devices must be individualized to the patient [5]. Generalizations, as occasionally seen in advertisements, and unscientific claims about the cleaning effect of interdental cleaning devices lead to uncertainty among all parties involved. Particularly with regard to the aspect of cleaning effectiveness, however, the often necessary reference to a lack of evidence must not be equated with a lack of effectiveness of the products. In general, the treatment of patients should not only be individualized but also evidence-based, taking into account the following three principles: (1.) the experience of the practitioner (internal evidence), (2.) patient preferences, and (3.) the current state of clinical research (external evidence). According to current guidelines, methods and interdental cleaning devices should always be selected according to the patient's skills and preferences, which is the only way to ensure patient acceptance of long-term use [14]. Consequently, a patient-specific optimal solution does not always have to be in accordance with general scientific findings, such as those found in systematic reviews. Since interdental cleaning (IC) involves additional effort for patients, explaining the need for IC is also a key aspect that must be communicated during patient instruction. In addition, each patient-specific decision should be adjustable. For an optimal cleaning result and to avoid trauma due to improper use of the interdental cleaning devices, individual instructions and adaptations to the respective situation must be provided on an ongoing basis. This requires qualified and empathetic dental professionals who select and adapt the appropriate oral cleaning devices together with the patients [5]. Both S3-guidelines "Home mechanical biofilm management in the prevention and treatment of gingivitis" (AWMF: 083-022) and "The treatment of periodontitis stage I–III" (AWMF: 083-043) contain scientifically based recommendations for the specific selection and use of devices for IC. However, the authors are not aware of any studies addressing the knowledge and familiarity of the above-mentioned guidelines as well as the understanding of the specific recommendations of the instructing dental professionals ((DP) qualified as: dental assistant (DA), dental prophylaxis assistant (DPA) and dental hygienist (DH)) in Germany. Therefore, the aim of this questionnaire-based study is to elicit the recommendation behavior of this group of persons regarding IC.

## Material and methods

The present scientific survey was conducted at 3 German dental training institutes, in Kiel, Bremen, and Karlsruhe, in 2018 (1. EV) from March to September, with the implementation of the S3-guideline (AWMF: 083-022), and in 2021 (2. EV) from July to December, with the amendment of the S3-guideline (AWMF: 083-022) and the publication of the S3-guideline "The treatment of periodontitis stage I–III" (AWMF: 083-043). DPs with and without certified education in dental hygiene were surveyed. Participants were made aware of the survey by notices with QR codes (linked questionnaires) in the training institutes. The inclusion criteria were 1. completed professional training as a dental assistant in Germany, 2. minimum age of 18 years, 3. understanding of the German language, and 4. own internet-enabled device to access the online questionnaire. Participants were excluded if they did not fulfill one or more of the above-mentioned 4 items.

To answer the question about the extent to which DPs' continuing education influences recommendations and use of IC devices, participants were divided into DPs who had completed certified prophylaxis continuing education (DP+), which includes DPAs and DHs, and DPs without such continuing education (DP–).

A written consent in compliance with the actual German General Data Protection Regulation was required to participate. A positive vote of the ethics committee of the medical faculty of Kiel University was available for the questionnaire-based study (FN: D 411/18).

### Questionnaire

The online survey and documentation of responses were performed using Unipark software (unipark.com, Tivian XI GmbH, Cologne, Germany). 21 DPs, employed at the Clinic for Dental Conservation and Periodontology at the University Hospital Schleswig-Holstein, Campus Kiel, validated the digital questionnaire in the period from January to February 2018.

The participants were able to open the questionnaire with a computer or mobile device via QR code or URL in the web browser and answer it anonymously. In total, the questionnaire consists of 11 items. The first 3 items refer to the subjects' professional background (highest certified advanced/further education), age, and work experience. The other items refer to the personal IC, the basis for recommending specific home IC devices, and the recommendations to patients regarding their home IC, such as the criteria for selecting a specific IC device or regarding additional application of toothpaste or interdental gel

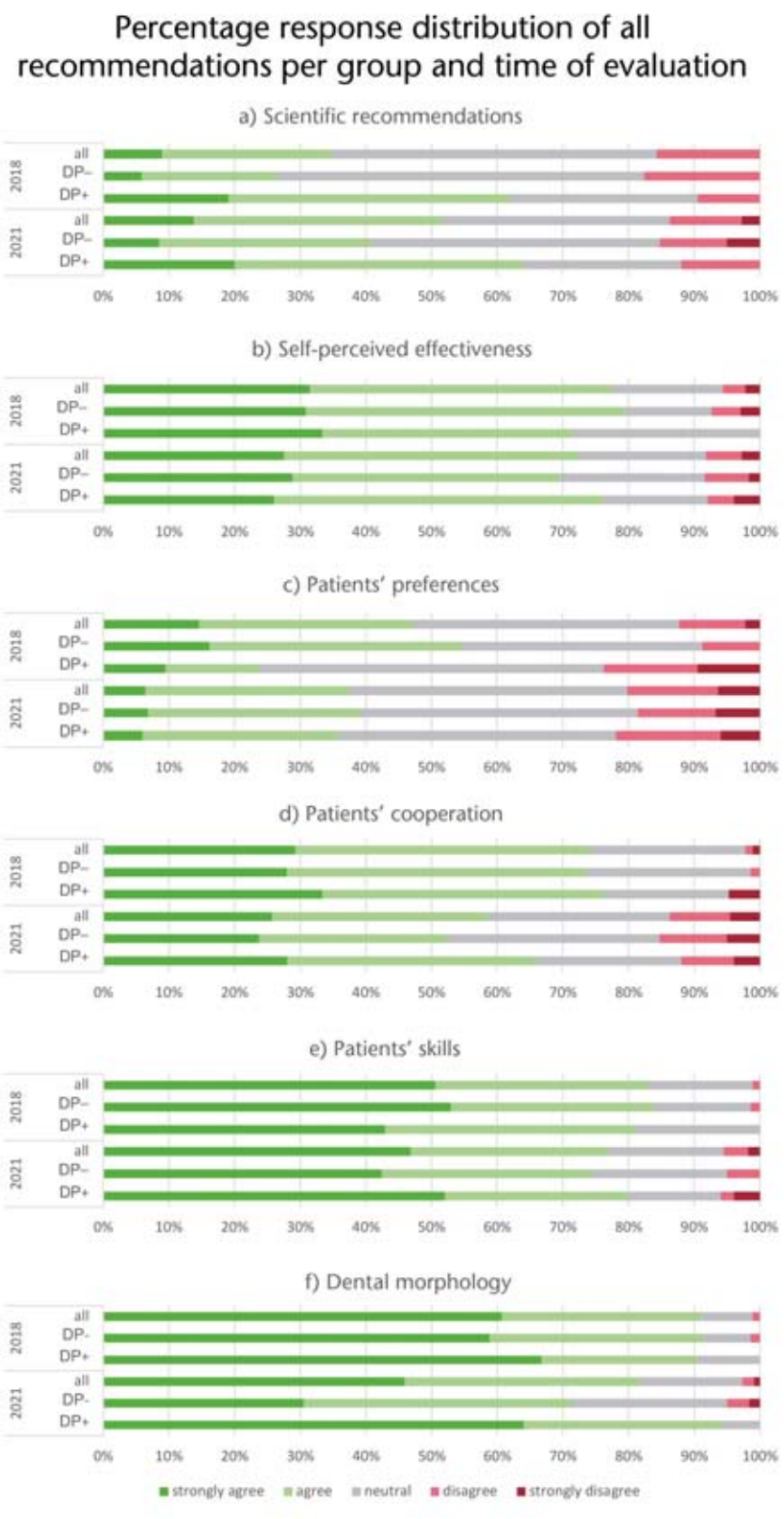


Fig 1: C. Graetz

**Figure 1** Percentage response distribution of all recommendations per group and time of evaluation.

Percentage distribution of the subjects in relation to the recommendation basis (Likert items) (a) scientific recommendations, (b) self-perceived effectiveness of the interdental cleaning devices, (c) patients' preferences, (d) patients' cooperation, (e) patients' skills, and (f) dental morphology, divided according to the evaluation in 2018 and 2021 and education in dental hygiene (DP+: dental professionals with certified education in dental hygiene; DP–: dental professionals without certified education in dental hygiene).

to the IC devices. The use and recommendation of IC devices was recorded dichotomously (0/1), whereas the basis for recommendations was recorded using Likert items (1–5: strongly agree to strongly disagree).

## Statistics

Data analysis was performed using IBM SPSS Statistics version 28.0.1.1 (14) statistical software. In addition to a primarily descriptive analysis, a comparison was made between the 2 evaluation time points and groups of DPs using the nonparametric Mann-Whitney U test. When more than 2 groups were compared, the Kruskall-Wallis test was used. Correlations between participant-specific variables and between recommendations or bases for recommendations were tested using the Kendall-Tau correlation and Phi correlation. All tests were 2-sided with a significance level of $p < 0.05$, correcting for multiple responses using the Bonferroni method.

## Results

A total of 361 participants took part, with a response rate of 45.9 % (89/194) in 2018 and 65.3 % (109/167) in 2021 with complete responses to all questions (Table 1).

## Demographic results

There were 18 out of the 89 participants in 2018 who reported DPA and 3 who reported DH as their certification. In 2021, of 109 DPs, 35 indicated DPA and 15 indicated DH as their certification. There were significant differences between the DP+ and DP– divided both by evaluation time point and between evaluation time points (Table 1). Similarly, there was a statistically significant younger mean age of all participants for 2018 than 2021 ($p = 0.022$), although the reported work experience at both evaluation times (2018 and 2021) was not statistically significantly different ($p = 0.332$). In 2018, the age structure of DP– and DP+ was the same, but at the second evaluation, DP– were younger than DP+ (2018/2021: $p = 0.145$/$p = 0.029$). Work experience data in 2018 were identical ($p = 0.476$), whereas DP+ noted longer work experience than DP– for 2021 ($p = 0.005$) (Tab. 1).

## Personal interdental cleaning of dental professionals surveyed

The majority of participants reported to use dental floss (78%; DP–/DP+: 79%/71%) and IDB (75%; DP–/DP+: 75%/76%) in 2018. As shown in Table 2, 55% used them daily (DP–/DP+: 54%/57%), mostly in the evening (85%; DP–/DP+: 90%/71%), and mostly without additional toothpaste or interdental gel (76%; DP–/DP+: 75%/81%). In 2021, using dental floss was also reported for personal IC by 84% (DP–/DP+: 86%/80%) and for IDB by 77% (DP–/DP+: 76%/78%). Again, 62% used them daily (DP–/DP+: 58%/68%), mostly in the evening (83%; DP–/DP+: 85%/80%), and mostly without additional toothpaste or interdental gel (79%; DP–/DP+: 78%/80%). Using IC devices together with toothpaste was reported by 16% (DP–/DP+: 15%/19%) of all DPs in 2018 and 17% (DP–/DP+: 17%/16%) in 2021.

## Dental professionals' bases of recommendation for interdental care

As shown in Figure 1a), DP+ were significantly more likely than DP– (27%/41%) to report the following scientific recommendations at both evaluation time points (2018/2021) (p = 0.003/p = 0.016).

The number of DPs who based their IC devices selection on dental morphology (2018 vs. 2021 DP/DP–/DP+: 91%/91%/91% vs. 82%/71%/94%), patient's skills (2018 vs. 2021 DP/DP–/DP+: 83%/84%/81% vs. 77%/75%/80%) and patient's cooperation (2018 vs. 2021 DP/DP–/DP+: 74%/74%/ 76% vs. 59%/53%/66%) decreased between both evaluation time points. At the first evaluation time point (2018), slightly more participants reported using the self-perceived effectiveness of IC devices on their own teeth as a basis for recommendation, with 78% of all DPs vs. 73% in 2021 (2018 vs. 2021 DP–/DP+: 79%/71% vs. 70%/76%) (Fig. 1). A correlation shows a significant relationship between the statement to recommend a specific IC device based on patients' cooperation and advanced training to become a certified DH (r = –0.136; p = 0.038). No significant difference was found between the DP– and DP+ groups when considering patients' preferences in recommendation behavior (p = 0.098). Figure 2 shows the percentage distribution of the participants with respect to individual recommendation bases.

| Evaluation time point | 2018 (1. EV) | 2021 (2. EV) | p-value |
|---|---|---|---|
| **Participants** | **100 % [89]** | **100 % [109]** | |
| Highest professional degree in the dental sector/highest certified further education | | | |
| **DP–** | 76.4 % [68] | 54.1 % [59] | 0.018* |
| **DP+** | 23.6 % [21] | 45.9 % [50] | 0.006* |
| **p-value** | 0.006* | 0.006* | |
| **Age** | | | |
| **MW ± SD [range] in years** | 31.49 ± 9.12 [21–56] | 34.76 ± 10,30 [18–62] | 0.022 |
| **DP–** | 29.99 ± 7.64 [21–51] | 32.25 ± 9,712 [18–62] | 1.000* |
| **DP+** | 36.38 ± 11.71 [21–56] | 37.72 ± 10,28 [23–59] | 1.000* |
| **p-value** | 0.145* | 0.029* | |
| **Work experience** | | | |
| **MW ± SD [range] in years** | 13.28 ± 8.95 [3–40] | 15.10 ± 10.55 [2–46] | 0.332 |
| **DP–** | 11.93 ± 7.52 [4–36] | 12.36 ± 9.58 [2–46] | 1.000* |
| **DP+** | 17.67 ± 11.71 [3–40] | 18.34 ± 10.89 [4–43] | 1.000* |
| **p-value** | 0.476* | 0.005* | |

**Table 1** Demographic data per evaluation time point in 2018 versus 2021 (number [N], mean ± standard deviation [range]).
MW: mean; SD: standard deviation; 1. EV: first evaluation time point; 2. EV: second evaluation time point; DP+: dental professionals with certified education in dental hygiene; DP–: dental professionals without certified education in dental hygiene

## Specific recommendations on interdental care by dental professionals

At both evaluation time points, the most frequent answers to which IC devices participants recommend were dental floss with 75%/78% (2018 vs. 2021 DP–/DP+: 77%/71% vs. 85%/70%) and IDB even with 99%/95% (2018 vs. 2021 DP–/DP+: 99%/100% vs. 93%/98%). The rubber interdental bristles were recommended by 25% of all participants. Applying toothpaste to the IC device was mentioned slightly less frequently as a recommendation in 2021 (22%; DP–/DP+ 24%/20%) than in 2018 (26%; DP–/DP+: 28%/19%). Of all participants who recommended this combination, less than 10% (2018 vs. 2021 DP/DP–/DP+: 9%/9%/10% vs. 9%/7%/10%) reported following scientific recommendations at both evaluation time points. In the DP+ group, there was a significant correlation between using and recommending dental floss (2018/2021: r = 0.533; p = 0.015/r = 0.546; p < 0.001). Moreover, in both groups, DP– and DP+, at both evaluation time points, there was a significant correlation between personal use of IC devices to-

gether with toothpaste and recommending it to patients (2018 DP–: r = 0.547; p < 0.001, 2018 DP+: r = 1.000; p < 0.001, 2021 DP–: r = 0.704; p < 0.001, 2021 DP+: r = 0.736; p < 0.001).

## Discussion

The present results show that a majority of the surveyed DPs, with or without certified further education and training in dental prophylaxis, have basic knowledge of various IC devices and their applications. In addition, it seems that the personal usage of IC devices of the surveyed DPs, despite further education, is the basis for the IC recommendations. Patient-specific factors or scientific evidence were given secondary consideration. Regardless of the evaluation time point, only 47 % of DP– and 32 % of DP+ considered patients' preferences when making recommendations (DP– vs. DP+: p = 0.098), which can influence patients' cooperation. However, the results of this study show that there is a significant relationship between specialization to DH and participants' decision to consider patients' cooperation as a basis for recommendations. Individualized recommendations are crucial when the prevention of oral diseases such as caries, gingivitis, and periodontitis is the focus. Only if the motivation and instruction of the patients is individually adapted to multiple parameters (e.g. age, periodontal health status) and needs (e.g. limited motor skills, fixed orthodontic appliances) of the patients, a long-term acceptance for regular home IC can be expected. The basic prerequisite for this is patient loyalty and education on the causes of periodontal diseases and caries as well as the various options for therapy and prevention, which must be individually adapted to the patients' understanding [8, 12], for example, supported by illustrations or videos. If, during the evaluation, it becomes clinically apparent that the home IC is not performed adequately or the patients report a lack of or difficulty in using the IC devices, the primary recommendation should be adapted to the patients' current situation. Complementary to this conventional instruction in dental practice, due to the increased use of digital media (e.g., smartphones) in all age groups, it is conceivable that these can be used to guide oral hygiene at home, as described by Günay et al. [7]. To be successful in the long term in the context of patient-centered dentistry, any recommendations on home oral hygiene should be properly communicated [15]. Patients should be treated with equal respect and should be "met on an equal footing" (e.g., according to the principle of Participatory Decision Making [17]). Instructions should not be given "top-down" [5]. In addition, according to the principle of evidence-based dentistry, the primary recommendation should be evaluated after implementation regarding clinical success and adjusted if necessary (evidence-based decision making). However, when considering the recommendations for the selection of specific IC devices based on current scientific studies, the available study results show some contradictions. For the prevention and treatment of gingivitis and periodontitis, respectively, size-adapted IDB, as opposed to dental floss, are recommended as first choice for IC[1]. When the point of contact between adjacent teeth is tight with open interdental spaces, as after attachment loss, flossing is not very effective in biofilm management due to the concave root surfaces below the cemento-enamel junction (CEJ) [3]. Due to a higher potential for trauma, e.g., as a result of a tight point of contact and thus increased force [2], flossing may even be contraindicated. However, the surveyed participants favored dental floss and IDB equally often over all other IC devices in their recommendations, regardless of their qualification and time of evaluation (Tab. 2). Evidence-based dental floss, as well as rubber interdental bristles, dental woodsticks or oral irrigators, are only recommended for interdental space morphology if it is not possible to clean with IDB[1]. Therefore, the present questionnaire study specifically asked DPs about the newer group of rubber interdental bristles, which, according to Abouassi et al. [1], have a higher patient acceptance and, according to the present results, are already recommended as an alternative by 25 % of the participants. On the other hand, van der Weijden et al. [16] found only very weak evidence of rubber interdental bristles for gingivitis and plaque reduction in their recent meta-analysis among gingivitis patients.

This is possibly due to the reduced cleaning effectiveness, which is inherent to the functional design of the IC device, in contrast to the IDB with metal core [6]. The use of nylon bristles of conventional IDB with the possibility of cleaning even concave interdental surfaces can be clearly mentioned as an advantage here. However, these bristles must be fixed with a metal core, which often leads to discomfort, trauma to the soft tissues or bending. This can only be prevented by intensive training of the DPs on the necessity and scope of structured instruction and motivation with adaptation of the correct IC device and its correct size to the individual patient's situations and preferences. Although approximately 44 % of all participants in the current study reported evidence-based findings as the basis for their recommendations to patients, more efforts need to be made to make the basis of decision-making less dependent on personal perception (approximately 75 % of all participants).

For example, flossing is difficult for many people, as it requires some fine motor skills in the fingers and also an understanding of how to use it and how it works [5]. Therefore, it is often not used correctly by patients [18], since in the layman's perception a single snap through the contact point is sufficient to remove food debris, but this does not succeed in removing biofilm. However, many of the surveyed participants seem to be aware of this misunderstanding, since although they themselves use dental floss as the IC device of first choice (approx. 70–80 % of all participants), they recommend IDB to their patients in 90–100 %. If flossing is still pre-

[1] S3-Leitlinie „Die Behandlung von Parodontitis Stadium I bis III, AWMF 083-043"; S3-Leitlinie „Häusliches mechanisches Biofilmmanagement in der Prävention und Therapie der Gingivitis", AWMF 083-022

| Evaluation time point | 2018 (1. EV) | 2021 (2. EV) |
|---|---|---|
| **Do you use interdental cleaning devices?** | | |
| Daily | 55.1 % [49] | 62.4 % [68] |
| Every second day | 29.2 % [26] | 31.2 % [34] |
| Once per week | 12.4 % [11] | 6.4 % [7] |
| Once per month | 3.4 % [3] | 0.0 % [0] |
| **When do you use interdental cleaning devices?** | | |
| Predominantly in the morning | 19.1 % [17] | 21.1 % [23] |
| Predominantly at noon | 3.4 % [3] | 1.8 % [2] |
| Predominantly in the evening | 85.4 % [76] | 82.6 % [90] |
| Only in combination with a toothbrush | 33.7 % [30] | 34.9 % [38] |
| **If you use an interdental cleaning product, which one do you use regularly?** | | |
| Dental floss | 77.5 % [69] | 83.5 % [91] |
| Interdental brushes | 75.3 % [67] | 77.1 % [84] |
| Wood sticks | 0.0 % [0] | 0.9 % [1] |
| Rubber interdental bristles (e.g. TePe EasyPicks, Gum Softpicks Advanced) | 13.5 % [12] | 15.6 % [17] |
| Oral irrigator | 2.2 % [2] | 0.9 % [1] |
| **Do you use additional products?** | | |
| I use interdental cleaning devices together with toothpaste (you apply toothpaste to the interdental cleaning device). | 15.7 % [14] | 16.5 % [18] |
| I use interdental cleaning devices together with interdental gel (you apply interdental gel to the interdental cleaning device). | 5.6 % [5] | 6.4 % [7] |
| I use interdental cleaning devices without additional products. | 76.4 % [68] | 78.9 % [86] |
| **Which interdental cleaning devices do you recommend to your patients?** | | |
| Dental floss | 75.3 % [67] | 78.0 % [85] |
| Interdental brushes | 98.9 % [88] | 95.4 % [104] |
| Wood sticks | 0.0 % [0] | 0.0 % [0] |
| Rubber interdental bristles (e.g. TePe EasyPicks, Gum Softpicks Advanced) | 23.6 % [21] | 26.6 % [29] |
| Oral irrigator | 3.4 % [3] | 5.5 % [6] |
| **Do you recommend additional products?** I recommend my patients to use interdental cleaning devices | | |
| together with toothpaste. | 25.8 % [23] | 22.0 % [24] |
| together with interdental gel. | 32.6 % [29] | 20.2 % [22] |
| without additional products. | 55.1 % [49] | 75.2 % [82] |
| **At what time/occasion do you recommend the use of interdental cleaning devices to your patients?** | | |
| Always in the morning | 6.7 % [6] | 18.3 % [20] |
| Always at noon | 2.2 % [2] | 2.8 % [3] |
| Always in the evening | 84.3 % [75] | 78.9 % [86] |
| Only in combination with a toothbrush | 21.3 % [19] | 21.1 % [23] |

**Table 2** Specific results per evaluation time point in 2018 versus 2021 (number [N]).
1. EV: first evaluation time point; 2. EV: second evaluation time point

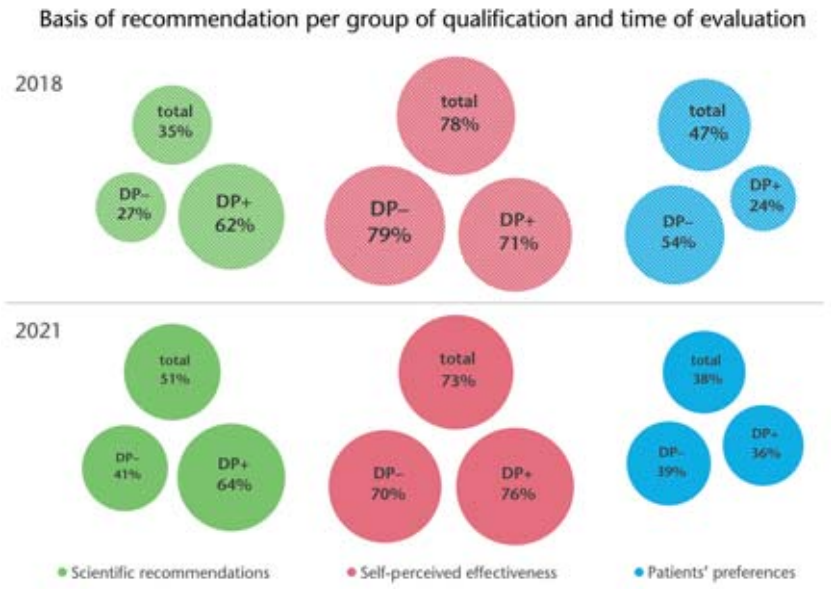


Fig. 2: C. Graetz

**Figure 2** Basis of recommendation per group of qualification and time of evaluation. Percentage distribution of participants regarding their recommendation basis of scientific recommendations, self-perceived effectiveness of interdental cleaning devices, and patients' preferences, based on the Likert items. Divided according to the evaluation time points 2018 (hatched) and 2021 (filled) (DP+: dental professionals with certified education in dental hygiene; DP–: dental professionals without certified education in dental hygiene)

ferred, floss holders can be an alternative. By facilitating their use, they help patients get used to regular IC and possibly better understand the actual benefits of the IC at home [10].

On the other hand, the outcome of patient-side recommendations or personal use of mechanical IC devices together with toothpastes must be critically questioned. Overall, almost 16 % of all participants in the survey stated that they use IC devices with additionally applied toothpaste and approximately 24 % also recommended this to their patients. This is not in line with the guidelines, since the abrasive cleaning agents often contained in toothpastes must be assumed to cause greater destruction of the interdental tooth structure. This applies to areas below the CEJ, as the root cementum and dentin are less hard than the enamel above the CEJ. Therefore, if only areas above the CEJ are touched by mechanical IC devices, a low risk of tooth structure damage can be assumed. However, even here, due to the firmer structure of IDB with metal wire, the additional use of abrasive toothpastes may have an increased destructive effect. If a complementary chemo-preventive effect is desired, then non-abrasive interdental gels can be recommended, which simultaneously help to reduce frictional resistance [4]. This was recommended by about 33 % of the participants (Table 2). To avoid risks of trauma due to lack of knowledge of the abrasiveness of the complementary product, guideline-simplified recommendations were made to reject the use of toothpaste altogether for any mechanical IC.

However, the results on the use/recommendation behavior of the studied cohort also raise the question of how well understandable and applicable such evidence-based guideline recommendations are. About 9 % of all participants who additionally recommended toothpastes with IC devices stated that they followed scientific recommendations. There is certainly a need for further improvement in the establishment and transfer of evidence-based knowledge into dental practice. It can also be noted that a higher professional qualification, which includes appropriate content of individual guidance on the instruction, motivation and techniques of IC, does not seem to change the personal IC of the DHs and DPAs surveyed and is comparable to the IC of DPs without appropriate further training. This can be interpreted to mean that if the practice team is appropriately instructed and motivated in home oral hygiene, even DVs without certified continuing education and training can provide individualized fitting of IC devices and patient instruction as part of the delegation, provided the staff is aware of and familiar with the guidelines.

For this, it proves useful to conduct regular training on oral hygiene instruction within the practice team. From 2018 to 2021, the proportion of participants without certified further education and training who made recommendations on IC based on scientific evidence increased by about one third (from 27 % to 41 %). This potential should be considered when it comes to transferring scientific knowledge into practice in a comprehensible way. It can also certainly help to ease the current high demand for trained dental assistants (e.g., in the context of the new German periodontal treatment directive from 2021). Instead of relying on non-specialist staff who do not know the patient-specific situation (e.g., in pharmacies), the authors suppose that it is a better alternative to have dental assistants recommending IC devices.

## Limitations of the study

One of the limitations of this 2-part online survey study was that it was not a longitudinal study in which the same participants were interviewed at both time points. Thus, for the present study, it is not possible to determine whether study participants who were surveyed in 2018 also participated in 2021. On the other hand, by means of the data management (IP addresses supported) of the survey software used, repeat participation of individuals at the evaluation times in 2018 and 2021 could be excluded. Another point that limits the possibility of generalizing the study results is the limited number of participants, which results from the selective choice from the 3 dental training institutes. This could also explain why more DP+ participated in 2021 than

in 2018. On the other hand, the cooperation with the dental training institutes made it possible to respond to any queries on site. Future studies with larger cohorts should be able to overcome these limitations with findings from online education during the Corona pandemic.

## Conclusion

The own application behavior of the surveyed dental assistants seems to be the main basis for the given IC recommendations, despite continuing education with evidence-based knowledge transfer. The influence on the recommendation behavior of the instructing professionals by recommendations of guidelines even 3 years after their publication is not visible. Since, on the one hand, both patient-specific factors and scientific findings were only given secondary consideration by all participants, irrespective of further training in the field of prophylaxis, efforts must be made to improve the knowledge of all dental professionals (externally). On the other hand, after appropriate guidance and training (internal), dental professionals can also take over the instruction and motivation of IC as part of the delegation.

## Conflict of interest

Prof. Dörfer conducts third-party funded oral hygiene studies with various auxiliaries. He is a member of the international scientific advisory board of P&G and gives educational lectures funded by P&G.

The other authors declare that there is no conflict of interest.

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### References

1. Abouassi T, Woelber JP, Holst K et al.: Clinical efficacy and patients' acceptance of a rubber interdental bristle. A randomized controlled trial. Clin Oral Investig 2014; 18: 1873–80.

2. Dörfer CE: Kontaktflächenpassage verschiedener handelsüblicher Zahnseiden in vitro. Dtsch Zahnärztl Z 1995; 50: 316–319.

3. Dörfer CE, Stückgen D, Cheung F: Häufigkeit und Morphologie von Wurzeleinziehungen. Dtsch Zahnärztl Z 2000; 55: 257–263.

4. Graetz C, Härdter A-K, Schorr S et al.: The influence of artificial saliva on the cleaning force of interdental rubber picks: an in-vitro comparison. BMC Oral Health 2022; 22: 459.

5. Graetz C, Sälzer S: Häusliche mechanische Mundhygiene 2020 – Mythen- oder Faktenbasiert? Zahnmedizin up2date 2020; 8: 284–297.

6. Graetz C, Schoepke K, Rabe J et al.: In vitro comparison of cleaning efficacy and force of cylindric interdental brush versus an interdental rubber pick. BMC Oral Health 2021; 21: 194.

7. Günay H, Diedrich N, Meyer-Wübbold K: Selbstkontrolle durch einen digitalen Abakus zur Verbesserung der häuslichen Mundhygiene. DZZ 2022.

8. Jepsen S, Blanco J, Buchalla W et al.: Prevention and control of dental caries and periodontal diseases at individual and population level: consensus report of group 3 of joint EFP/ORCA workshop on the boundaries between caries and periodontal diseases. J Clin Periodontol 2017; 44 Suppl 18: S85–S93.

9. Jordan AR, Micheelis W: Fünfte Deutsche Mundgesundheitsstudie (DMS V). IDZ Materialienreihe Band 35. 2016, Köln: Deutscher Ärzte-Verlag.

10. Ng E, Lim LP: An overview of different interdental cleaning aids and their effectiveness. Dent J (Basel) 2019; 7.

11. Salzer S, Slot DE, Van der Weijden FA, Dorfer CE: Efficacy of inter-dental mechanical plaque control in managing gingivitis – a meta-review. J Clin Periodontol 2015; 42 Suppl 16: S92–105.

12. Sanz M, Herrera D, Kebschull M et al.: Treatment of stage I–III periodontitis – the EFP S3 level clinical practice guideline. J Clin Periodontol 2020; 47 Suppl 22: 4–60.

13. Stauff I, Derman S, Barbe AG et al.: Efficacy and acceptance of a high-velocity microdroplet device for interdental cleaning in gingivitis patients – a monitored, randomized controlled trial. Int J Dent Hyg 2018; 16: e31–e37.

14. Steenackers K, Vijt J, Leroy R, De Vree H, De Boever JA: Short-term clinical study comparing supragingival plaque removal and gingival bleeding reduction of the Philips Jordan HP735 to a manual toothbrush in periodontal patients in a maintenance program. J Clin Dent 2001; 12: 17–20.

15. Tonetti MS, Eickholz P, Loos BG et al.: Principles in prevention of periodontal diseases: consensus report of group 1 of the 11th European Workshop on Periodontology on effective prevention of periodontal and peri-implant diseases. J Clin Periodontol 2015; 42 Suppl 16: S5–11.

16. van der Weijden F, Slot DE, van der Sluijs E, Hennequin-Hoenderdos NL: The efficacy of a rubber bristles interdental cleaner on parameters of oral soft tissue health-a systematic review. Int J Dent Hyg 2022; 20: 26–39.

17. Wicht MJ, Noack MJ: Der informierte Patient im Fokus: Partizipative Entscheidungsfindung in der Zahnmedizin. ZMK 2016; 32: 374–379.

18. Winterfeld T, Schlueter N, Harnacke D et al.: Toothbrushing and flossing behaviour in young adults – a video observation. Clin Oral Investig 2015; 19: 851–8.

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**PROF. DR. CHRISIAN GRAETZ**
Clinic for Dental Conservation and Periodontology at the University Hospital Schleswig-Holstein
Campus Kiel
Arnold-Heller-Straße 3, 24105 Kiel
christian.graetz@uksh.de

**PIA WESTPHAL**
Clinic for Dental Conservation and Periodontology at the University Hospital Schleswig-Holstein
Campus Kiel
Arnold-Heller-Straße 3, 24105 Kiel
piacarolin.westphal@uksh.de