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Curcumin versus propolis gel adjunctive to scaling and root planing in chronic periodontitis: A comparative study

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Abstract:

Local herbal drug delivery may enhance non-surgical periodontal therapy by sustaining anti-inflammatory and antimicrobial activity at periodontal sites. This study randomized 15 systemically healthy patients aged 30-60 years to scaling and root planing (SRP) alone, SRP plus curcumin gel, or SRP plus propolis gel and recorded plaque index, gingival index, probing pocket depth and relative attachment level through 6 months. All groups showed clinical improvement, with propolis producing the greatest improvement in plaque and gingival indices and curcumin showing a notable gain in relative attachment level. Adjunctive herbal therapy also reduced probing depth, although the pattern of benefit differed between the two test gels. Thus, curcumin and propolis gels are useful adjuncts to SRP, with propolis showing more consistent overall benefit and curcumin showing promise for attachment gain.

Keywords: Chronic periodontitis, propolis, curcumin, local drug delivery (LLD), scaling and root planing (SRP)

Background:

The periodontium, or periodontal tissues, consists of the gingiva, alveolar bone that forms the tooth socket, the cementum covering the tooth root and the periodontal ligament that connects the tooth to the surrounding bone [1]. Gingivitis is a localised inflammation of the gingiva caused by dental biofilm buildup, characterised by erythema and oedema without loss of periodontal attachment, usually painless and rarely causes spontaneous bleeding [2]. Localised drug delivery enables targeted periodontal therapy with lower drug doses, reduced systemic side effects and controlled drug release using systems such as fibres, gels, strips, films, microparticles and nanoparticles [3]. Turmeric (*Curcuma longa*), a rhizome of the Zingiberaceae family, has been used in Indian medicine for centuries [4]. Curcumin, its active component, possesses anti-inflammatory, antioxidant, antimicrobial, antiseptic and antimutagenic properties [4]. Propolis is a natural, non-toxic resinous substance ranging in colour from yellow-brown to dark brown, collected by honeybees from tree buds, sap flows, shrubs and other plant sources [5]. It is known for its wide range of therapeutic properties, including antimicrobial, antifungal, antiviral, anticancer and anti-inflammatory effects [5]. Recent clinical studies also support adjunctive propolis and curcumin with scaling and root planing [6, 7]. Therefore, it is of interest to compare curcumin and propolis gels as adjuncts to scaling and root planing for clinical improvement in chronic periodontitis.

Materials and Methods:**Study population and design:**

Fifteen (forty-five sites) systemically healthy patients (aged 30-60 years) with chronic periodontitis with ≥ 4 mm and ≤ 6 mm pocket depth were included. Ethical clearance was obtained and informed consent was signed by all participants. Patients were randomly assigned to-

- [1] Control (SRP alone),
- [2] Test Group A (Curcumin (SRP + Curcumin gel)), &
- [3] Test Group B (Propolis (SRP + Propolis gel))

Non-surgical procedure:

The patients received scaling and root planing, followed by application of Curcumin or Propolis gel one week later for test groups, after baseline clinical documentation.

Application of local drug delivery-preparation:

The two local drug delivery agents were provided in two distinct syringes.

Administration:

A delivery syringe was used to inject the product into the sulcular pocket from the base to the gingival margin; excess material was pushed deeper with a curette and a periodontal dressing was applied to retain the material.

Patient instructions:

After gel application, patients were instructed to avoid brushing/flossing the treated area for 7 days, avoid hard or sticky foods and contact with the area and follow oral hygiene instructions using the roll-on approach. Patients were recalled after 7 days for periodontal dressing removal and clinical parameters and any side effects were documented at subsequent recall visits.

Clinical evaluation:

- [1] Plaque Index (PI): Silness and Loe, 1964.
- [2] Gingival Index (GI): Loe and Silness, 1963.
- [3] Probing Pocket Depth (PPD) was measured using an UNC-15 probe.
- [4] Relative Attachment Level (RAL) - A stent was fabricated from self-cure acrylic resin for assessment.

Statistical analysis:

Data were analysed using SPSS version 25. Paired t-tests evaluated intra-group changes and independent t-tests analysed intergroup differences. Significance was set at $p < 0.05$.

Results:

Both groups showed significant improvements ($p < 0.05$) in all clinical parameters over 6 months. Plaque and Gingival scores-Improved in both test groups, but more highly in Test Group B. Reductions in PPD- Similar in both test groups. RAL- More

pronounced in Test Group A. **Table 1** presents the mean change, standard deviation (SD) and standard error (SE) of various clinical periodontal parameters in Group A (Curcumin) between successive follow-up intervals. For the Plaque Index (PI), the mean reduction was 0.49 ± 0.12 from baseline to 1 month, 0.52 ± 0.10 from 1 to 3 months, -0.79 ± 0.19 from 3 to 6 months and the overall change from baseline to 6 months was 0.22 ± 0.19 , indicating a progressive improvement in plaque control during the early follow-up period. For the Gingival Index (GI), the mean reductions were 0.42 ± 0.18 between baseline and 1 month and 0.22 ± 0.23 between 1 and 3 months, while a mean change of -0.32 ± 0.31 was observed between 3 and 6 months. The overall mean difference from baseline to 6 months was 0.32 ± 0.24 , suggesting sustained improvement in gingival inflammation following treatment. With respect to probing pocket depth (PPD), the mean changes were 0.20 ± 0.94 , -0.13 ± 0.35 , 0.07 ± 0.70 and 0.13 ± 1.06 during the baseline–1 month, 1–3 months, 3–6 months and baseline–6 months intervals, respectively. These findings indicate relatively small changes in pocket depth throughout the follow-up period. For relative attachment level (RAL), the mean improvement was 1.27 ± 0.80 mm from baseline to 1 month, 1.00 ± 1.96 mm from 1 to 3 months and 3.00 ± 1.89 mm from 3 to 6 months. The cumulative improvement from baseline to 6 months was 4.82 ± 1.58 mm, showing a marked gain in periodontal attachment over the study period, with the greatest improvement occurring during the later phase of healing (3–6 months). Overall, the Curcumin group exhibited gradual improvements in plaque accumulation, gingival health and periodontal attachment, while changes in probing pocket depth were comparatively modest. **Table 2** presents the mean change, standard deviation (SD) and standard error (SE) of different clinical periodontal parameters in Group B (Propolis) between successive follow-up intervals. For the Plaque Index (PI), the mean reduction was 0.73 ± 0.28 from baseline to 1 month and 0.94 ± 0.25 from 1 to 3 months. A mean change of -1.21 ± 0.33 was observed between 3 and 6 months, while the overall mean difference from baseline to 6 months was 0.45 ± 0.35 , indicating a marked reduction in plaque accumulation over the study period. Regarding the Gingival Index (GI), the mean reductions were 0.37 ± 0.34 between baseline and 1 month and 0.25 ± 0.16 between 1 and 3 months. Between 3 and 6 months, the mean change was -0.18 ± 0.42 and the overall improvement from baseline to 6 months was 0.44 ± 0.60 , reflecting progressive resolution of gingival inflammation throughout the follow-up period. For probing pocket depth (PPD), the mean reduction was 0.87 ± 0.83 mm from baseline to 1 month, whereas no change was observed between 1 and 3 months (0.00 ± 0.00 mm). A mean change of -0.33 ± 0.72 mm occurred between 3 and 6 months and the cumulative change from baseline to 6 months was 0.53 ± 0.74 mm, demonstrating an overall improvement in probing pocket depth following treatment. With respect to relative attachment level (RAL), the mean gain was 1.53 ± 0.92 mm from baseline to 1 month and 2.07 ± 1.33 mm between 1 and 3 months. A similar mean improvement of 2.07 ± 1.79 mm was observed between 3 and 6 months, resulting in a cumulative attachment gain of 4.50 ± 1.80 mm from baseline to 6 months. These findings indicate a

consistent and sustained improvement in periodontal attachment throughout the study period. Overall, Group B (Propolis) demonstrated progressive improvements in plaque control, gingival health, probing pocket depth and relative attachment level over the six-month follow-up. The most pronounced and consistent improvement was observed in relative attachment level, indicating favourable periodontal healing following adjunctive use of propolis gel with scaling and root planing. **Table 3** presents the mean change, standard deviation (SD) and standard error (SE) of different clinical periodontal parameters in Group C (Control) between successive follow-up intervals. For the Plaque Index (PI), the mean reduction was 0.75 ± 0.19 from baseline to 1 month and 0.80 ± 0.15 from 1 to 3 months. A mean change of -1.21 ± 0.29 was observed between 3 and 6 months, while the overall mean difference from baseline to 6 months was 0.34 ± 0.30 , indicating an overall improvement in plaque control following conventional scaling and root planing. For the Gingival Index (GI), the mean reductions were 0.61 ± 0.21 between baseline and 1 month and 0.29 ± 0.32 between 1 and 3 months. Between 3 and 6 months, a mean change of -0.43 ± 0.43 was observed and the cumulative improvement from baseline to 6 months was 0.47 ± 0.30 , suggesting a gradual reduction in gingival inflammation over the course of treatment. Regarding probing pocket depth (PPD), the mean reduction was 1.00 ± 0.85 mm from baseline to 1 month, whereas no change was observed between 1 and 3 months (0.00 ± 0.00 mm). A mean change of -0.27 ± 0.46 mm was recorded between 3 and 6 months, resulting in an overall reduction of 0.73 ± 0.80 mm from baseline to 6 months. These findings indicate that most of the improvement in probing depth occurred during the initial month after treatment. For relative attachment level (RAL), the mean gain was 1.73 ± 0.80 mm from baseline to 1 month and 1.00 ± 1.96 mm between 1 and 3 months. The greatest improvement was observed between 3 and 6 months, with a mean gain of 3.67 ± 2.06 mm, resulting in a cumulative attachment gain of 6.29 ± 2.20 mm from baseline to 6 months. This demonstrates continued periodontal healing and progressive improvement in attachment level throughout the follow-up period. Overall, the Control Group exhibited progressive improvements in plaque accumulation, gingival health, probing pocket depth and relative attachment level following conventional scaling and root planing alone. The most notable improvement was observed in relative attachment level, whereas the greatest reduction in probing pocket depth occurred during the first month after treatment.

Table 1: Mean, standard deviation of different parameters of group a (curcumin) between different time intervals

Parameter	Interval	Mean (δ)	SD (δ)	Se (δ)
Plaque Index (PI)	B-1M	0.49	0.12	0.03
	1M-3M	0.52	0.10	0.03
	3M-6M	-0.79	0.19	0.05
	B-6M	0.22	0.19	0.05
Gingival Index (GI)	B-1M	0.42	0.18	0.05
	1M-3M	0.22	0.23	0.06
	3M-6M	-0.32	0.31	0.08
	B-6M	0.32	0.24	0.06
PPD (mm)	B-1M	0.20	0.94	0.24
	1M-3M	-0.13	0.35	0.09

RAL (mm)	3M-6M	0.07	0.70	0.18
	B-6M	0.13	1.06	0.27
	B-1M	1.27	0.80	0.21
	1M-3M	1.00	1.96	0.51
	3M-6M	3.00	1.89	0.49
	B-6M	4.82	1.58	0.41

Table 2: Mean, standard deviation of different parameters of group b (propolis) between different time intervals

Parameter	Interval	Mean (Δ)	SD (Δ)	SE (Δ)
Plaque Index (PI)	B-1M	0.73	0.28	0.07
	1M-3M	0.94	0.25	0.06
	3M-6M	-1.21	0.33	0.08
	B-6M	0.45	0.35	0.09
Gingival Index (GI)	B-1M	0.37	0.34	0.09
	1M-3M	0.25	0.16	0.04
	3M-6M	-0.18	0.42	0.11
	B-6M	0.44	0.60	0.15
PPD (mm)	B-1M	0.87	0.83	0.22
	1M-3M	0.00	0.00	0.00
	3M-6M	-0.33	0.72	0.19
	B-6M	0.53	0.74	0.19
RAL (mm)	B-1M	1.53	0.92	0.24
	1M-3M	2.07	1.33	0.34
	3M-6M	2.07	1.79	0.46
	B-6M	4.50	1.80	0.46

Table 3: Mean, standard deviation of different parameters of group c (control) between different time intervals

Parameter	Interval	Mean (Δ)	SD (Δ)	SE (Δ)
Plaque Index (PI)	B-1M	0.75	0.19	0.05
	1M-3M	0.80	0.15	0.04
	3M-6M	-1.21	0.29	0.08
	B-6M	0.34	0.30	0.08
Gingival Index (GI)	B-1M	0.61	0.21	0.06
	1M-3M	0.29	0.32	0.08
	3M-6M	-0.43	0.43	0.11
	B-6M	0.47	0.30	0.08
PPD (mm)	B-1M	1.00	0.85	0.22
	1M-3M	0.00	0.00	0.00
	3M-6M	-0.27	0.46	0.12
	B-6M	0.73	0.80	0.21
RAL (mm)	B-1M	1.73	0.80	0.21
	1M-3M	1.00	1.96	0.51
	3M-6M	3.67	2.06	0.53
	B-6M	6.29	2.20	0.57

Discussion:

This study confirmed that both Test Groups A and B showed significant improvements in clinical outcomes. However, Test Group B showed superior outcomes. Propolis gel is an effective adjunct to scaling and root planing (SRP) in the treatment of

chronic periodontitis due to its antimicrobial, anti-inflammatory, antioxidant and wound-healing properties. Its bioactive constituents, including flavonoids, phenolic acids, caffeic acid phenethyl ester (CAPE), terpenoids and aromatic compounds, help reduce periodontal pathogens, decrease gingival inflammation, improve probing pocket depth and clinical attachment level and promote periodontal tissue healing [6]. Owing to its natural origin, biocompatibility and minimal adverse effects, propolis gel serves as a safe and effective local drug delivery agent that enhances the clinical outcomes of non-surgical periodontal therapy. Recent evidence supports adjunctive local curcumin and propolis during non-surgical periodontal therapy, while emphasizing variation in formulations and study design [8-10].

Conclusion:

Both curcumin and propolis gels improved clinical outcomes when used adjunctively with scaling and root planing. Propolis showed good improvement, whereas curcumin showed notable attachment gain. These herbal gels may be useful local adjuncts to non-surgical periodontal therapy.

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