

Original

Use of the Strength of Recommendation Taxonomy (SORT) to assess full-mouth treatments of chronic periodontitis

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Abstract: Previous studies have not resolved whether scaling and root planing with a full-mouth (with or without antiseptics) or quadrant approach is better for treatment of chronic periodontitis. We identified relevant studies and used Strength of Recommendation Taxonomy (SORT) criteria to critically interpret the results of all relevant studies. A literature search was performed using the PubMed, EMBASE, and Cochrane databases up to July 2015. Selected studies were stratified according to their quality, quantity, and consistency. In total, 377 studies were identified, and 36 articles selected for retrieval were stratified according SORT criteria, as follows: no level 1 studies, 15 level 2 studies, and 21 level 3 studies (which were excluded from subsequent analysis). Among the selected level 2 studies, including seven randomized clinical trials and three systematic reviews, 67% showed no significant difference between scaling and root planing with a full-mouth or quadrant approach. In conclusion, on the basis of the best available data, the strength of evidence is grade B (consistent, low-quality evidence) for full-mouth (with or without antiseptics) and quadrant scaling and root planing for treatment of chronic periodontitis.

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Keywords: full-mouth disinfection; full-mouth scaling; scaling and root planing; SORT.

Introduction

Periodontitis is an inflammatory disease that results in irreversible destruction of soft and hard periodontal tissues and formation of periodontal pockets (1), which are an almost ideal environment for bacteria, particularly gram-negative species (2).

Scaling and root planing (SRP) is the gold-standard therapy for patients with chronic periodontitis (CP) (1). This therapy is principally based on mechanical removal of subgingival biofilms from colonized root surfaces, which arrests and controls inflammatory processes (3) by reducing bacterial load. However, some evidence indicates that periodontopathogens can colonize other intraoral niches, such as the tongue dorsum, tonsils, saliva, and other mucous membranes, in addition to periodontal pockets (4,5). Thus, alternative protocols for anti-infective periodontal therapy have been introduced to optimize overall treatment outcomes (6). Full-mouth disinfection (FMD) consists of scaling and root planing of all pockets in two visits within 24 h, in combination with adjunctive chlorhexidine treatment of all oral niches (5). The concept of one-stage full-mouth disinfection was introduced to prevent reinfection of already-treated sites by untreated niches (2). This treatment approach was reported to result in superior clinical outcomes as compared with quadrant SRP (7). However, other studies failed to show a clear advantage for full-mouth approaches within 24 h, as compared with standard quadrant scaling, regardless of whether antiseptics were

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included (8). Dental practice is progressing toward an evidence-based model, although dentists must occasionally make clinical decisions based on limited scientific evidence. An evidence-based approach involves identifying, obtaining, and interpreting results from the best available studies of options for a given clinical treatment (9). Moreover, it is necessary to consider the interplay between the clinician's expertise and judgment and the patient's preferences and values (10). The clinician must understand how to develop a reliable evidence-based rationale to properly shape the clinical decision-making process (10).

To make this intellectual-logical process feasible, sound, and realistic, clinicians should be trained to assess and understand the quality of available evidence, to support clinical decision-making. Furthermore, within the framework of the evidence-based paradigm, a coherent methodological approach is required in order to answer a specific well-formulated question generated by uncertainty regarding a given clinical situation. One question that concerns dental clinicians and researchers is, "Are full-mouth strategies more effective than conventional quadrant scaling for periodontal treatment?"

A substantial number of randomized clinical trials (RCTs) have investigated the use of full-mouth approaches for CP treatment. Systematic reviews usually provide the best and most current evidence for decision-making (10). However, current studies, including findings from systematic reviews, disagree on the advantages of full-mouth approaches over conventional treatment. This contradictory evidence indicates a need for a critical interpretation of the results of full-mouth studies in the light of a new evidence-based approach that classifies studies, including RCTs and systematic reviews.

We used an evidence-based paradigm to identify, obtain, and critically interpret findings from clinical studies of full-mouth strategies. To determine the strength of evidence for full-mouth strategies in the treatment of chronic periodontitis, we used a patient-centered approach to classify the quality of available evidence on this subject. For that purpose, the quality of available evidence was assessed using the Strength of Recommendation Taxonomy (SORT) system (9).

Materials and Methods

A protocol was developed in order to include all aspects of the review methods: a) search strategy to identify studies, b) inclusion criteria for studies, c) screening methods, d) quality assessment, e) data synthesis of selected studies, and f) assessment of quality of the body of evidence available by means of SORT grade (9).

Search strategy

An extensive search of the recent biomedical literature was performed in the PubMed (up to July 2015), EMBASE (from 1980 to July 2015), and Cochrane databases, with appropriate headings and keywords related to FMD, full-mouth debridement, full-mouth ultrasonic debridement, FMS, and quadrant scaling and root planing approaches. Combinations of the following search terms were used: full-mouth, scaling, debridement, disinfection, quadrant, and chronic periodontitis.

To improve the results, the reference lists were hand-searched to identify any other related articles. This strategy was found to identify nearly twice as many clinical trials as digital database searching alone (11). Moreover, each issue of the following major periodontology journals was hand-searched (last 15 years): *Journal of Clinical Periodontology*, *Journal of Periodontology*, *Journal of Periodontal Research*, *Clinical Oral Investigations*, and *Journal of Dental Research*. The cross-referencing process continued until no new articles were identified.

Inclusion criteria

The following types of study were initially selected: systematic reviews, meta-analyses, RCTs, clinical trials, cohort studies, longitudinal studies, literature reviews, *in vitro* research, usual practice, clinical experience, and case series studies.

Exclusion criteria

During the screening step, two experienced reviewers (A. C. and G. D-D.) independently excluded studies through an assessment of the full text. Articles were excluded for the following reasons:

not a full-length article; duplicate study; no SRP control group; study of patients with periodontal conditions other than CP; study focusing on patients with systemic conditions (eg, diabetes, smoking, etc.); duration of follow-up <3 months; articles in a language other than English; and unpublished studies. Disagreements regarding study exclusion were resolved by discussion. The reasons for study rejection during screening were recorded.

Quality assessment

Three parameters were used to determine the final quality and consistency of individual studies in the SORT (9).

Quality is the level of evidence for each study. Figure 1 explains the method used to determine the level of evidence for a study, which accounts for the extent to which an identified study minimizes the possibility of bias (synonymous with the concept of validity).

Quantity is the number of selected studies and subjects

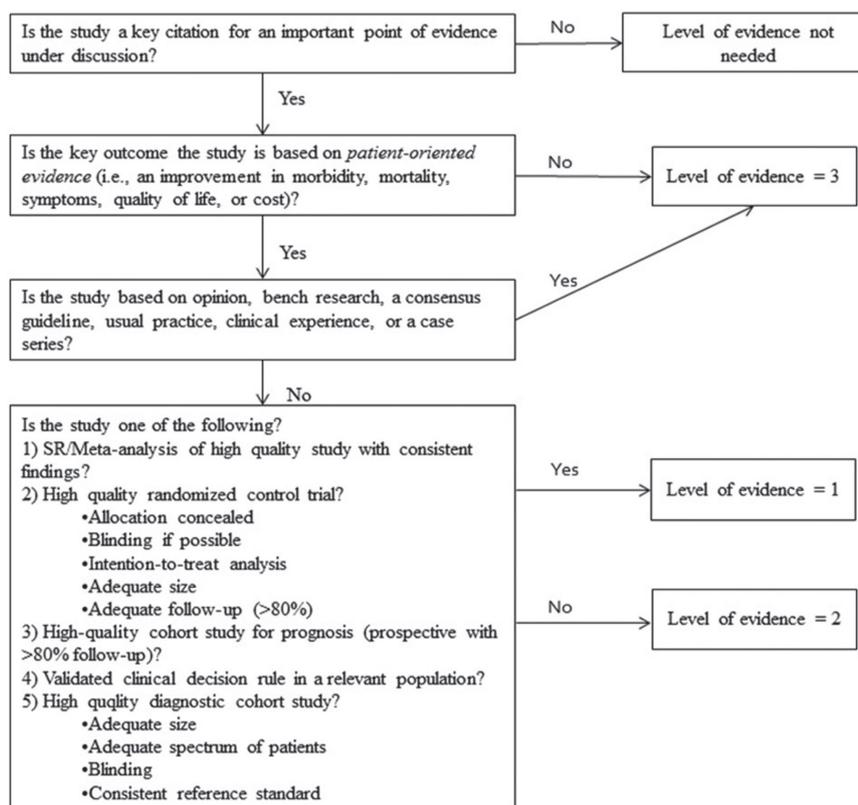


Fig. 1 Determining level of evidence for individual studies (9). Reproduced by permission of the American Board of Family Medicine.

included in those studies.

Consistency is the uniformity of evidence across all selected studies; i.e., the extent to which findings are similar between different studies of the same topic.

Level of evidence

Numbers are used to distinguish the ratings for selected studies.

Level 1 evidence—High-quality studies (low risk of bias): systematic review/meta-analysis with consistent findings; large, well-designed, randomized controlled clinical trial (with a diverse patient population, adequate method of randomization, allocation concealment and blinding, intention-to-treat analysis, power of study/large sample size, and long-term follow-up >80%), cohort studies of prognosis (prospective study with follow-up >80%).

Level 2 evidence—Medium- and low-quality studies (moderate/high risk of bias): systematic review/meta-analysis of medium-/low-quality studies with no consistent findings; randomized controlled clinical trial (with unclear or inadequate method of randomization, allocation concealment and blinding, intention-to-treat analysis, sample size, and follow-up), cohort studies of prognosis (prospective study with follow-up <80%).

Level 3 evidence—studies lacking quality; studies based on disease-oriented evidence, studies based on opinion or literature review with no systematic technique, *in vitro* research, usual practice, clinical experience, and case series studies.

Consistency of evidence across all selected studies

After determining the level of evidence for individual studies, the consistency of evidence across all selected studies was assessed, using the criteria below (9).

Consistent—Most studies found similar or at least coherent conclusions (coherence means that differences were explainable), or if high-quality and up-to-date systematic reviews or meta-analyses exist, they support the recommendation.

Inconsistent—Considerable variation among study findings and lack of coherence, or, if high-quality and up-to-date systematic reviews or meta-analyses exist, they do not yield consistent evidence in favor of the recommendation.

Assessment of quality of the body of evidence

In this phase of the SORT system, the letters A, B, and C are used to represent the strength of a recommendation of an intervention (9). Figure 2 shows how to determine

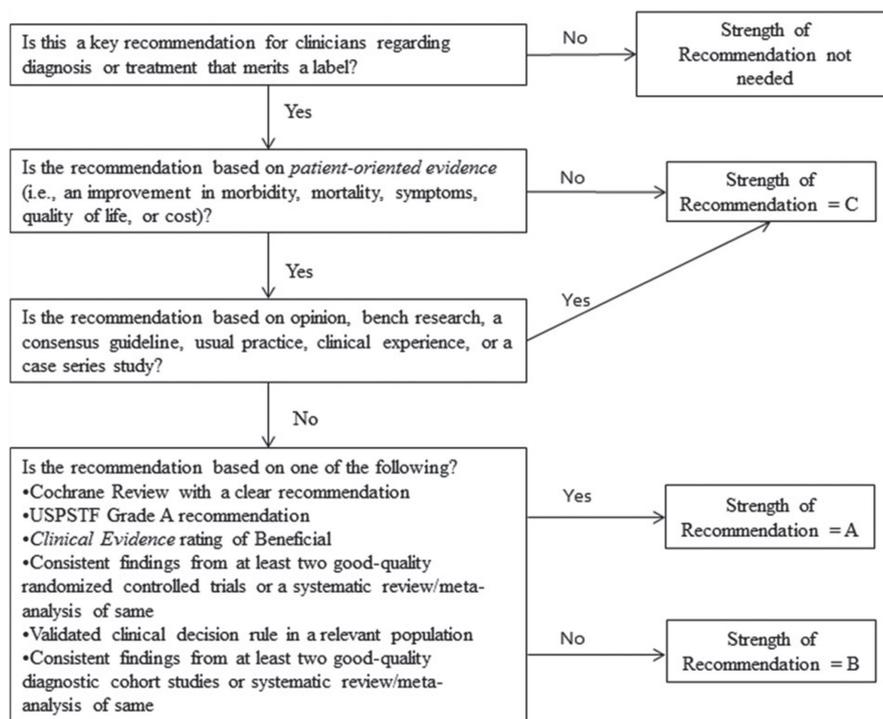


Fig. 2 Determining strength of a recommendation based on a body of evidence (9). Reproduced by permission of the American Board of Family Medicine.

Table 1 Summary of search strategy

Keyword combination	Number of articles retrieved
Full mouth scaling AND chronic periodontitis	114
Full-mouth debridement	104
Quadrant scaling AND chronic periodontitis	70
Full-mouth disinfection	62
Total from digital search	350
Total from manual search	27
Total from both searches	377
Screening of 377 full-text studies	
Number of articles eliminated	341
Total of articles included after screening	36

the strength of a recommendation, based on a body of evidence.

Results

Data synthesis of the selected studies

In total, 350 studies were identified by the systematic search protocol. Twenty-seven additional articles were identified during hand searches. Thus, 377 studies were identified after digital and hand searching. After the initial screening, 341 studies were eliminated, resulting in a yield of 36 articles selected for retrieval. A summary of the search process is shown in Table 1.

Determining strength of recommendations for a body of evidence

In the SORT system, assessing levels of evidence for indi-

vidual studies is the first step in determining the strength of recommendation grade for a body of evidence (9). Of the 36 articles, 15 were classified as level 2. The other 21 articles did not satisfy the criteria to be considered a study with good internal validity and were thus classified as level 3 and excluded from subsequent analysis. Because no study satisfied the minimum standard to be considered a high-quality study, there were no level 1 studies. The studies and reasons for classification are shown in Table 2 (5,12-31) and Table 3 (2,6,8,32-43).

Determining levels of evidence for individual studies

For the present study question, the selected body of evidence (level 2) was composed of studies that presented clear and consistent findings. Ten studies (67%) showed no significant difference in primary clinical outcome,

Table 2 Studies classified as level 3 and the reasons for classification

	Selected study	Type of study	Reason for Classification
1	Quirynen et al. (5)	RCT	Power of study not presented; only 2 months of follow-up
2	Papaioannou et al. (12)	Literature review	No systematic technique used
3	Bollen et al. (13)	RCT	Power of study not presented; some patients with aggressive periodontitis
4	Mongardini et al. (14)	RCT	Power of study not presented; some patients with aggressive periodontitis
5	Quirynen et al. (15)	RCT	Only microbiological data
6	Quirynen et al. (16)	CT	Method of randomization and allocation concealment not used
7	Quirynen et al. (17)	Literature review	No systematic technique used
8	Greenstein (18)	Critical commentary	No systematic technique used
9	Greenstein (19)	Literature review	No systematic technique used
10	Koshy et al. (20)	Literature review	No systematic technique used
11	Kinane (21)	Literature review	Expert opinion (editorial)
12	Zanatta et al. (22)	RCT	Power of study not presented
13	Apatzidou (23)	Expert opinion	No systematic technique used
14	Tomasi et al. (24)	RCT	Power of study not presented; site as unit of analysis
15	Knöfler et al. (25)	RCT	Power of study not presented
16	Kinane and Papageorgakopoulos (26)	Literature review	No systematic technique used
17	Matthews (27)	Expert opinion	No systematic technique used
18	Teughels et al. (28)	Literature review	No systematic technique used
19	Yashima et al. (29)	RCT	Power of study not presented; antibiotic use
20	Serrano et al. (30)	RCT	Power of study not presented; only 4-6 weeks of follow-up; clinical and microbiological data
21	Sagar (31)	Literature review	No systematic technique used

RCT: randomized clinical trial; CT: clinical trial. Obs: level C studies excluded from subsequent analysis.

namely, periodontal pocket depth (PPD) or clinical attachment loss (CAL), among treatment strategies (Table 3). However, the selected body of evidence has clear limitations because it is based on level 2 studies, which indicates limited quality of evidence. Therefore, the strength of recommendation of full-mouth strategies is assessed as level B, because the body of evidence was consistent but of limited quality.

Discussion

The main purpose of the present study was to determine the strength of recommendation of full-mouth strategies for periodontal treatment, based on SORT grade. By definition, the strength of recommendation of a given treatment “indicates the extent to which one can be confident that the desirable effects of an intervention outweigh the undesirable effects” (9).

The present study identified currently available evidence on full-mouth strategies, FMD (full-mouth debridement plus antiseptics), and FMS (hand or ultrasonic full-mouth debridement) in a systematic fashion and then assimilated information through in-depth explicit critical review of the best-designed studies, using the SORT grading system. The SORT system is a new unified taxonomy for strength of recommendations based on a body of evidence (including systematic reviews and other studies) and helps readers easily find new evidence

in daily practice (44).

In evidence-based medicine, adherence to a well-established scientific protocol is what distinguishes a high-level specialist from a common practitioner. However, implementing an evidence-based approach in the dental clinic has several inherent challenges, mainly related to educating and training clinicians in the language of evidence-based medicine. In this context, the simplicity of the SORT system is very welcome and can be regarded as a consequence of the major dichotomy (disease-oriented versus patient-oriented evidence) proposed by the system (9). Patient-oriented evidence that matters (POEM) allows clinicians to filter relevant information from the medical literature and focus only on what is indeed important for the patient (45). Disease-oriented evidence (DOE) includes intermediate, histopathological, physiological, or surrogate endpoints, such as probing depth reduction and x-ray changes in bone density, which may or may not reflect real improvement in patient outcomes (44).

The present review found that all groups showed significant improvement in clinical parameters after treatment with FMD or FMS. However, the strength of recommendation of full-mouth strategies is classified as grade B. This means that the best current evidence indicates no or very slight differences in clinical outcomes for mechanical debridement performed during one

Table 3 Studies ranked as level 2: types, methods, outcomes assessed, main results, and reasons for classification

	Selected studies	Study type	Methods	Outcomes assessed	Main result	Reason for classification
1	Vandekerckhove et al. (32)	RCT	10 CP patients; Groups: FMD (Clx) vs SRP. Follow-up: 1, 2, 4, and 8 months.	Plaque, PPD, recession, and BOP	FMD > SRP	Small sample; short-term follow-up; method of randomization and allocation concealment unclear
2	Apatzidou and Kinane (33)	RCT	40 CP patients; Groups: FMS vs SRP. Follow-up: baseline, 6 weeks, and 6 months.	Plaque, PPD, CAL, and BOP	FMS = SRP	Small sample; short-term follow-up; power of study unclear
3	Koshy et al. (34)	RCT	36 CP patients; PPD \geq 5 mm and radiographic bone loss; Groups: FMD (povidone) vs FM-ud vs SRP. Follow-up: 1, 3, and 6 months.	Plaque, PPD, CAL, and BOP, microbiological analysis and patient perception	FM > SRP	Small sample; short-term follow-up; drop out unclear, variation in treatment procedures; disinfectant regimen
4	Wennström et al. (35)	RCT	41 CP patients; PPD \geq 5 mm and BOP; Groups: FM-ud vs SRP. Follow-up: baseline, 3 and 6 months.	Plaque, PPD, RAL, and BOP, treatment efficiency, and discomfort	FMS = SRP	Small sample; short-term follow-up, variation in treatment procedures
5	Jervøe-Storm et al. (36)	RCT	20 CP patients; PPD \geq 5 mm and BOP; Groups: FMS vs SRP. Follow-up: baseline, 3 and 6 months.	Plaque, PPD, RAL, and BOP	FMS = SRP	Small sample; short-term follow-up; drop out unclear
6	Quirynen et al. (37)	RCT	71 CP patients; Groups: FMD (Clx) vs FMS vs SRP. Follow-up: baseline, 2, 4, and 8 months.	Plaque, PPD, CAL, and BOP	FMD and FMS > SRP	Short-term follow-up; examiner not blinded; disinfectant regimen
7	Knöfler et al. (38)	RCT	37 CP patients; Groups: FMS vs SRP; Follow-up: baseline, 6, and 12 months.	PPD, CAL, and BOP	FMS = SRP	Small sample; power of study unclear
8	Eberhard et al. (39)	Cochrane Meta-analysis	7 RCTs. Treatments: FMD (Clx) vs FMS vs SRP	PPD, CAL, and BOP	FMD and FMS > SRP (modest benefits)	Based on level 2 studies
9	Eberhard et al. (6)	Systematic Review	7 RCTs. Treatments: FMD (Clx) vs FMS vs SRP	PPD, CAL, and BOP	FMD and FMS > SRP (modest benefits)	Based on level 2 studies
10	Farman and Joshi (2)	Systematic Review	7 RCTs included. Treatments: FMD vs FMS vs SRP	PPD, CAL, and BOP	FM = SRP	Based on level 2 studies
11	Lang et al. (40)	Systematic Review	12 studies included. Treatments: FMD vs FMS vs SRP	PPD, CAL, and BOP	FM = SRP	Based on level 2 studies
12	Latronico et al. (41)	RCT	20 CP patients; Groups: FMD (Clx) vs SRP. Follow-up: baseline, 3, 6 and 12 months.	Plaque, PPD, CAL, and BOP	FMD = SRP	Small sample; short-term follow-up; power of study unclear; disinfectant regimen
13	Loggner et al. (42)	RCT	20 CP patients; Groups: FMS vs SRP. Follow-up: baseline and 6 months.	Plaque, PPD, CAL, and BOP	FMS = SRP	Small sample; short-term follow-up; power of study unclear
14	Zijngje et al. (43)	RCT	39 CP patients; Groups: FMS vs SRP. Follow-up: baseline and 3 months.	PPD, plaque, and BOP	FMS = SRP	Small sample; short-term follow-up; drop out unclear
15	Eberhard et al. (8)	Cochrane Meta-analysis	12 RCTs. Treatments: FMD (Clx) vs FMS vs SRP	PPD, CAL, and BOP	FMD = FMS = SRP	Based on level 2 studies

RCT: randomized clinical trial; FMD: full-mouth disinfection; FMS: full-mouth scaling; FM-ud: full-mouth ultrasonic debridement; SRP: scaling and root planing; PPD: periodontal pocket depth; CAL: clinical attachment loss, RAL: relative attachment loss; BOP: bleeding on probing.

or multiple visits, regardless of antiseptic use. Thus, a decision to select one nonsurgical periodontal therapy over another needs to include patient preferences and the convenience of the treatment schedule (12). In fact,

full-mouth approaches, especially when using ultrasonic devices, seem to offer treatment benefits, such as fewer appointments and shorter chair time, as compared with traditional SRP (35). However, the risk of increased pain

from these procedures may outweigh these benefits (27).

A SORT grade of B is satisfactory for a quickly developing field like periodontics, as it indicates that the assembled evidence is not merely based on expert opinion, bench and *in vitro* studies, usual practice, clinical experience, or single-case or case-series reports. A SORT grade of B indicates that a body of evidence satisfies the minimum scientific standard for clear determination of clinical recommendations (9). Therefore, all three approaches (FMD, FMS, and SRP) can be considered feasible, reliable clinical treatment options, on the basis of the rating model proposed by the SORT system.

In all 15 studies selected to determine the strength of recommendation, the primary outcomes assessed were clinical measurements such as clinical attachment gain and probing depth reduction. SORT emphasizes the use of patient-oriented outcomes that measure direct changes in “true” endpoints, i.e., outcomes that really matter to patients—for instance, aesthetics, quality of life, pain relief, and cost reduction—and thus provide patient-oriented evidence (9,44). Because tooth survival is a tangible benefit to a patient, it would have been desirable to determine which therapy was superior in preventing tooth loss. However, tooth loss is difficult to assess due to its low incidence and the extended time to event (6). Nevertheless, the selected outcome studies should be considered as true patient-oriented evidence from a practical standpoint, because successful clinical attachment gain and probing depth reduction are directly related to patient well-being. In fact, some recent studies found that severe CP is associated with poor quality of life (46). Still, it is clear that too few studies have specifically investigated patient-oriented endpoints. Therefore, future RCTs should not focus only on clinical outcomes; they must also include outcomes that matter to patients, such as preferences, well-being, overall quality of life, and cost-benefit analysis.

The levels of evidence used in the SORT system to rank individual studies (quality, quantity, and consistency) were established by the Agency for Healthcare Research and Quality (AHRQ) (9). Of the 15 studies that comprised the selected body of evidence, 10 were clinical trials (12,33-38,41-43) and five were systematic reviews (2,6,8,39,40). The overall quality of clinical trials was considered low to moderate, and this can be regarded as a consequence of bias control as well as of the internal validity of the trials. The internal validity of an RCT is strongly related to the reporting of an adequate method of random allocation, double-blinding, patient follow-up, and allocation concealment (9). All the included level 2 studies had flaws and inconsistencies in

the study design and methods, including use of unblinded examiners (37), unclear drop-outs (34,36,43), unclear methods of randomization and allocation concealment (12), variation in treatment procedures (34,35), variation in disinfectant regimens (34,37,41), inclusion of level 2 studies in systematic reviews (2,6,8,39,40), and unclear study power (33,38,41,42). In addition, all the RCTs had short durations of follow-up and small sample sizes. Thus, future RCTs require improvements in study design. Larger sample sizes will be needed in order to draw more-meaningful conclusions in future RCTs. A large sample is more representative of a population and limits the effect of outliers. In smaller samples, the risk of random imbalance of covariates is substantial. Furthermore, although duration of follow-up should be sufficient for outcomes to occur, RCTs in dentistry require longer duration of follow-up (2). It is possible that some RCTs classified as limited-quality evidence in the present study could indeed be good-quality evidence. Nonetheless, it was not possible to make this determination because of important limitations in the reported information in some of the included studies. This highlights the crucial role of adequate reporting of RCT methodology and the importance of following the CONSORT model.

Quantity is the second key element used in classifying a body of evidence and is related to the number of studies and subjects included in those studies (9). Consistency is related to uniformity in the findings provided by studies of a given issue and is a very important parameter, as it determines the choice between grades A and B. (9) In the present study, all three periodontal treatment modes resulted in significant improvements in all parameters, based on evidence from a small-to-moderate number of studies. Of the 15 studies, three RCTs (12,34,37) and two systematic reviews (6,39) tended to favor full-mouth approaches. However, the authors of one systematic review assumed that statistical differences favoring FMD over SRP were based on two studies of the Leuven group, which had a moderate-to-high risk of bias (6). Furthermore, as suggested by Eberhard et al., (6) these findings may be related to statistical artefacts resulting from the analysis of different numbers of sites for the various categories. Therefore, the results of such analyses should be interpreted with extreme caution.

Our overall analysis of the results from the 10 selected RCTs indicates that seven reached coherent conclusions and that there were no significant difference among FMD, FMS, and SRP (33,35,36,38,41,42,43). Moreover, the results from the three included systematic reviews are in agreement and do not show a superior clinical outcome for any given treatment (2,8,40). The other

two systematic reviews reported only modest additional improvements related to FMD (6,39), which limits any general conclusions regarding the clinical benefits of this approach. Only three selected RCTs (12,34,37), two of which were from the Leuven group (12,37), indicated that short-term clinical outcomes were better for full-mouth strategies than for SRP. It is important to note that in the Leuven group studies, subjects received tooth-brushing instructions only after the study start, which probably increased the risk of cross-contamination in the control SRP group. Moreover, many authors used an SRP protocol that included supra- and subgingival mechanical debridement at the same appointment (12,37). Because the entire treatment requires an average of four sessions, the risk of cross-contamination is increased. In fact, when supragingival plaque is present, a subgingival microbiota containing large numbers of spirochetes and motile rods is quickly re-established (47). The patient's own oral flora seems to be the main source of re-emerging periodontal pathogens, and a complex subgingival microbiota can develop within 1 week (48). Thus, recolonization of periodontal lesions may be better prevented by full-mouth approaches (43). However, weekly supragingival plaque removal diminished counts of supra- and subgingival species, thereby creating a microbial profile comparable to that observed in healthy periodontium (49). Thus, patients should receive repeated oral hygiene instructions and supragingival scaling and tooth cleaning before subgingival SRP procedures (39), to maintain a low plaque score and prevent cross-contamination between multiple appointments.

In conclusion, on the basis of the best available evidence, the strength of recommendation of both full-mouth (FMD and FMS) and quadrant SRP for treatment of chronic periodontitis is grade B (consistent, low-quality evidence).

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