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REVIEW

Gingival recession after scaling and root planing with or without systemic metronidazole and amoxicillin: a re-review

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Abstract

Background Gingival recessions inevitably occur during healing after scaling and root planing, but synoptic data on this topic is still lacking. This review compared the recession formation with and without the administration of systemic antibiotics.

Objectives To evaluate the formation of recession with and without the administration of antibiotics during the healing after scaling and root planing.

Materials and methods This study re-analyzed publications that reported clinical attachment levels (CAL) and probing pocket depths (PD) up to January 2019, including the pivotal review by Zandbergen and co-workers (2013). Whereas these studies traditionally focused on PD and CAL, the present analysis compared recession formation (ΔREC) after adjunctive systemic administration of amoxicillin (amx) and metronidazole (met) during scaling and root planing (SRP) and SRP alone. The mean increase in ΔREC, if not reported, was calculated from CAL and PD values and statistically analyzed. Recession formation was compared after 3 and 6 months after therapy. Results were separately reported for chronic periodontitis (CP) as well as aggressive periodontitis (AP) cases.

Results Recessions increased consistently between baseline and follow-up. In the AP group, median ΔREC was 0.20 mm after 3 months, irrespective of whether antibiotics were administered or not. After 6 months, median ΔREC increased to 0.35 mm after AB and remained stable at 0.20 mm with SRP alone. In the CP group, after 3 months with and without antibiotics, median ΔREC accounted for 0.30 mm and 0.14 mm, respectively. After 6 months, median ΔREC accounted for 0.28 mm (with AB) and 0.20 mm (without AB). The quantitative assessment by meta-analyses also yielded small values (≤ 0.25 mm) for the estimated differences in recession formation between AB and noAB; however, none of them reached statistical significance.

Conclusions Although a slight tendency towards higher recession formation after SRP in combination with AB could be observed in many studies, quantitative meta-analyses showed no clinically relevant difference in recession formation due to the administration of AB. In general, the description and discussion of recessions in the literature seems not to be a major focus so far.

Clinical relevance Since the preservation of gingival tissues is important by preventive and therapeutic means, e.g., when avoiding postoperative root sensitivity or performing regenerative surgery, these aspects should not be neglected. We thus suggest to report REC measurements along with PD and CAL values for more direct recession formation (ΔREC) assessments in the future.

Keywords Scaling and root planing · Debridement · Clinical attachment level · Periodontal healing · Systemic antibiotics

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Background

Recessions (REC) inevitably occur in the area of the inflamed gingival zone after thorough cleaning and in due course of successful healing, mainly due to the reduction of the swelling and shrinkage of the tissues [1]. Especially in severe cases with deep pockets, recession formation (ΔREC) may be even accentuated. It has been shown that gingival REC increase from shallow pockets (≤ 3 mm) to moderately deep (4–6 mm) and deep sites (≥ 7 mm) from 1 mm over 1.2 to 1.9 mm, respectively [1, 2]. Studies have also shown that neither repeated instrumentation nor operator variability influence ΔREC [3, 4]. Flat surfaces on either single-rooted or flat molar teeth, however, show more REC than furcation-associated sites [5]. This illustrates the interplay between lack of cleaning efficacy and cleaning accessibility and therefore decreased inflammation management and consequently less tissue shrinkage; vice versa, better cleaning (efficacy and accessibility) leads to more ΔREC. A plethora of strategies have been introduced including mechanical, physical, and chemical adjuncts to improve the results after conventional SRP procedures. Among these suggested alternatives, no option has proven better efficacy or effectiveness so far than the adjunctive use of systemic antibiotics (AB) combination therapy like amoxicillin (amx) and metronidazole (met) for example [6]. Several systematic reviews and meta-analyses have impressively shown its superiority in this context so far; as well as for AP and CP [7]. However, most studies and reviews have mainly focused on PD and CAL and their respective losses, gains, and the measurement of differences so far. These primary outcome parameters, however, still remain difficult to translate into clinically relevant treatment outcomes, especially if only means and standard deviations are depicted. Therefore, research has also focused on alternative measurements, such as the percentage of remaining pockets as such [8]. Unfortunately, the topic of ΔREC after non-surgical periodontal therapy has not yet gained much attention in this regard; especially not in the context of systemic AB usage.

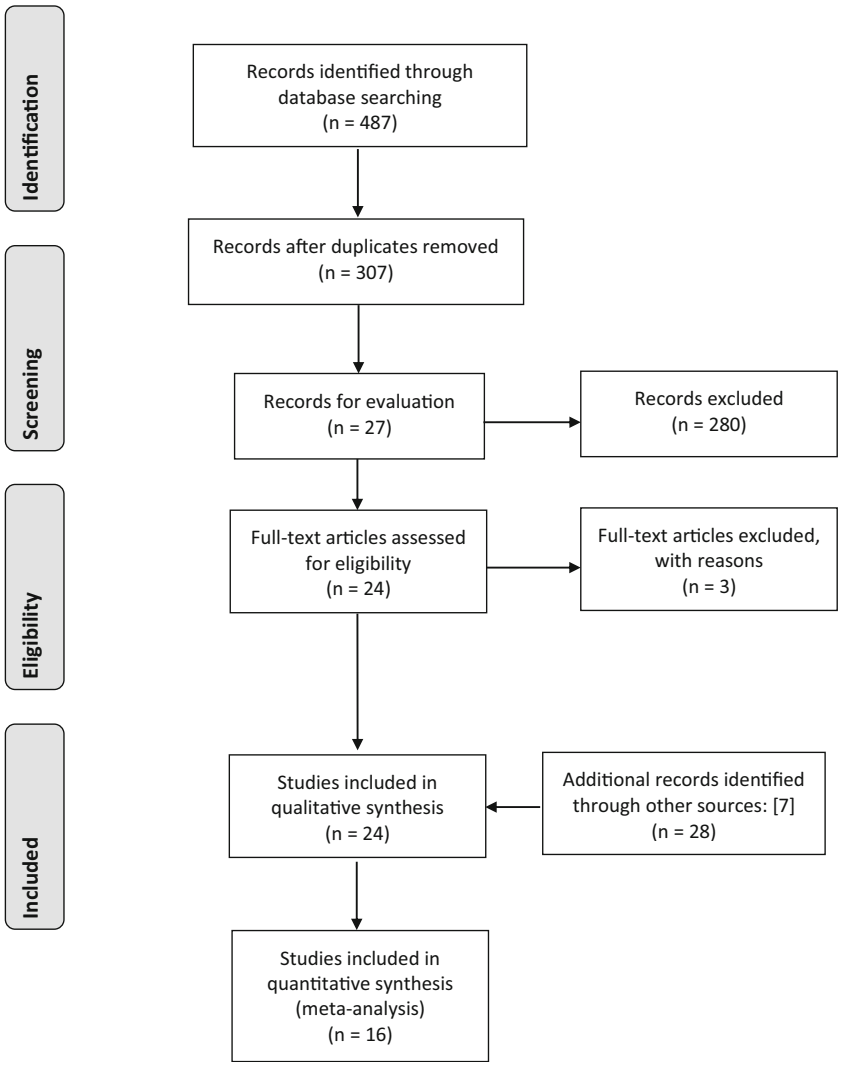

Fig. 1 Study selection PRISMA flowchart

Table 1 Characteristics of the studies included in the meta-analysis

Study	Design	Evaluation period (months)		Periodontitis		amx + met as adjuncts to SRP	Conclusion of the authors
		3 M	6 M	Aggressive	Chronic		
1. Xajigeorgiou et al. 2006	RCT parallel single-masked		x	x		500 mg met + 500 mg amx 7 days 3 times daily	Adjunctive amx + met is effective in deep pockets.
2. Mestnik et al. 2010	RCT parallel double-masked	x		x		400 mg met + 500 mg amx 14 days 3 times daily	Patients significantly benefit from the adjunctive use of amx + met.
3. Mestnik et al. 2012	RCT parallel double-blinded		x	x		400 mg met + 500 mg amx 14 days 3 times daily	Deepest reductions in mean PD and gain in CAL by the adjunctive use of amx + met, up to 1 year post-treatment, lower mean number of residual sites with PD ≥ 5 mm
4. Varela et al. 2011	RCT parallel double-masked	x	x	x		250 mg met + 500 mg amx 10 days 3 times daily	Amx + met bring additional clinical effects to the repeated mechanical treatment in the very short term (3 months) but these effects have a tendency to fade away over time.
5. Heller et al. 2011	RCT parallel double-masked	x	x	x		250 mg met + 500 mg amx 10 days 3 times daily	Systemic amx + met or placebos adjunctive to anti-infective mechanical debridement were comparable in lowering periodontal pathogens up to 6 months after treatment.
6. Aimetti et al. 2012	RCT parallel double-masked	x	x	x		500 mg met + 500 mg amx 7 days 3 times daily	Systemic administration of amx + met as an adjunct to 1-stage full-mouth disinfection therapy significantly improved clinical outcomes in patients over a 6-month period.
7. Oliveira et al. 2012	RCT parallel double-masked		x	x		400 mg met + 500 mg amx 14 days 3 times daily	The clinical outcome provided additional evidence of beneficial adjunctive clinical effect of the combination of amx + met when associated with mechanical debridement.
8. Lira et al. 2013	RCT parallel double-blinded		x	x		400 mg met + 500 mg amx 14 days 3 times daily	PD + CAL between baseline and 6 months were strikingly reduced by the SRP + amx + met therapy.
9. Taiete et al. 2016	RCT	x	x	x		250 mg met	

Table 1 (continued)

Study	Design	Evaluation period (months)		Periodontitis		amx + met as adjuncts to SRP	Conclusion of the authors
		3 M	6 M	Aggressive	Chronic		
	parallel blinded					+ 375 mg amx 7 days 3 times daily	Additional evidence of a benefit of an adjunctive combination of amx + met associated with nonsurgical periodontal therapy; superior reduction in PPD at 3 months and 6 months.
10. Matarazzo et al. 2008	RCT parallel double-blinded	x			x	400 mg met + 500 mg amx 14 days 3 times daily	Significant advantages are observed when systemic antibiotics are combined with SRP in the treatment of smokers. The greatest benefits in clinical and microbiological parameters are achieved with the use of SRP + amx + met.
11. Silva et al. 2011	RCT parallel double-masked	x			x	400 mg met + 500 mg amx 14 days 3 times daily	The adjunctive use of amx + met offers short-term clinical benefits in the treatment of patients who are non--smokers.
12. Feres et al. 2012	RCT parallel double-blinded	x	x		x	400 mg met + 500 mg amx 14 days 3 times daily	Treatment of generalized chronic periodontitis is significantly improved by the adjunctive use of amx + met and met.
13. Miranda et al. 2014	RCT parallel double-blinded	x	x		x	400 mg met + 500 mg amx 14 days 3 times daily	The adjunctive use of amx + met significantly improved the clinical and microbiological outcomes of SRP.
14. Cosgarea et al. 2016	RCT parallel double-masked	x	x		x	500 mg met + 500 m amx 7 days 3 times daily	At both 3 months and 6 months, all treatment protocols resulted in statistically significant improvements compared with baseline for all evaluated clinical parameters but at 6 months, a statistically significant greater reduction in the mean number of sites with PD ≥ 6 mm was observed in the antibiotic protocol.
15. Borges et al. 2017	RCT parallel double-blinded	x	x		x	400 mg met + 500 mg amx 14 days 3 times daily	The adjunctive use of amx + met over 14 days offers statistically significant and clinically relevant benefits over those achieved with SRP alone. The

Table 1 (continued)

Study	Design	Evaluation period (months)		Periodontitis		amx + met as adjuncts to SRP	Conclusion of the authors
		3 M	6 M	Aggressive	Chronic		
							added benefits of the 7-day regimen in this population were less evident.
16. Theodoro et al. 2018	RCT parallel-blinded	x	x		x	400 mg met + 500 mg amx 7 days 3 times daily	In smokers with periodontitis, the amx + met treatment significantly improved the effects of SRP.

However, it might be of special clinical interest to oversee and estimate differences regarding ΔREC in the light of preventive and therapeutic considerations. For example in order to avoid postoperative root sensitivity and caries or when dealing with severe cases, which may still require surgical intervention after SRP including regenerative approaches. Particularly in the latter cases, any loss of marginal soft tissue should be considered as a shortcoming: The preservation of the marginal soft tissue height at facial and interproximal aspects remains of outmost clinical interest in order to achieve optimal clinical results, since any lost tissue is difficult to restore again and wound closure may be complicated.

Therefore, the aim of the present re-review was to investigate whether there are potential differences in ΔREC after administration of AB, i.e., amoxicillin (amx) and metronidazole (met) during SRP as compared with SRP alone. For this purpose, papers and data included in the meta-analysis by Zandbergen et al. [7] and other studies [9–15] were re-analyzed in order to calculate sensible estimates for REC values from PD and CAL measurements and quantitatively assess them by meta-analyses. The literature was updated and supplemented up to January 17, 2019. Our working hypothesis was that the use of systemic AB would lead to increased ΔREC in both, CP and AP cases, 3 and 6 months after SRP.

Methods

The present re-review was based on the 28 studies, which were originally selected for inclusion in a systematic review by Zandbergen et al. [7]. This high-quality publication followed the guidelines of Transparent Reporting of Systematic Reviews and Meta-analyses (PRISMA-statement) [16]. The original internet search included MEDLINE-PubMed, EMBASE, and Cochrane-CENTRAL as databases. Language restrictions were set to English and Dutch. The focused question of the latter publication was adapted in the present study as follows: In patients with periodontitis what is the effect of adjunctive systemic administration of amx and met to SRP as compared with SRP alone with respect ΔREC?.

For details regarding quality assessment, data extraction, and grading of the body of evidence, we also refer to the original article [7].

In addition to the existing review [7], an original internet search using identic search terms and databases was performed from April 1, 2012, until January 17, 2019. For specific search terms and search strategy, cf. Fig. 1. The update of the systematic review was also conducted in accordance with the PRISMA guidelines [16]. Table 1 illustrates the characteristics of the included studies for meta-analysis ($n = 16$), and Table 2 shows summary statistics of the target variable ΔREC across the studies (Fig. 2).

Table 2 Descriptive summary of recession formation (ΔREC) by treatment and over time

Type and length of study period	Amount of studies	ΔREC (mm) with AB			ΔREC (mm) without AB		
		Median	Min	Max	Median	Min	Max
AP—3 months	5	0.20	− 2.80	0.40	0.20	− 2.80	0.60
AP—6 months	8	0.35	− 2.90	0.59	0.20	− 2.80	0.60
CP—3 months	7	0.30	0.02	1.03	0.14	− 0.82	0.74
CP—6 months	5	0.28	0.04	0.97	0.20	0.13	0.77

AB Antibiotics

Data preparation

Data on original REC values were not available for most included studies. Therefore, mean recession REC at a given time was assessed as the difference between the reported mean clinical attachment level CAL and mean pocked depth PD, using the additive property of expectations $E(\mathrm{REC}) = E(\mathrm{CAL} - \mathrm{PD}) = E(\mathrm{CAL}) - E(\mathrm{PD})$. Hence, the mean recession formation (ΔREC) between baseline (BL) and follow-up (FU) was calculated for each study for both groups (AB, noAB), again using the additivity property:

$$E(\Delta\mathrm{REC}) = E(\mathrm{REC_{FU}}) - E(\mathrm{REC_{BL}}) \quad (1)$$

The variance for ΔREC for each study was assessed according to the equation of Bienaymé [17].

$$\mathrm{Var}(\Delta\mathrm{REC}) = \mathrm{Var}(\mathrm{REC_{BL}}) + \mathrm{Var}(\mathrm{REC_{FU}}) \quad (2)$$

Thus, our approach neglects potential covariance between CAL and PD, as well as between $\mathrm{REC_{FU}}$ and $\mathrm{REC_{BL}}$, because these values were not reported, and it would require patient-level information to estimate them correctly. However, the estimates for mean ΔREC are not affected, and merely the variances for ΔREC are potentially too large, i.e., potentially too conservative. We thus deemed these simple calculations appropriate for a first assessment of a potential antibiotic effect on REC, considering the current scarcity of data in the literature.

Meta-analyses

The calculated means and variances for ΔREC in combination with the respective sample sizes were then entered in a fixed and random effects meta-analysis model, using the metaphor package in R [18, 19].

Four separate meta-analyses for the mean difference in ΔREC ($\Delta\mathrm{REC_{noAB}} - \Delta\mathrm{REC_{AB}}$) between AB and noAB treatment were conducted at 3 months and 6 months follow-up for the AP and the CP subset. In all cases, the heterogeneity parameter in the random effects model could not be satisfactorily assessed or was estimated to be zero; therefore, the fixed effects model was chosen. Model assumptions were checked using residuals, funnel, and radial plots.

Results

Considering the summary statistics (Table 2), REC increased consistently between baseline and follow-up. In the AP group,

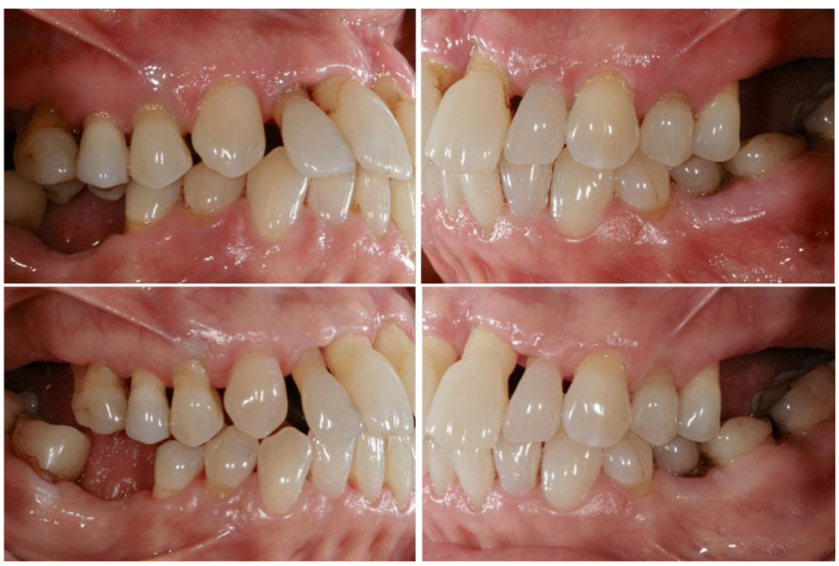

Fig. 2 Clinical example of a case treated with antibiotics before (upper images) and after therapy (lower images). Recession can be locally identified at periodontally affected facial and interproximal areas, especially in the maxilla. The resulting tissue loss renders regenerative approaches more difficult.

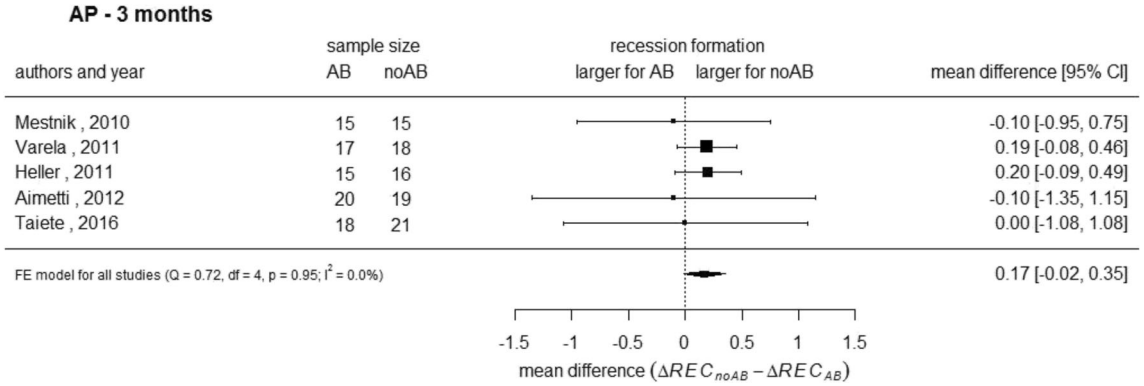

Fig. 3 Meta-analysis with respect to the difference in recession formation between AB and noAB treatment (forest plot, mm) after 3 months in aggressive periodontitis (AP)

irrespective of whether AB was administered or not, median ΔREC was 0.20 mm. After 6 months, ΔREC increased to 0.35 mm with AB and remained stable at 0.20 mm with SRP alone. In the CP group after 3 months with AB and without AB, the median differences accounted for 0.30 mm and 0.14 mm, respectively. After 6 months, median ΔREC accounted for 0.28 mm (with AB) and 0.20 mm (without AB).

After 3 months, two out of five studies with AP showed slightly higher values for ΔREC without the use of AB, six out of seven considered studies dealing with CP showed more ΔREC when using AB. After 6 months, five out of eight studies with AP and 2 out of five studies in the CP group showed larger ΔREC with AB.

None of the meta-analyses showed a significant effect with respect to the difference in ΔREC between AB and noAB treatment. In case of the AP group, the mean difference in ΔREC ($\Delta REC_{noAB} - \Delta REC_{AB}$) was estimated to be 0.17 mm (95% CI − 0.02, 0.35) after 3 months and − 0.01 mm (95% CI − 0.19, 0.17) after 6 months, demonstrating a minimally larger REC increase for the noAB and AB group after the different follow-up times, respectively (Figs. 3 [12, 20–23] and 4 [14, 20–25]). The differences between ΔREC for the CP group were estimated to be − 0.25 mm (95% CI − 0.60, 0.09) after 3 months and − 0.04 (95% CI − 0.43, 0.36) after 6 months, also not yielding any significant difference, but with a more accentuated pattern, which possibly suggests a slightly higher REC increase for the AB group (Fig. 5 [9–11, 13, 15, 26, 27] and Fig. 6 [9–11, 13, 15]). However, this pattern could also be due to a slight publication bias as the smallest studies show the largest effects (cf. Fig. 5). Using the meta-analysis approach, the estimated differences in ΔREC between AB and noAB were thus always small, i.e., ≤ 0.25 mm.

Discussion

This re-review calculated the ΔREC from available PD and CAL values in the literature and compared non-surgical periodontal therapy with systemic AB (amoxicillin/metronidazole) to SRP alone after 3 and 6 months for CP and AP cases.

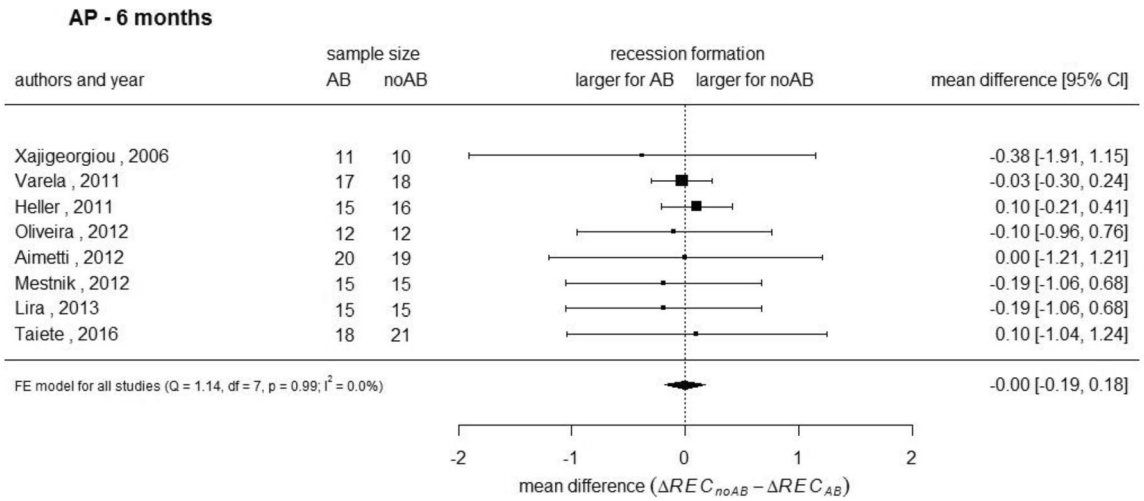

Fig. 4 Meta-analysis with respect to the difference in recession formation between AB and noAB treatment (forest plot, mm) after 6 months in aggressive periodontitis (AP)

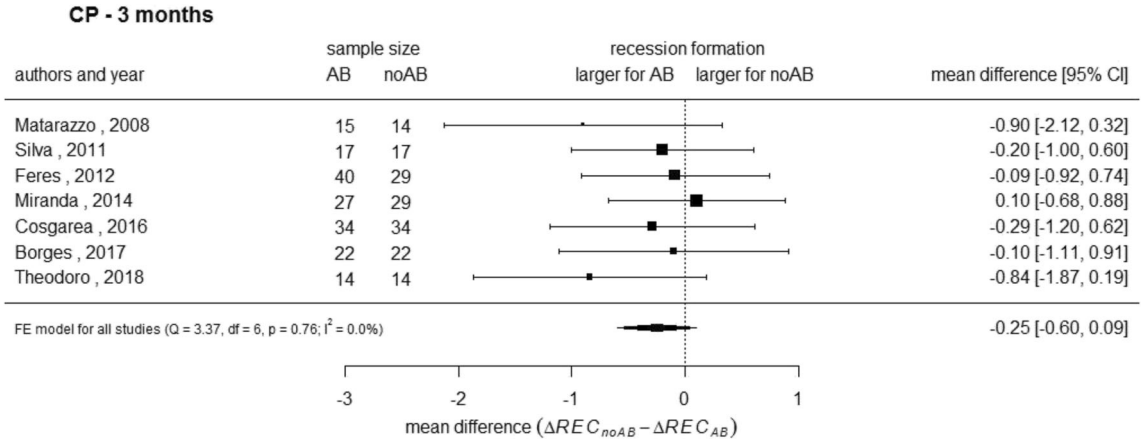

Fig. 5 Meta-analysis with respect to the difference in recession formation between AB and noAB treatment (forest plot, mm) after 3 months in chronic periodontitis (CP)

Moreover, respective meta-analyses were conducted to quantitatively assess the potential differences in ΔREC.

The data set in this study comprised studies of a previously published meta-analysis [7], which served as the basis for our re-analysis. Notably, the underlying set of literature was identical, but in the present study, we focused on the REC outcome parameter, which was unfortunately not directly assessed so far, neither in the included individual studies nor—as a consequence—in other reviews. The data on REC first had to be calculated from the reported CAL and PD measurements, i.e., from the differences between these two parameters. Accepting relatively conservative standard errors, the statistical methodology to achieve the clinical parameter of ΔREC over time was straightforward.

As a general finding, a slight tendency towards higher ΔREC after SRP in combination with AB was found as compared with SRP alone in many studies. However, using the meta-analyses, estimated differences between the use of AB and noAB with regard to ΔREC yielded rather small values for the estimated difference between the treatments, and none of them reached statistical significance. At first sight, the difference between the SRP treatment with and without AB would therefore not appear to be clinically relevant, since the largest estimated difference in ΔREC was only 0.25 mm (between AB and noAB in CP after 3 months). Nevertheless, the calculated differences should be related to the overall PD reduction and the additional CAL gain with observed mean values of − 0.47 mm and + 0.33 mm, respectively [28]. These values were also below 0.5 mm, and one should acknowledge in this context the fact that the results are based on calculations related to multiple (also non-diseased) sites, which may dilute the actual effect.

In general, ΔREC after non-surgical therapy depends on the initial PD and may slightly increase during maintenance over time [29]. Long-term studies showed that REC decreased again over time, especially after surgical treatment [30]. The present study was limited to 3 and 6 months. However, from a clinical perspective, this time frame is relevant after non-surgical therapy, at least in terms of further decision-making and most probably also in view of the initial tissue response and tissue shrinkage [1, 2]. The systemically determined difference between the AB and noAB treatment was shown to be rather small with absolute values around 0.00–0.25 mm; although in practice, the clinical outcome may strongly depend on the type of patient and diagnosis and thus show large inter-patient variability. Unfortunately, there is very little published

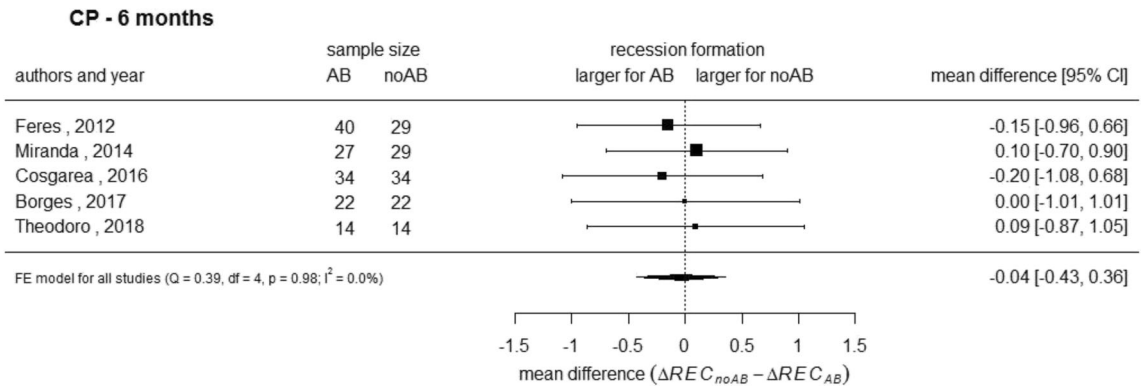

Fig. 6 Meta-analysis with respect to the difference in recession formation between AB and noAB treatment (forest plot, mm) after 6 months in chronic periodontitis (CP)

data available from directly measurements and reporting REC after SRP. A study in CP patients reported ΔREC values after 3 and 6 months after non-surgical therapy with AB of 2.2 and 2.0 mm and 1.5 and 1.4 mm without AB [31].

Within the limitations of our re-review, the results should be interpreted with caution due to the presence of uncontrolled confounding factors in the included studies such as different dosage and time of the AB or unreported smoking status of the patients.

In summary, reporting REC values still seems to be of minor interest to researchers, except in studies where regenerative products are used and where REC appears more appropriate as a relevant surrogate parameter for shrinkage and tissue height. In our opinion, REC represents an important and valuable measure for judging the clinical outcome of any successful periodontal therapy. The unavoidable side-effect of the healing process, i.e., recession formation, may even lead to a reduction of patient's perception of oral health related quality of life (OHQoL) [32]. Patients only realize what the esthetic outcome of recession formation (papilla loss (esthetics), dentin hypersensitivity, or enhanced risk of root caries) means for them personally once treatment is completed, and additional therapy needs may emerge. Also, for clinicians, it is quite a daunting task to balance the therapy goals with acceptable endpoints for the individual patient regarding recession. Therefore, we recommend further investigations in this direction and adequate reporting on this relevant periodontal parameter as well. More original data and respective reviews are still warranted, and further research on this topic may lead to new insights as well as optimized treatments in view of esthetic outcomes.

Conclusion

Although a slight tendency towards higher ΔREC after SRP in combination with AB could be observed as compared with SRP alone in many studies, quantitative meta-analyses showed no clinically relevant difference in ΔREC due to the administration of AB. Since the preservation of (healthy) gingival tissues is one of the major therapeutic goals in periodontology and is also important by preventive and therapeutic means, the aspect of ΔREC should not be neglected. We thus suggest to report REC measurements along with PD and CAL values in future studies as its indirect, mathematical assessment is cumbersome and less precise than when reported directly.

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Availability of data and materials All relevant data supporting the conclusion of this article are within or mentioned in the manuscript.

Authors' contributions PRS conceived the study and supervised the study. DW did the statistical evaluation of the papers and participated in its design. MK did the literature search. MK, AS and UZ drafted the manuscript. TA helped to supervise the methodological correctness of the performed study and the coordination. All authors carefully read and approved the final text.

Compliance with ethical standards

Conflict of interest The authors declare that they have no conflict of interest.

Ethical approval This article does not contain any studies with human participants or animals performed by any of the authors.

Informed consent For this type of study, formal consent is not required.

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