



Instrumentation during the second stage of periodontal therapy: a European survey

Isabelle Laleman¹ · Laurence Seidel² · Gilles Gagnot³ · Michèle Reners⁴ · France Lambert^{1,5}

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Abstract

Objectives To gather practice-based information about instrumentation during the second stage of periodontal therapy among the members of the European Federation of Periodontology.

Methods This survey was conducted to investigate periodontal instrumentation (e.g., frequency, instruments, their maintenance) during the second stage of periodontal therapy.

Results Questionnaires from 2008 responders actively involved in periodontal therapy (general dental practitioners, periodontists, and dental hygienists) were analyzed. The frequency of use of hand and mechanical instruments was similar during the second stage of periodontal therapy and 94.4% of the participants combined both. The most popular hand instruments were Gracey curettes, and the preferred mechanical devices were ultrasonic scalers. For the latter, mostly the combination of standard and micro/slim inserts was preferred (42.4%) over solely standard inserts (32.1%) or micro/slim inserts (25.5%). The wear of hand instruments was systematically checked by 46.1% of the respondents and the wear of the inserts by 41.3%. The more experienced the dental professional, the more frequent the wear of the instruments and inserts was checked.

Conclusion The most popular periodontal instrumentation technique in clinical practice during the second stage of periodontal therapy is a combination of hand and mechanical instruments.

Clinical relevance Clinicians should check the wear of their instruments systematically to have the most performant instruments possible for periodontal instrumentation. Scientists should see the results of this questionnaire as an incentive to set up studies investigating whether the combination of hand and mechanical instruments, the preferred treatment method of clinicians, is better than either of these instruments alone.

Keywords Periodontal diseases · Periodontitis · Subgingival instrumentation · Nonsurgical treatment · Periodontal instrumentation · Practice-based evidence

Introduction

Supra- and subgingival instrumentation is next to patient self-care, one of the most important components to create a periodontal environment compatible with health [1–3].

It is the core procedure of the second treatment stage, but also an integral part of the third and fourth treatment stage as defined in the “European Federation of Periodontology (EFP) S3 level clinical practice guidelines” [4].

The goal of supra- and subgingival instrumentation is to remove the biofilm and calculus from the tooth surfaces to create biologically acceptable tooth surfaces enabling the binding of the connective tissue to the greatest extent possible [5]. Traditionally, it is performed by using hand instruments such as scalers and curettes [6]. Its most used alternative is the use of (ultra)sonic devices [7]. Over time it has become clear that the clinical effect of both is irrespective of the choice of the instrument [6, 8]. Hand and (ultra)sonic instruments are as efficacious in reducing probing pocket depth, inflammation, and number of diseased sites in periodontitis patients [8, 9]. The only scientific proven

✉ Isabelle Laleman
isabelle.laleman@chuliege.be

¹ Department of Periodontology and Oral Surgery, Faculty of Medicine, University of Liège, 4000 Liège, Belgium

² University Hospital of Liège, 4000 Liège, Belgium

³ T3P, 7 rue Ricordais, 35500 Vitré, France

⁴ Private Practice, Liège, Belgium

⁵ Dental Biomaterials Research Unit (d-BRU), Faculty of Medicine, University of Liège, 4000 Liège, Belgium

advantage of (ultra)sonic instrumentation is that it is time saving and less labor intensive [8]. It is 20% to 50% faster than hand instrumentation [9–15] and leads to less wrist deviation and inclination of head and neck (potentially leading to musculoskeletal problems) [16]. Additionally, hand instruments are also experienced as more tiring than (ultra)sonic instruments [16].

Although with the successful clinical results with hand and (ultra)sonic instrumentation, these methods also have their drawbacks. For example, the result is often impeded by limited access and visibility to the bottom of (deep) pockets [17]. Furthermore, irregularities such as fine grooves, ridges, or lacunae are typical sites where biofilm and calculus remain after traditional mechanical instrumentation [17]. Therefore, several adjunctive/alternative methods have been proposed in literature and are used in clinical practice such as lasers and photoactivated disinfection [18–21].

The aim of this study was therefore to collect information about which instruments (hand and/or mechanical and/or alternative instruments) are used during the second stage of periodontal therapy in day-to-day clinical practice.

Materials and methods

This cross-sectional web-based questionnaire survey was initiated to gain better understanding into how the members of the EFP carry out periodontal treatment in their daily practice. The aim was twofold: firstly, collect information about how the respondents effectuate behavioral changes, supragingival biofilm, and gingival inflammation control. Secondly, to gain better knowledge concerning the different methods of instrumentation during each stage of periodontal therapy. While data concerning the first stage of periodontal therapy (behavioral changes/oral hygiene instructions) are already published [22], the present work focused on the practices during the second stage of periodontal therapy (the questions analyzed for this article can be found in appendix 1).

A first invitation to complete the questionnaire was e-mailed on 24 April 2015 to all members of the 29 national societies of the EFP as listed in the member directory. The e-mail informed about the nature of the study and contained a personal hyperlink, so that the questionnaire could only be filled in by each EFP member. When the questionnaire was not completed within 7 days, a reminder was sent. Access to the questionnaire was closed 17 May 2015. Data collection was coordinated by “Dedicated” (Watermael-Boitsfort, Belgium) and carried out through their platform; the survey company was also responsible for the anonymous and confidential processing of the collected data.

The population of interest consisted of the members of the EFP, in particular those actively involved in treating patients

with periodontal diseases: periodontists (P), general dental practitioners (GDP), and dental hygienists (DH). As the target audience was international, the original questionnaire was drawn up in English. However, to collect as much (and as accurate) information as possible, the questionnaire was also made available in French, German, Italian, and Spanish.

Before becoming widely available, the questionnaire was thoroughly tested for validity and reliability among the members of the periodontology department at the University Hospital in Liège. A version of the final questionnaire can be found as an online appendix (online appendix 2). The questionnaire surveyed the profile of the respondents and their execution of periodontal therapy in day-to-day practice.

Participation in the pan-European survey was voluntary and consent was notified by completing the survey. Before the study start, the ethical committee of the University Hospital in Liège (Le Centre hospitalier universitaire de Liège, Liège, Belgium) was consulted and ruled that further approval was not needed [22].

Statistical analysis

Quantitative variables were summarized as mean and standard deviation (SD) while frequency distributions (number/percent) were used for categorical variables. Professional experience was log-transformed to normalize its distribution. Since the main variables of interest (instrumentation during periodontal therapy) were coded as systematically (100%), most often (70–90%), occasionally (30–60%), rarely (10–20%), and never (0–10%), data were analyzed by ordinal logistic regression. Covariates included characteristics of the participants, namely, profession GDP (Yes/No), profession DH (Yes/No) with profession P serving as reference, gender, professional experience (log-scale), private practice (Yes/No), public clinic (Yes/No), university clinic (Yes/No), other practice (Yes/No), teaching at university, and teaching elsewhere (no teaching being used as reference). A variable selection approach was used to eliminate useless and redundant variables. Results were considered significant at the 5% critical level ($p < 0.05$). All calculations were done with SAS (version 9.4).

Results

The survey questionnaire emailed to 13,622 members of the EFP was completed by 2079 (15.3%) dental practitioners. Among the latter, 71 were excluded because of missing data or because they fell outside the scope of the study (such as dental assistants or students). Thus 2008 questionnaires were used for the statistical analysis. The characteristics of the study participants are displayed in Table 1.

Table 1 Characteristics of the survey participants ($n=2008$)

Variable	Category	Number (%)
Profession	Periodontist (P)	863 (43.0)
	General dental practitioner (GDP)	748 (37.3)
	Dental hygienist (DH)	397 (19.8)
Gender	Male	943 (47.0)
	Female	1065 (53.0)
Professional experience (years)		18.5 ± 11.5 (1–60)
Private practice	Yes	404 (20.1)
	No	1604 (79.9)
Public practice	Yes	1721 (85.7)
	No	287 (14.3)
University practice	Yes	1587 (79.0)
	No	421 (21.0)
Other practice	Yes	1965 (97.9)
	No	43 (2.1)
Teaching	None	1171 (58.3)
	University	365 (18.2)
	Other	472 (23.5)

Table 2 The usage of hand and mechanical devices during the second stage of periodontal therapy ($n=2008$)

Frequency	Hand instruments N (%)	Mechanical devices N (%)
Systematically (100%)	1192 (59.4%)	1341 (66.8%)
Most often (70–90%)	406 (20.2%)	407 (20.3%)
Occasionally (30–60%)	219 (10.9%)	145 (7.2%)
Rarely (10–20%)	136 (6.8%)	51 (2.5%)
Never (0–10%)	55 (2.7%)	64 (3.2%)

The frequencies at which the different types of instruments (hand and mechanical) were used during the second stage of periodontal therapy are presented in Table 2.

Hand instruments were systematically used by 1192 (59.4%) of the survey participants. Gracey curettes were the most popular hand instruments: 1459 participants (74.7%) solely used these type of curettes, and 378 participants (19.4%) combined these with McCall curettes. Fifty (2.6%) dental professionals used solely McCall curettes and the remaining 66 (3.4%) used other types of curettes (such as Langer curettes). Of note, 55 (2.7%) respondents never used curettes.

The wear of the hand instruments was checked systematically by 926 participants (46.1%). This was mostly done by DH followed by P and less by GDP ($p < 0.0001$). Professionals with a longer experience checked more frequently the wear of their curettes ($p = 0.0021$). No relevant

differences were seen for gender, private practice, and teaching. Almost 80% of the participants (1600, 79.9%) sharpened their curettes. Profession was the sole influencing factor: 87.9% of the DH did this versus 84.5% of P and 69.8% of GDP ($p < 0.0001$).

The most popular method to sharpen curettes was with a sharpening stone, carried out by 813 (50.8%) participants. Four hundred-sixty (28.8%) used a sharpening machine, 297 (18.6%) an Arkansas stone mounted on a hand piece, and 30 (1.9%) used another method.

Mechanical devices were systematically used by most of the respondents ($N = 1341$, 66.8%) during initial instrumentation. In total, 1944 dental professionals (96.8%) used mechanical devices, 1660 of them used ultrasonic instruments (85.4%), and 368, sonic scalers (18.9%) (different devices could be combined). Among the ultrasonic instruments, piezo-electric instruments (1087, 55.9%) were most frequently used compared to magnetostrictive (406, 20.8%) and piezo-modified instruments (167, 8.6%). When looking to the types of insert, standard inserts were used by 624 (32.1%) participants, micro/slim inserts by 496 (25.5%), and a combination of both by 824 (42.4%) participants.

The wear of the inserts was reported to be systematically checked by 830 (41.3%) participants. This was mostly done by DH and P but less by GDP ($p < 0.0001$). Professionals with a longer experience checked more frequently the wear of their inserts ($p < 0.0001$). This was also the case for professionals in private practice compared to others ($p = 0.0014$). Professionals teaching outside university checked more frequently their inserts as non-teachers and university teachers ($p = 0.0093$).

The vast majority of the participants (1896, 94.4%) combined the use of hand and mechanical instrumentation. In contrast, 57 participants solely used mechanical (2.8%) instruments and 48 only hand instruments (2.4%). Seven participants mentioned using neither hand nor mechanical instruments. More detailed information about the combination of both types of instruments can be found in Fig. 1.

Tooth polishing was a common practice during this stage of periodontal therapy and was systematically carried out by 1162 (57.9%) respondents. More details can be found in Table 3. The most popular tooth polishing method was with the aid of brushes/rubber cups ($n = 1057$), followed by a combination of this with a powder jet ($n = 442$) and using only a powder jet ($n = 188$).

Discussion

This wide scale study generated, to the best of the authors' knowledge, for the first time a large amount of practice-based data on instrumentation during the second stage of

Hand instruments

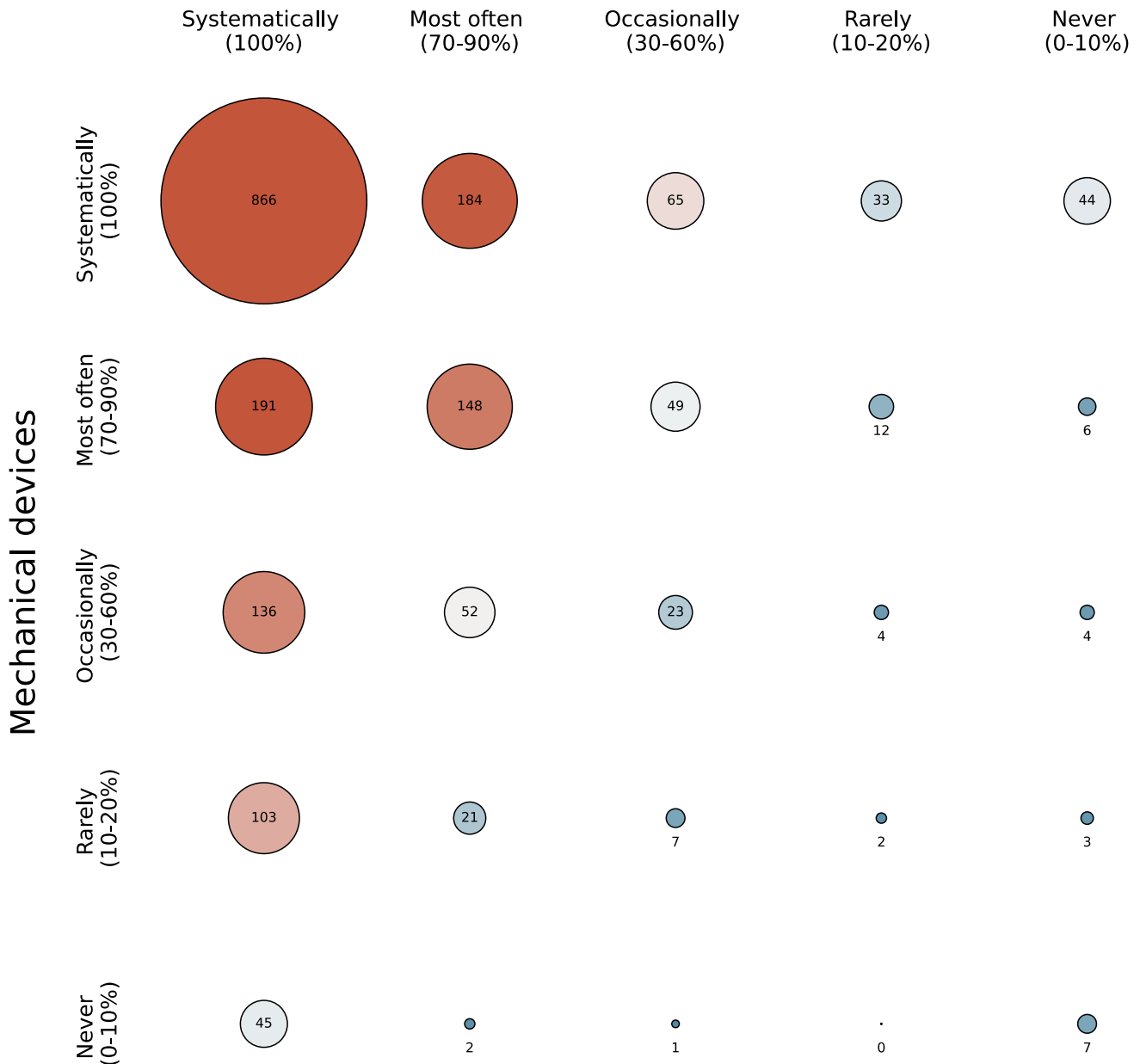


Fig. 1 How the participants combined the use of hand instruments@@ and mechanical devices (*n* = 2008)

Table 3 The frequency of tooth polishing during the second stage of periodontal therapy (*n* = 2008)

Frequency	<i>N</i> (%)
Systematically (100%)	1162 (57.9%)
Most often (70–90%)	380 (18.9%)
Occasionally (30–)	157 (7.8%)
Rarely (10–20%)	202 (10.1%)
Never (0–10%)	107 (5.3%)

periodontal therapy. The survey data showed that almost all participants (94.4%) preferred a combination of hand and mechanical instruments. Gracey curettes were the most popular hand instruments and ultrasonic scalers the preferred mechanical instruments. The wear of the instruments was systemically checked by 46.1% of the respondents for hand instruments and by 41.3% for mechanical instruments. Tooth polishing was a common practice during this treatment stage, carried out by 94.7% of the respondents (Table 4).

The main finding of this study was that hand and mechanical instruments were usually combined during the second step of periodontal therapy. It is important to explore the reasons behind this practice because scientific evidence to support this is lacking. To date, all available RCTs are limited to the comparison hand versus (ultra)sonic instruments. Moreover, the (to our knowledge) only study comparing hand versus mechanical instruments versus a combination of both showed that the clinical results of all these techniques were equally efficacious [23]. The most plausible reason why people prefer the combination of hand and ultrasonic instruments is probably because they have learned it that way during their basic dental/periodontal training or from additional courses that they have attended. In general, hand instruments are promoted to finalize the periodontal instrumentation [24].

Another often cited reason in textbooks and articles [25] for using hand instruments in addition to ultrasonics is a better tactile sensitivity with hand instruments. However, the available literature seems to indicate the opposite, namely, that tactile sensitivity increases with ultrasonic instrumentation over a 45-min period in contrast to manual instrumentation [26]. Another possible, but anecdotal, explanation for why practitioners feel more comfortable using hand instruments in addition to mechanical instrumentation as opposed to mechanical instruments is that there are many different types of hand instruments, each targeting a specific region. And by also using these different types of hand instruments, clinicians feel more confident that they have properly reached all tooth surfaces. We hypothesize that this will mainly be the case for clinicians who do not use micro/slim inserts. These micro/slim inserts mimic the form of certain often used curettes. These inserts lead to better plaque removal in deep pockets [27] and are less aggressive to the tooth surface [28] than conventional inserts.

In addition, we should note that the EFP practice guidelines (which were however published after this survey was carried out) state: “We recommend that subgingival periodontal instrumentation is performed with hand or powered (sonic/ultrasonic) instruments, either alone or in combination [4].” These guidelines do thus also recommend the combination of both, despite the fact that the systematic

review on which this guideline is based only examined hand versus mechanical instrumentation [8].

Whatever type of instrument the dental professional prefers, it is of utmost importance that this instrument is in good condition. Our findings showed that less than 50% of the respondents systematically checked the wear of their instruments. If one does not sharpen and/or replace his/her instruments timely, one risks working with worn instruments, which are less efficient [29]. This, in turn, can lead to for example a longer treatment duration and more pressure on the instruments, and hence to worse patient- and practitioner-related outcomes.

Virtually, all survey participants mentioned to carry out polishing during the second step of periodontal therapy. However, to our knowledge, there is no scientific support for carrying out polishing during the second treatment stage of periodontal therapy. Although patients like the look and feel of polished teeth, the positive effect of this procedure on the periodontium of periodontitis patients was never shown [30–32].

The response rate of 15.3% could be seen as a shortcoming of the study. The low response rate may be explained by three factors, already discussed in the literature: firstly, the absence of a personalized cover letter; secondly, the fact that there was only a single reminder; and thirdly, that health care professionals respond little to this type of survey [33]. The response rate is, however, in line with other web-based surveys on periodontics, for example, a web-based survey of US periodontist reporting a 15.6% response rate [34] and a recent Canadian survey examining evidence-based practice concerning periodontics with a 16.6% response rate [35]. Even more important than the response rate is the representativeness of the respondents (external validity). To start with, as explained elaborately in the first part of this study, the demographics of the respondents were fairly representative of the demographics of dental professionals in Europe [22]. In contrast, the distribution of the questionnaire (to solely the members of the EFP) and the fact that a reminder to complete it was only send once (possibly leading to non-response bias by only selecting the people really interested in this subject [35]), point to the non-generalizability to all (European) dental professionals. This study may thus not represent the whole European dental field, but anyhow, the target population of interest of this survey were periodontally minded dental professionals. Additionally, it should also be noted that a large proportion of the respondents were actively involved in teaching and/or worked in a university hospital.

The generated data showed thus a gap between research and clinical day-to-day practice. The available clinical studies show that periodontal instrumentation with hand and ultrasonic instruments both give comparable results, yet most clinicians prefer a combination of both. There is thus

Table 4 Distribution of participants according to checking the wear of their instrument ($n = 2008$)

Frequency	Hand instruments N (%)	Inserts N (%)
Systematically (100%)	926 (46.1%)	830 (41.3%)
Most often (70–90%)	542 (27.0%)	583 (29.0%)
Occasionally (30–60%)	352 (17.5%)	359 (17.8%)
Rarely (10–20%)	130 (6.5%)	163 (8.1%)
Never (0–10%)	58 (2.9%)	74 (3.7%)

a need for future clinical research to answer the questions, “Does the combination of hand and mechanical instruments during the second stage of periodontal therapy provide better treatment outcomes (periodontal healing, cost-effectiveness, patient satisfaction) than hand or mechanical instrumentation alone?”.

Future RCTs should therefore focus on clinical- and patient- centered data examining (a combination of) the latest hand and mechanical instrumentation instruments/techniques. They should also report important working parameters, such as time needed for the instrumentation, number of strokes, and lateral force and, for mechanical instruments, the power settings and used inserts. Reporting these features will facilitate comparison of studies in future systematic reviews/meta-analysis.

At this moment, the mechanical removal of the biofilm by hand and mechanical instruments is still the gold standard, but there are new and exciting methods on the horizon to target the biofilm. One of these is attacking its matrix through biofilm-dispersing enzymes [17]. However, a lot of research is still needed to translate these *in vitro* findings to clinical day-to-day practice.

Conclusion

This study gathered a substantial body of practice-based data concerning periodontal instrumentation in day-to-day practice among European periodontally minded dental professionals. It showed that, in 2015, most practitioners preferred a combination of manual and mechanical instruments and not the exclusive use of either manual or mechanical device as mostly described in the literature. Questionnaire studies could therefore be useful instruments to examine the practices carried out in day-to-day practice, and, when identifying a gap between clinical practice and existing scientific evidence, guiding researchers to clinical pertinent research questions.

Supplementary Information The online version contains supplementary material available at <https://doi.org/10.1007/s00784-022-04442-9>.

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Declarations

Ethics approval Not applicable.

Consent to participate Not applicable.

Conflict of interest The authors declare no competing interests.

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