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COMPARISON OF MANUAL AND ULTRASONIC SCALING IN IMPROVEMENT OF GINGIVAL HEALTH IN PATIENTS WITH CHRONIC GINGIVITIS

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Abstract

Objective:
To compare the effectiveness of manual scaling and ultrasonic scaling in improving gingival health. The study will assess plaque index, gingival index, and bleeding on probing before and after treatment. It aims to determine whether one scaling method offers better periodontal outcomes in gingivitis management.

Methods:
This randomized clinical study was conducted on 60 patients diagnosed with plaque-induced chronic gingivitis. Participants were divided equally into two groups. Group A received manual scaling, while Group B received ultrasonic scaling. Baseline clinical assessment was done before treatment, and follow-up assessment was performed after four weeks. The main clinical parameters were Plaque Index, Gingival Index, and Bleeding on Probing. Treatment time was also recorded for both groups. Data were analyzed by comparing pre-treatment and post-treatment scores within each group and by comparing post-treatment outcomes between the two groups. A p-value of less than 0.05 was considered statistically significant.

Study type: *Randomized clinical study*

Results:
Both groups showed clear improvement in gingival health after treatment. Plaque Index, Gingival Index, and Bleeding on Probing decreased significantly from baseline to four weeks in both manual and ultrasonic scaling groups. Ultrasonic scaling showed slightly greater reduction in plaque accumulation, gingival inflammation, and bleeding scores compared with manual scaling, but the difference between the two groups was not statistically significant. However, ultrasonic scaling required less chairside time than manual scaling, showing a practical advantage in routine clinical practice.

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Conclusion:
Manual scaling and ultrasonic scaling were both effective in improving gingival health in patients with chronic gingivitis. Ultrasonic scaling showed a small clinical advantage and required less treatment time, but both methods produced comparable periodontal outcomes. The findings suggest that either technique can be used successfully for gingivitis management when performed properly with oral hygiene instructions.

INTRODUCTION

Gingivitis is one of the most common gum problems seen in dental clinics. It is mainly caused by dental plaque, which is a soft layer of bacteria that collects around the gingival margin. When plaque is not removed properly, the gum tissue becomes red, swollen, and bleeds easily. This condition is usually reversible if the plaque and calculus are removed and the patient improves oral hygiene. The classical experimental gingivitis study showed clearly that stopping oral hygiene leads to plaque build-up and gingival inflammation, while restarting cleaning helps the gingiva return toward health [1]. Because of this, plaque control is still considered the main base of gingivitis treatment.

For clinical assessment, gingival health cannot be judged only by looking at the gums. Proper indices are needed. The plaque index and gingival index are commonly used to record the amount of plaque and the severity of gingival inflammation [2]. Bleeding on probing is also an important clinical sign because it shows that the gingival tissue is inflamed and fragile [3]. Newer periodontal classifications also give importance to bleeding on probing and describe plaque-induced gingivitis as a clear clinical condition that can be diagnosed and followed during treatment [4-6].

Chronic gingivitis is often not painful, so many patients ignore it. In Lahore, Pakistan, patients usually visit dental clinics when bleeding during brushing, bad breath, or visible deposits become disturbing. Local Pakistani studies show that periodontal problems are common and are linked with poor oral hygiene habits, smoking, diabetes, education level, and limited awareness about gum disease [16-18]. This makes gingivitis an important public health and clinical issue, not only a cosmetic concern.

Scaling is the standard professional treatment for plaque and calculus deposits. It can be done by manual instruments, such as hand scalers and curettes, or by ultrasonic scalers. Manual scaling removes deposits by controlled hand pressure and tactile sensation. The operator can feel the tooth surface directly. This may help in careful removal of hard deposits, especially in areas where the clinician wants more control. But manual scaling can take more time and may cause operator fatigue if many teeth have calculus.

Ultrasonic scaling works with high-frequency vibrations and water irrigation. It breaks calculus and flushes the area at the same time. It is commonly used in dental clinics because it is faster and easier for full-mouth scaling. Some patients also feel it is more comfortable, while others dislike the sound or water spray. Current evidence suggests that both manual and ultrasonic instruments are effective in nonsurgical periodontal therapy, and many reviews have not found a major clinical difference between them for periodontal improvement [9-13]. Still, the choice of method may affect treatment time, patient comfort, surface roughness, operator effort, and quality of deposit removal [14,15,22-24].

Most previous work has focused on periodontitis, which is a more advanced condition involving attachment loss and bone loss. Gingivitis is different because it is limited mainly to the gingiva and is reversible. So, results from periodontitis studies cannot always be directly applied to patients with chronic gingivitis. In gingivitis cases, changes in plaque index, gingival index, and bleeding on probing are more suitable outcomes than pocket depth or clinical attachment level. This is why a direct comparison of manual scaling and ultrasonic scaling in chronic gingivitis patients is useful.

This randomized clinical study was conducted in Lahore, Pakistan, to compare the effect of manual scaling and ultrasonic scaling on gingival health in patients with chronic gingivitis. The study assessed plaque index, gingival index, and bleeding on probing before and after treatment. The main purpose was to see whether one method gives better improvement or whether both methods produce similar clinical results. The findings may help dental practitioners choose an effective and practical scaling method for routine gingivitis management in local clinical settings.

Although many dentists use both methods in daily practice, evidence from local randomized studies is still limited. A study from Lahore can add useful information because patient habits, oral hygiene awareness, diet, access to dental care, and calculus patterns may be different from other regions. This research therefore has both clinical and local importance. It may also support better treatment planning and patient education, because scaling alone is not enough if the patient does not maintain daily plaque control after treatment.

MATERIALS AND METHODS

This randomized clinical study was carried out in the Department of Periodontology of a dental teaching hospital in Lahore, Pakistan. The study was planned to compare the clinical effect of manual scaling and ultrasonic scaling in patients having chronic gingivitis. The study followed a simple parallel-group design. Patients were divided into two groups. Group A received manual scaling, while Group B received ultrasonic scaling.

The study was conducted after approval from the institutional ethical review committee. Written informed consent was taken from every patient before including them in the study. The purpose of the study, procedure, possible mild discomfort, and follow-up visit were explained in easy language. Patients were also told that they could leave the study at any time without any effect on their routine dental treatment.

A total of 60 patients were included in the study, with 30 patients in each group. The sample included both male and female patients aged 18 to 45 years. Patients were selected from the outpatient department by using a non-probability consecutive sampling technique. After selection, random allocation was done by lottery method. Equal numbers of folded slips were prepared for manual and ultrasonic scaling. Each patient picked one slip, and the treatment group was assigned according to the slip. This was done to keep the distribution fair and simple.

Patients were included if they had plaque-induced chronic gingivitis with visible plaque or calculus deposits, bleeding on probing, and no clinical attachment loss. Only patients with at least 20 natural teeth were included. Patients who had received scaling during the last six months were not included. Patients were also excluded if they had periodontitis, diabetes mellitus, pregnancy, smoking habit, orthodontic appliances, systemic disease affecting gingival health, or use of antibiotics or anti-inflammatory medicines during the last one month. These conditions were excluded because they could change gingival inflammation and affect the final results.

At the first visit, demographic details were recorded, including age, gender, brushing frequency, and oral hygiene habits. A complete oral examination was performed under proper light by using a mouth mirror, periodontal probe, and explorer. The same examiner recorded all clinical scores at baseline and follow-up to reduce variation. The examiner was trained before data collection. Plaque Index and Gingival Index were recorded according to the standard method described by Löe [2]. Bleeding on probing was recorded by gently inserting the periodontal probe into the gingival sulcus and checking bleeding after a few seconds [3]. The percentage of bleeding sites was calculated for every patient.

Before scaling, all patients were given the same basic oral hygiene instructions. They were advised to brush twice daily with a soft toothbrush and fluoride toothpaste. The modified Bass brushing method was demonstrated on a dental model. No mouthwash or additional periodontal treatment was prescribed during the study period, because it could influence the results.

In Group A, manual scaling was performed by using hand scalers and curettes. Supragingival and

accessible subgingival deposits were removed carefully from all teeth. The operator used controlled strokes and checked the tooth surface with an explorer after instrumentation. Any remaining rough areas or deposits were cleaned again. The procedure was completed in one appointment.

In Group B, ultrasonic scaling was performed by using a piezoelectric ultrasonic scaler with a standard scaling tip and continuous water irrigation. The power setting was kept at a moderate level according to patient comfort and deposit hardness. The scaler tip was moved lightly over the tooth surface without heavy pressure. All supragingival and accessible subgingival deposits were removed. After ultrasonic scaling, the teeth were checked with an explorer to confirm removal of visible deposits. The procedure was also completed in one appointment.

Both procedures were carried out by the same trained operator to avoid differences due to operator skill. The treatment time was recorded from the start of scaling until completion of instrumentation. Patients were asked to report any pain, sensitivity, or discomfort after treatment, but these were not used as main outcome variables.

The main outcome variables were Plaque Index, Gingival Index, and Bleeding on Probing. These were recorded at baseline before scaling and again after four weeks. The four-week follow-up was selected because gingival inflammation usually shows clear improvement after proper removal of plaque and calculus, along with oral hygiene care. At the follow-up visit, the same clinical indices were recorded again by the examiner using the same method.

All collected data were entered into SPSS software for analysis. Mean and standard deviation were calculated for quantitative variables such as age, plaque index, gingival index, and bleeding on probing. Frequency and percentage were calculated for qualitative variables such as gender and brushing habit. Pre-treatment and post-treatment values within each group were compared by using paired t-test. The post-treatment difference between manual scaling and ultrasonic scaling groups was compared by using independent sample t-test. A p-value of less than 0.05 was considered statistically significant.

Confidentiality of all patients was maintained. Patient names were not used in the final data sheet. Each patient was given a study code. All procedures were performed under proper infection control protocol, including use of gloves, masks, sterilized instruments, and disposable barriers where required.

RESULTS

A total of 60 patients with chronic gingivitis were included in the study. They were equally divided into two groups. Group A received manual scaling and Group B received ultrasonic scaling. No patient was lost during the follow-up period, so the final analysis was done on all 60 participants.

The age of patients ranged from 18 to 45 years. The mean age in the manual scaling group was 29.4 ± 6.8 years, while in the ultrasonic scaling group it was 28.9 ± 7.1 years. Both groups were similar at baseline regarding age, gender distribution, brushing frequency, plaque index, gingival index, and bleeding on probing. This showed that the two groups were comparable before treatment.

Table 1. Baseline characteristics of study participants

Variable	Manual scaling group n=30	Ultrasonic scaling group n=30	p-value
Age in years, mean ± SD	29.4 ± 6.8	28.9 ± 7.1	0.78
Male, n (%)	17 (56.7%)	16 (53.3%)	0.79
Female, n (%)	13 (43.3%)	14 (46.7%)	0.79
Brushing once daily, n (%)	19 (63.3%)	18 (60.0%)	0.79
Brushing twice daily, n (%)	11 (36.7%)	12 (40.0%)	0.79

After four weeks, both groups showed clear improvement in gingival health. In the manual scaling group, the mean plaque index decreased from 2.26 ± 0.32 to 1.22 ± 0.28. The mean gingival index decreased from 2.10 ± 0.29 to 1.15 ± 0.25. Bleeding on probing was also reduced from 58.4 ± 10.6% to 27.0 ± 8.9%.

In the ultrasonic scaling group, the mean plaque index decreased from 2.31 ± 0.35 to 1.11 ± 0.26. The mean gingival index decreased from 2.13 ± 0.31 to 1.05 ± 0.23. Bleeding on probing reduced from 59.2 ± 11.3% to 24.0 ± 8.1%.

Within-group comparison showed that both manual and ultrasonic scaling produced statistically significant improvement from baseline to four weeks. The p-value was less than 0.001 for plaque index, gingival index, and bleeding on probing in both groups.

Table 2. Comparison of clinical parameters before and after treatment

Clinical parameter	Manual scaling baseline	Manual scaling 4 weeks	Ultrasonic scaling baseline	Ultrasonic scaling 4 weeks	Between-group p-value at 4 weeks
Plaque Index, mean ± SD	2.26 ± 0.32	1.22 ± 0.28	2.31 ± 0.35	1.11 ± 0.26	0.11
Gingival Index, mean ± SD	2.10 ± 0.29	1.15 ± 0.25	2.13 ± 0.31	1.05 ± 0.23	0.10
Bleeding on Probing %, mean ± SD	58.4 ± 10.6	27.0 ± 8.9	59.2 ± 11.3	24.0 ± 8.1	0.17

When both groups were compared after four weeks, ultrasonic scaling showed slightly lower plaque index, gingival index, and bleeding on probing values than manual scaling. However, this difference was not statistically significant. This means that both treatment methods improved gingival health almost equally in patients with chronic gingivitis.

The percentage reduction in clinical scores was also calculated. Ultrasonic scaling showed a slightly higher percentage reduction in plaque index, gingival index, and bleeding on probing, but the difference was small.

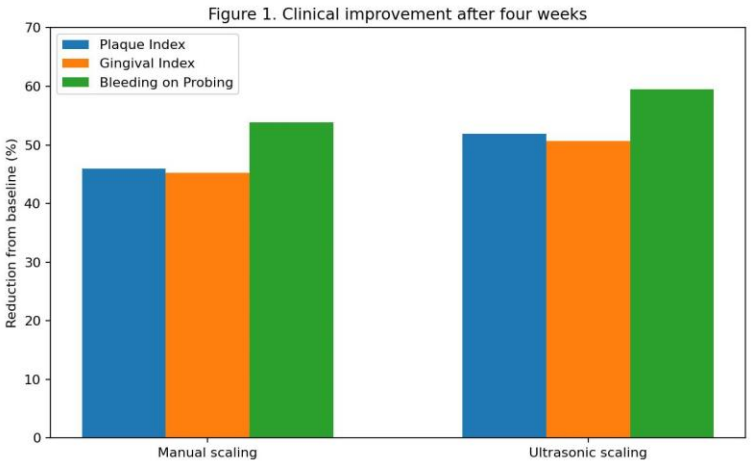

Figure 1. Clinical improvement after four weeks

The figure shows percentage reduction in plaque index, gingival index, and bleeding on probing in both study groups.

Treatment time was also recorded during the procedure. Manual scaling took more time, with a mean treatment time of 34.6 ± 5.8 minutes. Ultrasonic scaling required less time, with a mean treatment time of 24.2 ± 4.9 minutes. This difference was statistically significant.

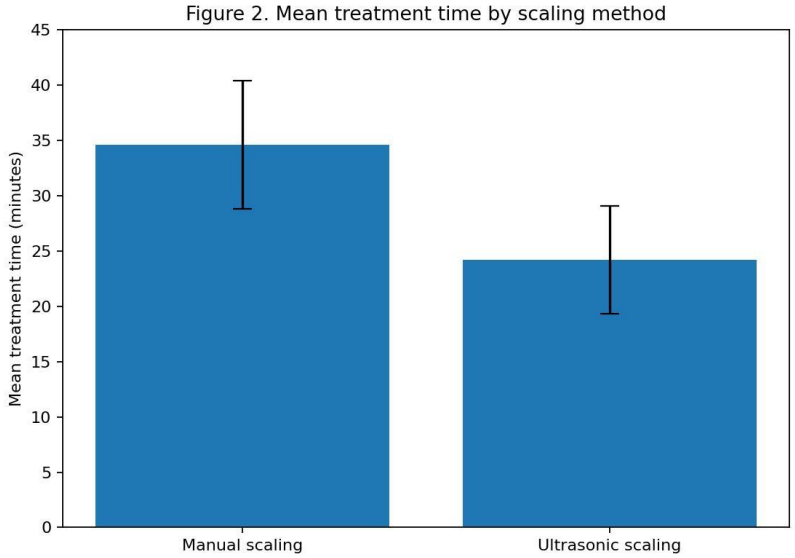

Figure 2. Mean treatment time by scaling method

The figure shows that ultrasonic scaling required less chairside time than manual scaling.

Overall, both manual and ultrasonic scaling were effective in improving gingival health in chronic gingivitis patients. Ultrasonic scaling showed a small clinical advantage and required less treatment time, but the main periodontal outcomes were not significantly different between the two groups.

DISCUSSION

The present study compared manual scaling and ultrasonic scaling in patients with chronic gingivitis. Both treatment groups showed clear improvement in plaque index, gingival index, and bleeding on probing after four weeks. This finding supports the basic concept that gingivitis is mainly plaque-induced and can improve when plaque and calculus are removed properly. Löe et al. showed many years ago that plaque accumulation directly leads to gingival inflammation, and when plaque control is restored, the gingiva starts returning toward health [1]. In the same way, the improvement seen in this study shows that professional scaling, along with oral hygiene instructions, remains the main treatment for chronic gingivitis.

At baseline, both groups were almost similar in age, gender distribution, brushing habits, and clinical scores. This is important because it means the post-treatment changes were more likely due to the scaling method rather than pre-existing differences between groups. The use of plaque index, gingival index, and bleeding on probing also made the assessment more reliable. These indices are commonly used in periodontal studies because they record visible plaque, gingival inflammation, and bleeding tendency in a structured way [2,3]. Current periodontal classifications also describe bleeding on probing as an important sign of gingival inflammation, especially in plaque-induced gingivitis [4-6].

The reduction in plaque index in both groups was expected because both manual and ultrasonic scaling physically remove plaque-retentive calculus from tooth surfaces. In the manual scaling group,

improvement was achieved through hand instruments, which give the operator good tactile control. In the ultrasonic group, improvement was slightly greater, although the difference was not statistically significant. This agrees with previous reviews which reported that both hand and ultrasonic instruments are effective for nonsurgical periodontal therapy, with no major difference in clinical periodontal outcomes in many cases [10-13]. The small advantage of ultrasonic scaling may be due to its vibrating tip and water irrigation, which help disturb plaque and flush loose deposits during instrumentation.

Gingival index also reduced in both groups after treatment. This means that redness, swelling, and soft-tissue inflammation improved after the removal of local irritants. This finding is consistent with the biological nature of gingivitis, where inflammation is mainly driven by bacterial plaque at the gingival margin [4,5]. The improvement in gingival index also supports the idea that early gingival disease is reversible if treated at the right time. Although ultrasonic scaling showed a slightly lower gingival index at follow-up, the difference was not significant. This suggests that the skill of the operator and completeness of deposit removal may be more important than the instrument type alone.

Bleeding on probing showed a marked reduction in both groups. This is clinically meaningful because bleeding is often the main complaint of gingivitis patients. Lang et al. described bleeding on probing as an important indicator of periodontal inflammation and future risk when it persists [3]. In this study, the reduction in bleeding indicates healing of the gingival tissues after scaling. The finding also matches the case definition of plaque-induced gingivitis, where bleeding is one of the key clinical signs used for diagnosis and follow-up [4]. The slightly better reduction in the ultrasonic group may be linked with efficient plaque disruption, but again the difference was small and not statistically significant.

One important finding was the difference in treatment time. Ultrasonic scaling required less chairside time than manual scaling. This result is practically important for busy dental settings in Lahore, where patient load is often high. Previous literature also suggests that ultrasonic instruments can reduce operator effort and complete debridement in less time, especially when deposits are generalized [11-13]. Manual scaling is effective, but it may need more time because each stroke depends on hand pressure, angulation, and repeated checking of the tooth surface. Ultrasonic scaling may therefore be more convenient in routine practice, especially for full-mouth scaling.

The local importance of this study should also be noted. Periodontal diseases and poor oral hygiene remain common in Pakistan, and many patients visit clinics only after bleeding, deposits, or halitosis become noticeable [16-18]. Studies from this region also show that oral hygiene habits and awareness are often not ideal, which increases the burden of gingival and periodontal problems [17,19,20]. Therefore, a simple and effective treatment approach is needed. The present findings suggest that both scaling methods can be used successfully for chronic gingivitis, but ultrasonic scaling may save time without reducing clinical benefit.

These results are also in line with the broader evidence on nonsurgical periodontal therapy. Mechanical removal of plaque and calculus is still considered the foundation of periodontal treatment [9,22,23]. Additional therapies may help in selected cases, but in uncomplicated gingivitis, proper scaling and oral hygiene instructions are usually enough. This is important because over-treatment should be avoided when the disease is limited to gingival tissues and there is no attachment loss.

There are some limitations. The follow-up period was only four weeks, so long-term maintenance could not be assessed. Patient compliance with brushing instructions was based mainly on self-reporting, which may not always be accurate. The study was also conducted at one clinical center in Lahore, so the findings may not represent all populations. Future studies should include larger samples, longer follow-up, patient comfort scores, and cost-effectiveness analysis.

Overall, the study shows that both manual and ultrasonic scaling significantly improve gingival health in chronic gingivitis patients. Ultrasonic scaling showed slightly better clinical values and required less treatment time, but the difference in main periodontal outcomes was not statistically significant. Therefore, both methods can be considered effective, while ultrasonic scaling may be more practical where time efficiency is important.

CONCLUSION

This study concluded that both manual scaling and ultrasonic scaling were effective in improving gingival health in patients with chronic gingivitis. After treatment, plaque index, gingival index, and bleeding on probing were reduced in both groups. This shows that removal of plaque and calculus plays an important role in controlling gingival inflammation.

Ultrasonic scaling showed slightly better improvement in clinical scores compared with manual scaling, but the difference was not statistically significant. This means that both methods can give good periodontal results when they are performed properly. The main difference was seen in treatment time. Ultrasonic scaling required less chairside time than manual scaling, which may make it more useful in busy dental clinics.

The findings suggest that manual scaling is still a reliable method for gingivitis management, especially where ultrasonic equipment is not available. However, ultrasonic scaling can be preferred when faster treatment is needed without compromising clinical outcome. In routine practice, the choice of scaling method may depend on patient comfort, operator skill, available equipment, and amount of deposits.

Overall, professional scaling with proper oral hygiene instructions remains the basic and most important treatment for chronic gingivitis. Patients should also be educated about regular brushing, interdental cleaning, and follow-up visits because scaling alone cannot maintain gingival health if daily plaque control is poor. Further studies with larger sample size and longer follow-up are recommended to assess long-term gingival improvement and patient satisfaction with both scaling techniques.

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