Treatment of periodontitis ameliorates the extent and severity of psoriasis – A randomized clinical trial

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Conflict of Interest statement

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Data availability statement

The data that support the findings of this study are available upon reasonable request to the corresponding author.

Author Contribution

CM contributed to study conception and design, to data collection, data analysis and interpretation, and to manuscript drafting. MR contributed to data analysis and data interpretation, and to manuscript drafting. CG contributed to data collection and data interpretation. ET, EC, and PR contributed to study conception and design, to data collection, and to manuscript drafting. SG contributed to study conception and design, and to manuscript drafting. All the authors gave their final approval of the version to be published and agreed to be accountable for all aspects of the work.

Abstract

Aims. To assess the impact of steps 1-2 of periodontitis treatment on the extent and severity of psoriasis in patients affected by comorbid psoriasis and periodontitis.

Methods. Seventy-four patients affected by both psoriasis and periodontitis were randomized to receive either immediate Steps 1-2 of periodontal therapy (test group; n=37) or no treatment (control group; n=37). The Psoriasis Area Severity Index (PASI) at 10 weeks was regarded as the primary outcome. The Body Surface Area (BSA) and the Dermatology Life Quality Index (DLQI) were also considered. Probing pocket depth (PPD), recession depth (REC), full-mouth plaque and bleeding scores (FMPS/FMBS) were also measured. Regression models were built to compare the two groups and to predict changes in PASI.

Results. Periodontal therapy in the test group led to a significant reduction in PASI (MD=-4.0) compared to the control group. The test group also showed improvements in BSA (MD=-4.3) and periodontal parameters compared to the control group. DLQI only showed a non-statistically significant tendency (MD=-2.0). Relevant predictors for PASI changes were: treatment group (MD=-4.7), and baseline values of PASI (MD=-0.4), DLQI (MD=-0.2), and % of sites with PPD≥6 mm (MD=-5.8).

Conclusion. Steps 1-2 of periodontal therapy showed an additional effect over medications in reducing the extent and severity of psoriasis.

Keywords. Psoriasis; Periodontal Diseases; Non-surgical Treatment; Periodontal Therapy; Systemic Inflammation; Periomedicine; Clinical Trial.

Clinical relevance box

Background. It has been hypothesized that periodontitis may contribute to exacerbating psoriasis. However, no randomized clinical trial is available examining the additional effect of periodontal therapy over the use of medications in patients with psoriasis. Moreover, it remains unclear whether periodontal therapy may be less effective in patients taking psoriasis-related systemic medications or biologics.

Added value of this study. Steps 1-2 of periodontal therapy showed an additional effect over medications in reducing the extent and severity of psoriasis. Periodontal therapy was also effective in improving periodontal status. The prediction model indicated that patients with higher severity/extent of both psoriasis and periodontitis may benefit the most from periodontal therapy in terms of psoriasis control.

Clinical implications. Patients with both periodontitis and psoriasis may benefit from periodontal therapy for the control of both diseases, especially in the presence of higher severities of both.

1. Introduction

Periodontitis is a highly prevalent chronic inflammatory disease that affects the tooth-surrounding tissues, leading to clinical attachment loss [1,2]. If left untreated, it may ultimately result in extensive tooth loss, affecting masticatory and esthetic functions. Besides its oral consequences, severe periodontitis has been associated with an increased risk of various systemic diseases, including diabetes, cardiovascular diseases, cancer, and even mortality [3–8]. Bacterial translocation and low-grade systemic inflammation (LGSI) are suggested as the main mechanisms involved in the perio-systemic relationships [9–13].

Psoriasis is a skin disorder characterized by scaly, indurated erythema, affecting 2-3% of the world population [14]. Among its different types, psoriasis vulgaris is the most prevalent form [15]. Typical clinical manifestations include sharply demarcated, scaly, and erythematous plaques [16]. Despite its significant impact on quality of life, available treatments are often insufficient [17]. Due to the dysbiosis-driven inflammatory nature of psoriasis, it has been hypothesized that periodontitis may contribute to psoriasis exacerbation through its above-mentioned systemic impact routes [18–20]. Moreover, psoriasis and periodontitis were also found to share many lifestyle-related risk factors [21–26].

The only available randomized clinical trial on the effects of periodontal therapy in patients with psoriasis did not target any dermatological clinical measure as a primary endpoint, and it was focused solely on mild psoriasis cases not requiring systemic medications or biologics [27]. Both limitations may have an impact on the study's conclusions and external validity, especially since it was not possible to ascertain whether the possible benefits of periodontal therapy over psoriasis may exceed conventional therapy with systemic medications of biologics. Moreover, since these systemic medications or biologics may also affect the

periodontal status [28], there is interest in understanding whether periodontal therapy is effective in this group of patients as well.

Therefore, the primary aim of this randomized clinical trial was to assess the impact of steps 1-2 of periodontitis treatment on the extent and severity of psoriasis in patients affected by comorbid psoriasis and periodontitis. Secondly, this study aimed to verify the efficacy of periodontal treatment on surrogate periodontal outcomes in this group of patients and to build predictive models of psoriasis control outcomes, also taking into account periodontal variables.

2. Methods

This study is reported following the Consolidated Standards of Reporting Trials (CONSORT) 2010 guidelines [29]. Its protocol was prospectively registered in clinicaltrial.gov (NCT05311501) and approved by the Ethical Committee of Clinical Investigations of the Azienda Ospedaliero Universitaria Senese (protocol number: 19659/2021). All participants were informed in detail about the study protocol and provided written informed consent prior to inclusion.

2.1. Trial design

The present study was designed as a randomized, single-center, dermatological outcome-assessor blinded, clinical trial with two parallel groups, a 1:1 allocation ratio and a follow-up of 10 weeks. The following the PICO structure was considered:

(P) Participants. Patients affected by both psoriasis and periodontitis.

(I) Intervention. Step 1-2 of periodontal therapy (i.e., immediate periodontal treatment).

(C) Control. No periodontal therapy (i.e., 10-week delayed periodontal treatment).

(O) Outcomes. Primary outcome: severity and extent of psoriasis (i.e., Psoriasis Area and Severity Index - PASI). Secondary outcomes: body surface area (BSA), dermatological health-related quality of life, periodontal clinical parameters.

2.2. Participants

Potential participants were identified from a specialty outpatient dermatology clinic (Unit of Dermatology, Azienda Ospedaliero-Universitaria Senese, Siena, Italy) from May 2022 to November 2023. Inclusion criteria were: i) age between 18 and 70 years; ii) diagnosis as periodontitis case [30]; iii) diagnosis of psoriasis vulgaris [31]; iv) presence of at least 20 remaining teeth. Patients were excluded if: i) unable or unwilling to give informed consent; ii) received periodontal treatment within the previous 6 months; iii) ongoing immunosuppressive treatments or antibiotic therapy for other systemic diseases; iv) pregnant or on lactation; v) had additional comorbidities apart from psoriasis and periodontitis.

2.3. Interventions and Controls

Patients were randomly assigned to receive steps 1-2 of periodontal therapy either immediately (test group) or at study termination after 10 weeks (control group). The randomization sequence was determined using an Excel-based simple randomization list with a 1:1 allocation ratio. Allocation was concealed through the use of sealed, opaque envelopes, which were opened after patient inclusion.

Participants allocated to the Test Group received Steps 1/2 of periodontal therapy by two therapists (CM, CG). Step 1 involved the administration of oral hygiene instructions and motivational strategies, alongside supra-gingival instrumentation using ultrasonic instruments (Cavitron Select SPS, Dentsply Sirona, Rome, Italy). Step 2 of the periodontal therapy entailed

subgingival instrumentation utilizing both ultrasonic and manual instruments (Gracey curetters, HuFriedy, Chicago), administered under local anesthesia (articaine 4% with epinephrine 1:100,000), within two or four sessions depending on disease severity and extent [32]. Following the completion of Steps 1 and 2, participants received reinforcement of OHIs and motivation one month later.

Participants allocated to the Control Group received Step 1 and 2 of periodontal therapy at study termination (10 weeks after the baseline examination).

2.4. Outcomes

Study outcomes were collected at baseline and 10 weeks after the baseline examination for the control group, or after the last session of subgingival instrumentation for the test group.

2.4.1. Dermatological outcomes

The extent and severity of psoriasis vulgaris were clinically assessed by one dermatologist (ET), who was blinded to the study groups. The following measures were considered:

- PASI [33]. Briefly, the body was divided into six regions: head, two upper extremities, trunk, and two lower extremities. An "area score" was determined to describe the number of regions involved, ranging from 0 (no psoriasis) to 6 (total skin involvement). For each region, a "severity score" was then assigned, indicating the severity of psoriasis impact, based on three parameters: thickness, scaliness, and redness, each graded from 0 to 4. The total severity score for each region could therefore range from 0 to 12. The PASI score was derived by multiplying the "area score" by the "severity score" (maximum 6 × 12 = 72).

- BSA [33]. It indicated the percentage of the body covered by psoriasis, considering that one hand covers roughly 1% of the participant's body surface area (the "1% Hand Test").

Moreover, dermatological quality of life was assessed through a structured questionnaire (Dermatology Life Quality Index (DLQI))[34] administered by the same dermatologist (ET). The questionnaire included 10 questions, each one rated ranging between 0 and 3. The total score was obtained by summing up each question and ranged between 0 and 30 (Supplementary Table 1). The higher the score, the more the quality of life is impaired due to psoriasis.

Finally, psoriasis severity was also categorized according to different criteria:

- PASI categorization (severe psoriasis): PASI≥7 [35].
- BSA categorization (moderate/severe psoriasis): BSA≥4 [36];
- Composite score (severe psoriasis): (BSA>4% or PASI>10) & DLQI>10 [33].

2.4.2. Periodontal outcomes

A full-mouth periodontal examination was performed at baseline and at 10 weeks for both groups by one calibrated examiner, who was not blinded to patient allocation (CM). Probing pocket depth (PPD), recession depth (REC), presence of plaque [37], and bleeding on probing (BoP) [38] were recorded with a standardized periodontal probe (UNC 15 probe, HuFriedy Group, Chicago, IL, USA) at six sites per tooth, with third molars excluded. Clinical attachment levels (CAL) at site-level, as well as mean PPD/REC and full-mouth plaque (FMPS) and bleeding (FMBS) scores at patient-level, were computed. Periodontal parameters were also categorized as follows: % of sites with PPD≥4 mm, % of sites with PPD≥5 mm, % of sites with PPD≥6 mm, number of sites not exhibiting the endpoint of periodontal therapy (absence of PPD=4-5 mm

with BoP and PPD≥6 mm)[32] at 10 weeks. Intra-examiner agreement calculation was performed on two non-study subjects and resulted in ICC=0.89 (p = .002) for PPD.

2.4.3. Co-variates

For the prediction models, the baseline values of the dermatological and periodontal variables were considered. Moreover, self-reported characteristics (age, gender, body mass index [BMI], education, occupation, and family history of periodontitis) were also considered. Finally, information about medications taken for psoriasis was collected from patient dermatological records and categorized as follows: no therapy or topical/phototherapy, systemic medications (e.g., methotrexate, ciclosporin), biologics (e.g., anti-TNF-alpha, anti-IL-17).

2.5. Sample size

The sample size was calculated targeting a 10% difference in PASI reduction between groups, considering a longer follow-up compared with the reference study [27]. A minimum of 74 participants (n=37 per group) was needed to achieve a power of 80% and setting the alfa error at 5%.

2.6. Data analysis

Data analysis was performed using an ad hoc software (STATA BE v.17.1, StataCorp, Texas, USA). Continuous variables were presented as mean (standard deviation - SD), while categorical variables were presented as number of observations (percentage - %). The normality of data distribution was verified using the Shapiro-Wilk test.

Differences between groups were tested through logistic (binary) or linear (continuous) regression analyses, using two-sided hypotheses and an $\alpha < 0.05$ level of significance. Results

of pairwise comparisons were expressed as differences in means (MD) or odds ratios (ORs), together with 95% CIs.

A predictive model was finally built targeting the changes in the primary outcome (PASI) at 10 weeks. Univariate estimates for each independent covariate were firstly calculated. Significantly associated parameters ($p<.10$) were then added to an intermediate development model, and backward stepwise selection was performed. The final model included only non-collinear relevant independent predictors ($p<.05$).

3. Results

Seventy-four participants (37 in each group) were included, all of whom completed the 10-week follow-up (Figure 1). The study population consisted mainly of male patients (69.9%) and had a mean age at baseline of 57.9 (12.1) years (Table 1). Most patients were receiving biologics as the primary treatment for psoriasis. No changes in medications were implemented between baseline and the 10-week follow-up. Figure 2 illustrates an exemplary case of clinical presentation of comorbid psoriasis and periodontitis at baseline and 10 weeks in each group.

3.1. Periodontal outcomes

Table 2 shows the results on periodontal outcomes. Steps 1-2 of periodontal therapy were effective in the test group in reducing FMPS (MD=-53.6), FMBS (MD=-29.1), and mean PPD (MD=-0.4) at 10 weeks, compared to the control group. Mean REC increased in the test group compared to the control group (MD=0.2). The test group also exhibited fewer sites with PPD ≥ 4 mm (MD=-9.4), PPD ≥ 5 mm (MD=-8.16), and PPD ≥ 6 mm (MD=-1.2) at 10 weeks than the

control group. The endpoint of periodontal therapy was not reached in 55.6% of the patients in the control group and 7.9% of the patients in the test group (MD=-7.91).

3.2. Dermatological outcomes

Periodontal therapy in the test group led to a significant reduction in PASI (MD=-4.0; 95% CI: -6.3, -1.6; p=0.001) compared to the control group (Table 3). Patients in the test group also exhibited a reduction in BSA (MD=-4.3) compared to the control group. DLQI only showed a non-statistically significant tendency towards a stronger reduction in the test group (MD=-2.0). Patients in the test group also showed lower odds of being considered as having severe psoriasis according to the composite score (OR=0.19) and moderate-to-severe psoriasis according to the BSA categorization (OR=0.26), while the same tendency was not statistically significant with the PASI categorization for severe psoriasis (OR=0.39).

3.3. Prediction of dermatological outcomes through periodontal parameters

The final prediction model for PASI changes at 10 weeks is shown in Table 4. Relevant predictors were: treatment group (MD=-4.7), and baseline values of PASI (MD=-0.4), DLQI (MD=-0.2), and % of sites with PPD≥6 mm (MD=-5.8).

4. Discussion

The results from this randomized clinical trial showed an additional benefit of steps 1-2 of periodontal therapy over medications in reducing the extent and severity of psoriasis in patients with both diseases. Periodontal therapy also demonstrated its effectiveness in improving surrogate periodontal outcomes and showed a non-statistically significant trend toward improving dermatological health-related quality of life. Finally, the prediction model

indicated that patients with higher severity/extent of both psoriasis and periodontitis may benefit the most from periodontal therapy in terms of psoriasis control.

The results obtained in the current study are consistent with a previous randomized clinical trial investigating the effects of periodontal therapy on psoriasis management, which however only included milder psoriasis cases not requiring systemic medications [27]. Despite it may appear obvious, the found efficacy of periodontal therapy over clinical periodontal outcomes is also worth mentioning, given the previously documented potential association between the two diseases [19,20], and the possible negative impact that some psoriasis-medications, such as anti TNF-alfa or anti IL-17, might have on periodontal status [28].

The treatment of periodontitis may have an influence on the extent and severity of psoriasis mainly through the reduction of the bacterial traslocation from the oral cavity to the skin as well as through an alteration/reduction of immuno-inflammatory mechanisms [13]. Indeed, reports on the oral-gut and skin-gut axis microbiota influence support the hypothesis that periodontal therapy may ameliorate the psoriasis-associated skin dysbiosis [39,40]. In particular, a recent longitudinal study demonstrated that periodontal treatment both mitigates oral dysbiosis as well as significantly changes gut microbiota composition [40]. In turn, gut dysbiosis was found to be at the root of the onset of multiple skin diseases, and the gut-skin microbiota axis has become one of the primary target of interventions for many skin inflammatory disorders [39]. Hence, the potential existence of an oral-skin microbiota axis can be hypothesized. This reciprocal influence between oral and skin microbiota is partially corroborated by a clinical study underlining significant differences in the salivary microbiota composition of individuals affected by psoriasis [41].

The treatment of periodontitis may influence the extent and severity of psoriasis also via the alteration of the innate and acquired immune responses as well as the reduction of systemic inflammatory markers following periodontal therapy [13,42]. A recent review underlined that active severe psoriasis is mainly characterized by an active state of innate immunity while mild quiescient disease shows a dominancy of acquired immunity [43]. As such, it can be hypothesized that periodontal therapy might play a significant role in the innate vs. acquired immunity balance, thus potentially contributing to the shift towards quiescent psoriasis and preventing exacerbations of the disease. Moreover, our combined experimental murine model of psoriasis and periodontitis supported this bidirectional relationship, showing that periodontitis was associated with increased inflammation of the otherwise-healthy dorsal skin (i.e., increased epidermal thickening and inflammatory infiltrate), and vice versa psoriasis was associated with a higher number of osteoclasts in the palatal tissues than the naïve mice. In this combined model, the common host inflammatory response triggered by periodontitis and psoriasis was identified as the potential biological mechanism [44]. Hence, it can be hypotesized that periodontal therapy might be able to induce an amelioration of the severity and extent of periodontitis by decreasing systemic inflammation and acting on the same molecular pathways as the medications administered for psoriasis, thus providing a significant adjunctive effect.

Despite being the first randomized clinical trial examining the additional effect of periodontal therapy over the use of medications in patients with psoriasis and the relevance of the built prediction model, readers should consider some inherent limitations. Specifically, the short follow-up employed for ethical reasons prevents us from proving that the effects of

periodontal therapy are substantiated in the long term, and the specific geographical provenance of the study sample may reduce the external validity of the present findings.

5. Conclusions

In patients with both periodontitis and psoriasis, steps 1-2 of periodontal therapy showed an additional effect over medications in reducing the extent and severity of psoriasis. In this group of patients, periodontal therapy was also effective in improving surrogate periodontal outcomes. The prediction model indicated that patients with higher severity/extent of both psoriasis and periodontitis may benefit the most from periodontal therapy in terms of psoriasis control.

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Table 1. Characteristics of the study population.

Variables	Overall (N=74)	Control Group (N=37)	Test Group (N=37)
Age (years), mean (SD)	57.90 (12.12)	60.10 (10.00)	55.81 (13.63)
Sex, N (%)			
Males	51 (68.92)	23 (63.89)	28 (73.68)
Females	23 (31.08)	13 (36.11)	10 (26.32)
Occupation, N (%)			
Unemployed	5 (6.76)	1 (2.78)	4 (10.53)
Employed	40 (54.05)	20 (55.56)	20 (52.63)
Retired/Not working	29 (39.19)	15 (41.67)	14 (36.84)
Education, N (%)			
Less than high school	26 (35.14)	15 (41.67)	11 (28. 95)
High school	38 (51.35)	17 (47.22)	21 (55.26)
University	10 (13.51)	4 (11.11)	6 (15.79)
Smoking, N (%)			
Non-smoker	23 (31.08)	10 (27.78)	13 (34.21)
Former smoker	24 (32.43)	9 (25.00)	15 (39. 47)
Current smoker	26 (35.14)	16 (44.44)	10 (26. 32)
BMI (kg/m^2), mean (SD)	26.96 (4.37)	27.80 (4.52)	26.16 (4.12)
Familiarity for periodontitis, N (%)			
No	52 (70.27)	22 (61.11)	30 (78.95)
Yes	*22 (29.73)*	*14 (38. 89)*	*8 (21.05)*
Medications for psoriasis, N (%)			
None/ topical/ phototherapy	9 (12.33)	5 (14.29)	4 (10.53)
Systemic medications	10 (13.70)	5 (14.29)	5 (13.16)
Biologics	54 (73.97)	25 (71.43)	29 (76.32)

Abbreviations. BMI, Body Mass Index; kg, kilograms; m^2, square meters; N, number; SD, Standard Deviation; %, percentage.

Table 2. Periodontal outcomes.

Variables	Overall (N=74)	Control Group (N=37)	Test Group (N=37)	Effect size	Intergroup p-value
FMPS (%), mean (SD)					
Baseline	71.44 (19.57)	73.50 (17.96)	69.5 (21.04)		
10 weeks	46.53 (31.56)	73.72 (18.35)	20.08 (14.37)	MD=-53.64 (95% CI:-61.28, -46.00)	*<0.001*
FMBS (%), mean (SD)					
Baseline	36.41 (20.40)	37.33 (18.00)	35.55 (22.65)		
10 weeks	22.90 (19.73)	37.63 (18.09)	8.56 (5.70)	MD=-29.07 (95% CI:-35.29, -22.85)	*<0.001*
Mean CAL (mm), mean (SD)					
Baseline	2.72 (0.69)	2.74 (0.69)	2.71 (0.69)		
10 weeks	2.67 (0.76)	2.78 (0.68)	2.57 (0.82)	MD=-0.21 (95% CI:-0.56, 0.14)	0.234
Mean PPD (mm), mean (SD)					
Baseline	2.57 (0.53)	2.60 (0.56)	2.55 (0.51)		
10 weeks	2.44 (0.61)	2.63 (0.58)	2.25 (0.59)	MD=-0.38 (95% CI:-0.65, -0.11)	*0.007*
Mean Rec (mm), mean (SD)					
Baseline	0.15 (0.34)	0.14 (0.24)	0.16 (0.42)		
10 weeks	0.23 (0.37)	0.14 (0.26)	0.31 (0.45)	MD=0.17 (95% CI:-0.0003, 0.34)	0.050
Sites PPD≥4 mm (%), mean (SD)					
Baseline	10.93 (10.45)	11.97 (11.01)	9.94 (9.93)		
10 weeks	7.65 (9.49)	12.41 (10.89)	3.02 (4.48)	MD=-9.39 (95% CI:-13.25, -5.53)	*<0.001*
Sites PPD≥5 mm. (%), mean (SD)					

Baseline	9.96 (8.32)	10.47 (8.39)	9.47 (7.04)		
10 weeks	6.75 (5.42)	10.89 (7.85)	2.73 (3.28)	MD=-8.16 (95% CI:-10.95, -5.37)	*<0.001*
Sites PPD≥6 mm. (%), mean (SD)					
Baseline	0.97 (2.27)	1.50 (3.01)	0.47 (1.03)		
10 weeks	0.90 (2.25)	1.52 (3.00)	0.29 (0.77)	MD=-1.23 (95% CI:-2.25, -0.22)	*0.018*
Sites with Endpoint of periodontal therapy not met (number), mean (SD)					
10 weeks	4.9 (7.20)	8.92 (9.17)	1.01 (1.06)	MD=-7.91 (95% CI:-10.94, -4.88)	*<0.001*

Abbreviations. BoP, Bleeding On Probing; CI, Confidence Interval; FMBS, Full Mouth Bleeding Score; FMPS, Full Mouth Plaque Score; MD, Mean Difference; N, number; OR, Odds Ratio; PPD, Probing Pocket Depth; SD, Standard Deviation.

Table 3. Dermatological outcomes.

		Overall (N=74)	Control group (N=37)	Test Group (N=37)	Effect size	Intergroup p-value
PASI (n), mean (SD)						
	Baseline	7.07 (6.45)	6.33 (6.23)	7.78 (6.66)		
	10 weeks	5.08 (5.38)	7.11 (6.09)	3.15 (3.78)	MD=-3.96 (95% CI:-6.31, -1.61)	*0.001*
BSA (%), mean (SD)						
	Baseline	7.0 (6.60)	6.33 (6.66)	7.63 (6.57)		
	10 weeks	5.22 (5.37)	7.41 (5.91)	3.15 (3.84)	MD=-4.26 (95% CI:-6.57, -1.95)	*<0.001*
DLQI (n), mean (SD)						
	Baseline	4.14 (6.21)	4.11 (6.35)	4.18 (6.16)		
	10 weeks	3.77 (5.48)	4.77 (6.27)	2.81 (4.48)	MD=-1.96 (95% CI:-4.49, 0.57)	0.126
PASI categorization (Severe Psoriasis: PASI≥7)[†], N (%)						
	Baseline	32 (43.24)	15 (40.54)	17 (45.94)		
	10 weeks	25 (33.78)	16 (43.24)	9 (24.32)	OR=0.39 (95% CI: 0.14, 1.05)	0.062
BSA categorization (Moderate/Severe Psoriasis: BSA≥4%), N (%)						
	Baseline	65 (87.84)	29 (78.38)	32 (86.49)		
	10 weeks	33 (44.59)	22 (59.46)	11 (29.73)	OR=0.26 (95% CI: 0.09, 0.68)	*0.006*
Composite score (Severe Psoriasis: [BSA>4% or PASI>10] & DLQI>10), N (%)						
	Baseline	26 (35.14)	13 (35.13)	13 (35.14)		
	10 weeks	21 (28.38)	16 (43.24)	5 (13.51)	OR=0.19 (95% CI: 0.06, 0.60)	*0.004*

Abbreviations. BSA, Body Surface Area; CI, Confidence Interval; DLQI, Dermatological Life Quality Index; PASI, Psoriasis Area and Severity Index; MD, Difference in Means; N, number; OR, Odds Ratio; SD, Standard Deviation. The reported p-values were adjusted for type of medications for psoriasis.

Table 4. Multivariate predictive regression model for the change in PASI baseline to 10 weeks (10 weeks - baseline).

Best Model (Mallow's Cp= 5.21) – Change in PASI (10 weeks - baseline)						
					95% CI	
Predictors	**Coefficients**	**SE**	**t**	***p*-value**	**Lower**	**Upper**
(Constant)	-0.15	2.59	-0.06	0.864	-5.31	5.02
PASI (Baseline)	-0.40	0.06	-6.43	*<0.001****	-0.52	-0.27
DLQI (Baseline)	-0.15	0.06	-2.25	*0.027**	-0.27	-0.02
% sites PPD≥6 mm (Baseline)	-5.80	6.90	-0.84	*0.049**	-19.58	-1.09
Test group (vs. Control group)	-4.68	0.79	-5.92	*<0.001****	-6.26	-3.10
BMI	0.16	0.09	1.79	*0.044**	0.02	0.36
				Analysis of Variance		
			Source	**Sum of squares**	**df**	**Mean Square**
R^2	0.6308		Model	1195.48	6	199.25
Adjusted R^2	0.5977		Residual	699.77	67	10.44
Root MSE	3.2318		Total	1895.26	73	25.96
			F=19.08; p<0.001***			

Abbreviations. BMI, Body Mass Index; CI, Confidence Interval; df, degrees of freedom; DLQI, Dermatology Life Quality Index; PASI, Psoriasis Area Severity Index; PPD, Probing Pocket Depth; Root MSE, Root Mean Square Error; SE, Standard Error.

Figure Legends

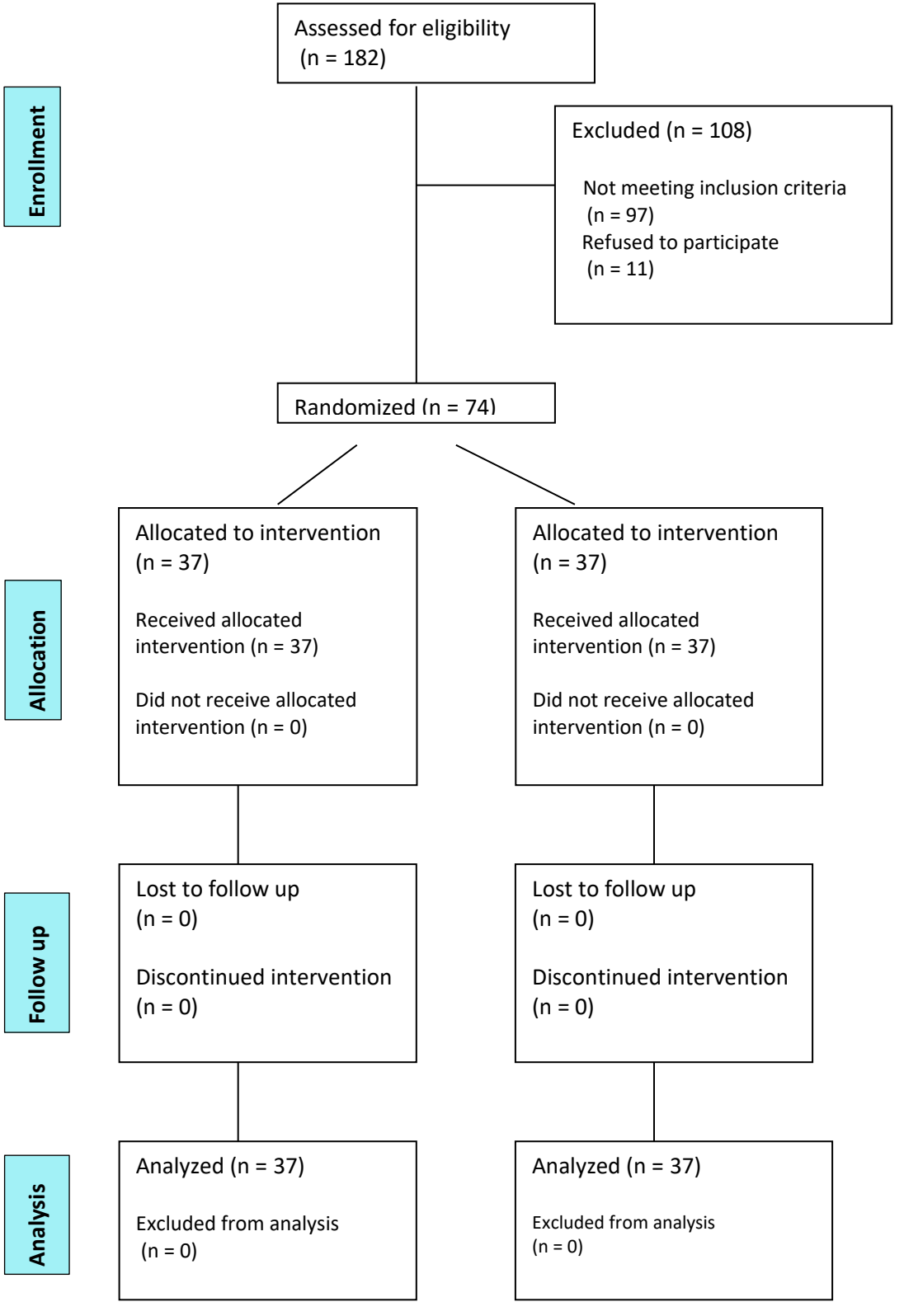
Figure 1. CONSORT 2010 flow diagram.

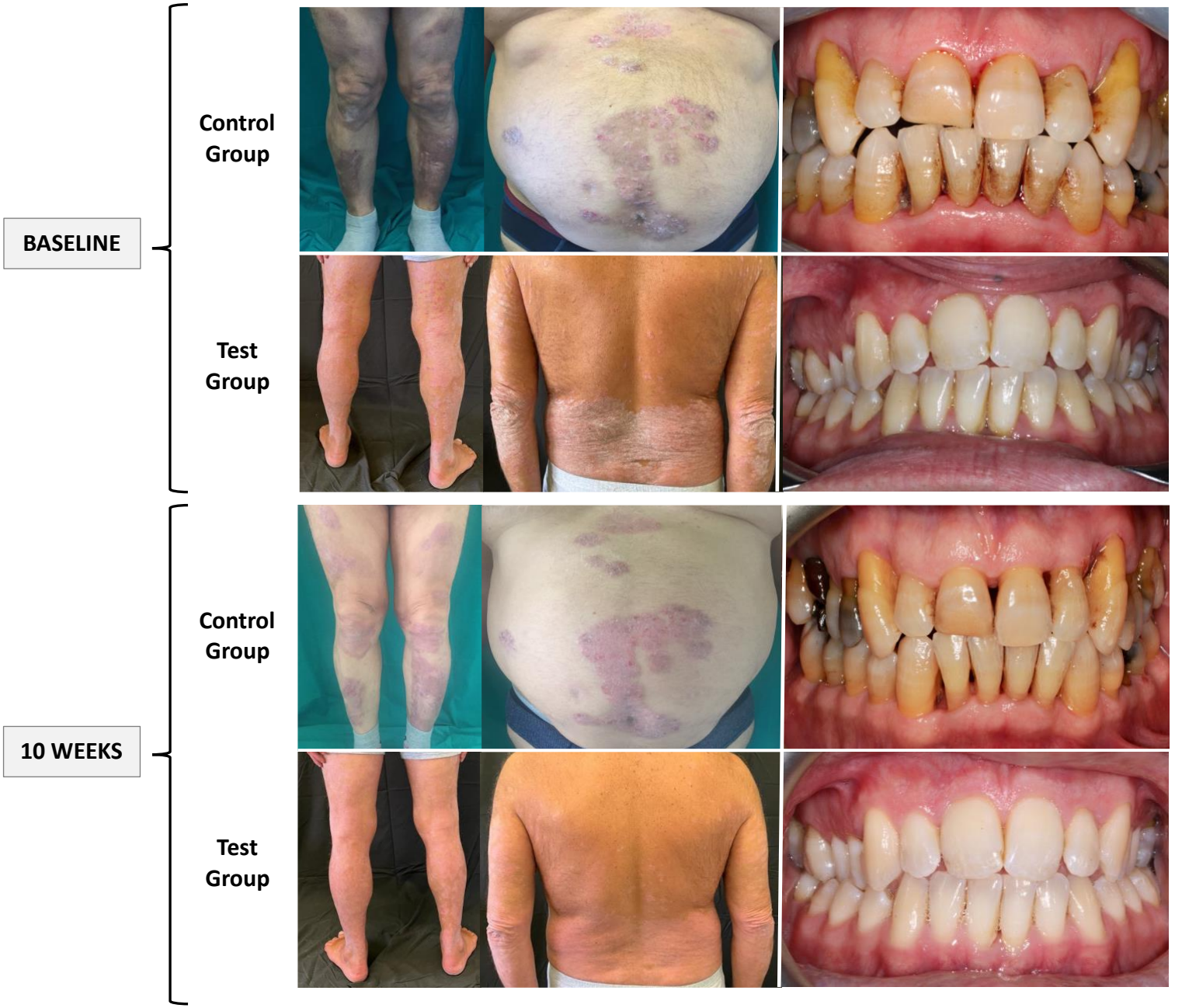
Figure 2. Exemplary case of clinical presentation of comorbid psoriasis and periodontitis at baseline and 10 weeks in each group.

Supplementary Information

Supplementary Table 1. Dermatology Life Quality Index (DLQI) questionnaire.

CONSORT Flow Diagram




BASELINE
Control Group
Test Group
10 WEEKS
Control Group
Test Group

Supplementary Table 1. Dermatology Life Quality Index (DLQI) questionnaire.

DERMATOLOGY LIFE QUALITY INDEX

DLQI

Hospital No: Date:
Name: Score:
Address: Diagnosis:

The aim of this questionnaire is to measure how much your skin problem has affected your life OVER THE LAST WEEK. Please tick ☑ one box for each question.

1.	Over the last week, how **itchy**, **sore**, **painful** or **stinging** has your skin been?	Very much A lot A little Not at all	❒ ❒ ❒ ❒	
2.	Over the last week, how **embarrassed** or **self conscious** have you been because of your skin?	Very much A lot A little Not at all	❒ ❒ ❒ ❒	
3.	Over the last week, how much has your skin interfered with you going **shopping** or looking after your **home** or **garden**?	Very much A lot A little Not at all	❒ ❒ ❒ ❒	 Not relevant ❒
4.	Over the last week, how much has your skin influenced the **clothes** you wear?	Very much A lot A little Not at all	❒ ❒ ❒ ❒	 Not relevant ❒
5.	Over the last week, how much has your skin affected any **social** or **leisure** activities?	Very much A lot A little Not at all	❒ ❒ ❒ ❒	 Not relevant ❒
6.	Over the last week, how much has your skin made it difficult for you to do any **sport**?	Very much A lot A little Not at all	❒ ❒ ❒ ❒	 Not relevant ❒
7.	Over the last week, has your skin prevented you from **working** or **studying**?	Yes No	❒ ❒	 Not relevant ❒
	If "No", over the last week how much has your skin been a problem at **work** or **studying**?	A lot A little Not at all	❒ ❒ ❒	
8.	Over the last week, how much has your skin created problems with your **partner** or any of your **close friends** or **relatives**?	Very much A lot A little Not at all	❒ ❒ ❒ ❒	 Not relevant ❒
9.	Over the last week, how much has your skin caused any **sexual difficulties**?	Very much A lot A little Not at all	❒ ❒ ❒ ❒	 Not relevant ❒
10.	Over the last week, how much of a problem has the **treatment** for your	Very much A lot	❒ ❒	

skin been, for example by making	A little	❒	
your home messy, or by taking up time?	Not at all	❒	Not relevant ❒

Please check you have answered EVERY question. Thank you.