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Original article

Comparative Assessment of Ultrasonic versus Manual Scaling in the Treatment of Chronic Gingivitis: Randomized Controlled Trial

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Abstract
Gingivitis is a chronic inflammatory condition caused by dental plaque accumulation, leading to destruction of periodontal tissues. Scaling is the main non-surgical treatment, performed using ultrasonic or manual instruments. To compare the clinical effectiveness of ultrasonic versus manual scaling in periodontal treatment. This randomized controlled clinical trial included 20 patients aged 25–45 years with chronic gingivitis. Patients were randomly assigned to ultrasonic or manual scaling groups. Probing depth (PD) and bleeding on probing (BOP) were recorded at baseline and after one month. Both groups showed improvement in PD and BOP. The ultrasonic group showed slightly greater reductions, but the difference was not statistically significant ($p > 0.05$). Both ultrasonic and manual scaling are effective in improving periodontal health, with no significant difference between the two methods.
Keywords. Periodontal Disease, Ultrasonic Scaling, Manual Scaling, BOP, PD

Introduction

Gingivitis is an inflammatory response of the gingival tissues resulting from bacterial plaque accumulation located at and below the gingival margin [1]. It is a reversible inflammatory condition that does not affect the underlying supporting structures of the teeth. In contrast, periodontitis results in the loss of connective tissue attachment and alveolar bone support and is considered one of the major causes of tooth loss in adults [2]. Gingivitis can progress to periodontitis in susceptible individuals. In addition to oral hygiene, genetics and nutrition are important factors that impact the host's immune-inflammatory response [3]. The bacterial challenge induces the production of cytokines and chemokines by the gingival epithelium, resulting in the expression of adhesion molecules, increased permeability of gingival capillaries, and chemotaxis of polymorphonuclear neutrophils through the junctional epithelium and into the gingival sulcus [4]. Environmental changes within the oral cavity create multiple ecological niches that support the growth of a wide variety of oral pathogens.

To date, more than 700 bacterial species have been identified in the oral cavity. These microorganisms mainly belong to the phyla Actinobacteria, Proteobacteria, Firmicutes, Bacteroidetes, and Spirochaetes [5]. As plaque extends subgingivally, the flora becomes more complex and exists in a more protected environment. The immune response also changes. Salivary components no longer have access to the bacteria colonizing the subgingival environment. However, the crevicular fluid bathing the gingival sulcus or pocket contains many factors capable of resisting bacterial progression, such as lysozyme, bradykinin, thrombin, fibrinogen, complement, antibodies, and neutrophil-derived components [6]. Ultrasonic scaling is an effective component of dental prophylaxis and is widely recommended by dental practitioners. Ultrasonic scalers generate tip vibrations from electrical energy and are classified into magnetostrictive units operating at 18,000–45,000 cycles per second (cps) and piezoelectric units operating at 25,000–50,000 cps [7].

Ultrasonic scalers offer several advantages over conventional hand scaling. The ultrasonic tip spray aids in the removal of dental plaque and debris, while the absence of sharp cutting edges minimizes tissue trauma. Continuous water irrigation provides tissue lavage, reduces the need for rinsing during the procedure, and improves visibility throughout treatment. In addition, ultrasonic scalers are highly effective for stain removal, which may otherwise be tedious with hand instruments, and they generally provide greater patient comfort [8]. Periodontal treatment also involves behavioral modifications by the patient to improve oral hygiene practices and reduce the level of tissue inflammation [9]. Historically, infection control depended mainly on the mechanical removal of subgingival plaque, calculus, and endotoxins using curettes, files, and hoes. Aggressive scaling and root planing with hand instruments were traditionally considered necessary to remove tenacious calculus deposits and produce smooth root surfaces for effective endotoxin removal [10]. The first commercially available ultrasonic equipment for cleaning tooth surfaces was introduced during the 1950s and later became available as relatively inexpensive home-use instruments in the 1970s. Over the decades, the industrial application of ultrasonic technology in cleaning complex surfaces and improving treatment procedures has demonstrated promising results [11]. During the twentieth century, the introduction of ultrasound technology into dentistry marked the beginning of ultrasonic applications for calculus removal because of its cavitation effects and mechanical energy. Ultrasonic scalers exhibit

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mechanical, thermal, and biological actions that contribute to their effectiveness in periodontal therapy [12]. This study aims to compare the effectiveness of ultrasonic and manual scaling. All interventions were performed by the same operator to ensure consistency and minimize operator variability.

Methods

Study design

Twenty systemically healthy patients aged 25–45 years diagnosed with chronic gingivitis were randomly assigned to two groups: Group A (ultrasonic scaling) (Figure 1) and Group B (manual scaling with curettes) (Figure 2). All patients were prescribed mouthwash and educated on oral hygiene to ensure that they could maintain a proper level of oral health during the treatment. Clinical parameters—probing depth (PD), bleeding on probing (BOP)- were recorded. The results were compared after treatment for one month. This study was designed as a randomized controlled clinical trial.

Inclusion criteria

- Patients aged between 25 and 45.
- Willingness of patients to participate in the study.

Exclusion criteria

- Patients who presented contraindications for scaling and root planing or anaesthesia.
- Patients with systemic conditions affecting periodontal health.
- History of periodontal therapy in the last 6 months.
- Pregnant patients and smokers.

Clinical examinations

This study includes 20 patients, evaluated by measurement of bleeding on probing (BOP), probing depth (PD) using Williams probe. (Figure 1): case (a) Before and after manual scaling (heavy calculus in lower anterior teeth)

Figure 1. Case(a) before and after Manual scaling (before scaling, heavy calculus due to crowding and mouth breathing)

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Figure 2. Clinical parameters probing depth (PD), bleeding on probing (BOP), before and after 1 month of treatment were measured.

Methodology

The study combined a method of analysis (descriptive analysis) with a tool (SPSS) to examine the data collected.

Table 1. Frequencies of Category Gender in group I (Ultrasonic) and group II (Manual).

Category	ULTRASONIC	MANUAL	Total	Percentage %
Female	8	7	15	75%
Male	2	3	5	25%
Total	10	10	20	100%

Source: SPSS output. V24.

Table 1 shows the frequencies of the 20 cases by gender category in group I (Ultrasonic) and group II (Manual). However, the largest number was female (75%), and the smallest was male (25%).

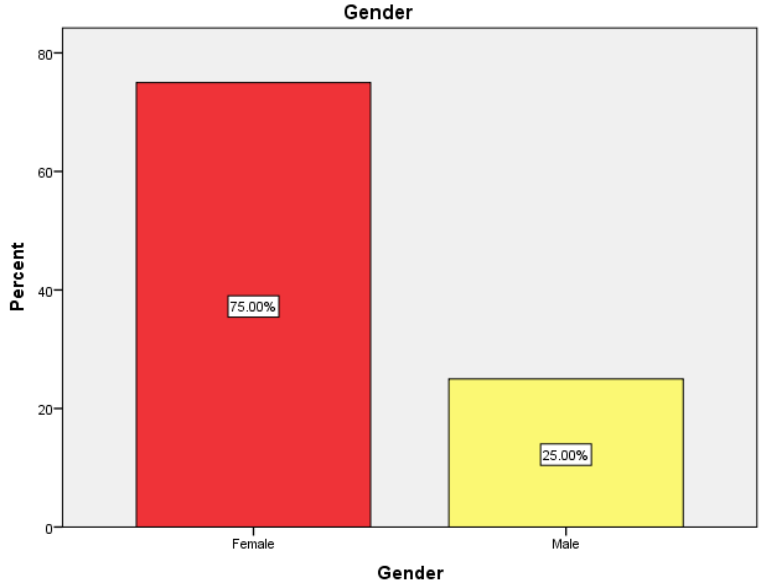

Figure 3. Bar Chart showing the indication of 20 cases' frequencies of category gender in group I (Ultrasonic) and group II (Manual)

Table 2. frequencies variable in group I and group II.

ULTRASONIC / Group I				MANUAL / Group II			
Patient	**Category Gender**	**Probing depth**	**BOP**	**Patient**	**Category Gender**	**Probing depth**	**BOP**
1	Female	2.281	1.740	1	Female	1.844	1.021
		1.906	1.448			1.302	0.844
2	Female	2.479	2.125	2	Female	2.313	1.594
		2.042	1.542			1.656	1.156
3	Female	2.988	1.833	3	Female	2.479	1.833
		1.854	1.479			1.729	1.146
4	Female	2.656	2.063	4	Female	2.490	1.750
		2.208	1.656			1.802	1.063
5	Female	2.500	2.021	5	Female	2.125	1.521
		1.979	1.604			1.521	0.979
6	Female	1.823	1.573	6	Female	1.969	1.354
		1.760	1.490			1.573	0.906
7	Female	2.135	1.521	7	Female	1.885	1.125
		1.833	1.396			1.490	0.844
8	Female	2.656	1.917	8	Male	2.458	1.594
		1.813	1.438			1.927	0.969
9	Male	2.375	1.906	9	Male	2.198	1.594
		1.646	1.313			1.771	0.969
10	Male	2.260	1.813	10	Male	2.313	1.438

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		1.552	1.229			1.854	0.990

Table 3. Test results of Treatment Method Crosstabulation

Count		Treatment Method		Total
		Probing depth	BOP	
Method	ULTRASONIC	43	33	76
	MANUAL	39	25	64
Total		82	58	140

Source: SPSS output. V24

Table 4. Test results of Chi-Square Tests

Chi-Square Tests	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	.272[a]	1	.602
Likelihood Ratio	.272	2	.602
Linear-by-Linear Association	.270	1	.603
N of Valid Cases	140		

Source: SPSS output. V24

a. 0 cells (0.0%) have an expected count less than 5. The minimum expected count is 26.51.

b. Computed only for a 2x2 table

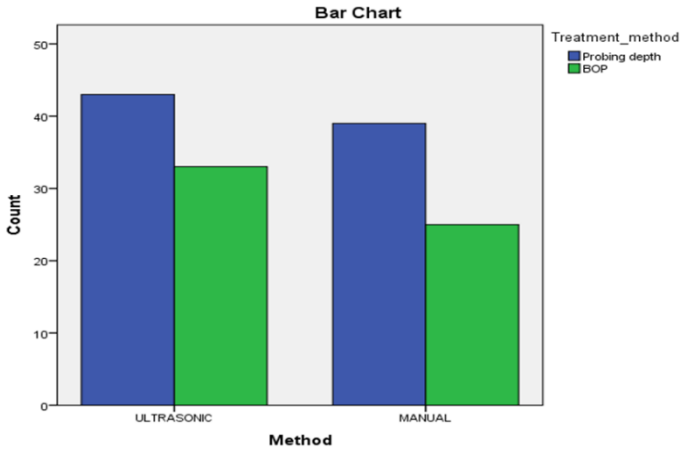

Figure 4. Bar Chart showing the method of each group (group I and group II). Using the Ultrasonic method and the Manual method

Table 5. Results Symmetric Measures

		Value	Asymptotic Standard Error[a]	Approximate T[b]	Approximate Significance
Interval by Interval	Pearson's R	-.044-	.084	-.518-	.605[c]
Ordinal by Ordinal	Spearman Correlation	-.044-	.084	-.518-	.605[c]

N of Valid Cases: Source: SPSS output. V24

a. Not assuming the null hypothesis.

b. Using the asymptotic standard error assuming the null hypothesis.

c. Based on normal approximation.

Result of hypotheses

(Table 4) shows the results of the chi-square test, which indicate that there is no relationship between the methods of each group of the study sample. The significance value was greater than 0.05. Based on the above, we accept the null hypothesis, which is that there is no significant difference between ultrasonic and manual instrumentation in the treatment outcomes, and we reject the alternative hypothesis, which is that Ultrasonic scaling is more effective than manual scaling in reducing periodontal disease.

Discussion

The present study compared the clinical effectiveness of ultrasonic and manual scaling in the treatment of chronic gingivitis. The findings demonstrated that both treatment modalities were effective in reducing probing depth (PD) and bleeding on probing (BOP) after one month of therapy. Although the ultrasonic scaling group showed greater reductions in

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these clinical parameters compared with the manual scaling group, the differences between the two groups were not statistically significant ($p > 0.05$). These findings indicate that both ultrasonic and manual instrumentation provide comparable clinical outcomes in the management of chronic gingivitis. An in-vitro study utilizing scanning electron microscopy (SEM) evaluated the effectiveness of manual and ultrasonic scaling and root planing with and without the use of a calculus softening agent. The findings revealed no significant difference between the two techniques regarding surface roughness and calculus removal. Additionally, none of the methods achieved complete removal of deposits, and minor surface alterations were observed with all instrumentation methods. These results suggest that both manual and ultrasonic techniques provide comparable outcomes in root surface debridement [13].

Manual scaling demonstrated superior effectiveness in reducing probing pocket depth, particularly in moderate and deep periodontal pockets, while ultrasonic scaling showed comparable results in some parameters. However, evidence suggests that neither method should fully replace the other, and a combined approach provides optimal clinical outcomes [14]. A clinical trial comparing hand and ultrasonic scaling in patients with periodontitis demonstrated that both techniques effectively reduced plaque index, gingival index, and probing pocket depth. No significant differences in clinical outcomes were found between the two groups; however, ultrasonic instruments were associated with reduced treatment time and lower operator fatigue. This study supports previous evidence that both methods are clinically effective, while highlighting practical advantages of ultrasonic scaling in routine periodontal therapy [15]. Investigated the effects of manual and ultrasonic instrumentation on root surface mechanical properties, including surface roughness, hardness, and elastic modulus. Using extracted teeth and advanced profilometry and nano-indentation techniques, the study found that both manual Gracey curettes and ultrasonic scalers significantly reduced surface roughness after root planing. Manual instruments tended to produce smoother surfaces, but no statistically significant differences were found in mechanical properties between the two methods. These findings suggest that both instrumentation techniques are comparable in terms of their impact on root surface mechanics [16].

A study conducted a comparative evaluation of hand scaling versus ultrasonic scaling in patients with chronic periodontitis. Results indicated that both hand and ultrasonic scaling significantly improved periodontal health, with no significant difference between the two techniques. However, ultrasonic scaling was notably more time-efficient, requiring approximately half the time of hand scaling. These findings support the effectiveness of both scaling methods while highlighting the practical advantage of ultrasonic instruments in clinical settings [17]. An in-depth comparative study of manual curettes and ultrasonic mini-inserts on cementum surfaces, particularly examining the influence of lateral pressure during instrumentation. Their SEM analysis revealed that while both instrument types were effective in removing plaque and calculus, ultrasonic inserts provided better access to apical regions. Crucially, the study demonstrated that the amount of cementum damage and residual calculus was significantly influenced by the lateral pressure applied by the clinician, with excessive pressure reducing ultrasonic effectiveness and increasing cementum removal. These findings emphasize that operator technique is a major determinant of treatment outcomes, beyond the choice of instrumentation [18].

Research gap and Limitations

The present study was limited by its relatively small sample size (n = 20), short follow-up period of one month, and the absence of clinical attachment level (CAL) assessment. Future studies with larger samples and longer observation periods are recommended.

Conclusion

Based on the findings of this comparative study, both ultrasonic scaling and manual scaling demonstrated comparable effectiveness in periodontal debridement and plaque and calculus removal. No statistically significant difference was observed between the two techniques in terms of overall clinical outcomes, indicating that both methods can be considered reliable and effective when performed correctly. Ultrasonic scaling showed advantages in terms of reduced treatment time and improved patient comfort, particularly in cases with heavy calculus deposits and deep periodontal pockets. Conversely, manual scaling provided superior tactile sensitivity, allowing for more precise root surface instrumentation, especially in anatomically complex areas. These complementary characteristics highlight that neither technique should be considered superior in all clinical situations. In conclusion, the choice between ultrasonic and manual scaling should not be based on technique preference alone, but rather on individual patient factors, clinical conditions, and operator skill. A combined approach utilizing both ultrasonic and manual instrumentation is recommended to achieve optimal periodontal health.

Recommendations

Ultrasonic and manual scaling should be selected based on the patient's condition, with ultrasonic preferred for heavy calculus and manual for delicate cases. Continuous professional training, strict infection control, and patient education are essential to ensure optimal periodontal outcomes, while further long-term studies are recommended to validate effectiveness. Further research with a large sample size and follow-up for a better evaluation period 3-6months.

Reference

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1. Murakami S, Mealy BL, Mariotti A, Chapple ILC. Dental Plaque-Induced Gingival Condition.. J Periodontol 2018;89(1):17-27. https://doi.org/10.1002/JPER.17-0095
2. Pihlstrom BL, Michalowicz BS, Johnson NW. Periodontal diseases. Lancet. 2005;366(9499):1809-20.
3. De Almeida Silva Levi YL, Ribeiro MC, Silva PHF. et al. Effects of oral administration of Bifidobacterium animalis subsp. lactis HN019 on the treatment of plaque-induced generalized gingivitis. Clin Oral Invest 2023;27(1), 387–398 https://doi.org/10.1007/s00784-022-04744-y .
4. Silva N, Abusleme L, Bravo D, Dutzan N, Garcia-Sesnich J, Vernal R, et al. Host response mechanisms in periodontal diseases. J Appl Oral Sci. 2015;23(3):329-55.
5. Vukovic D, Gveric I, Matic Z. Periodontal pathogenesis and their link to neuroinflammation and neurodegeneration. Microorganisms. 2023;11(7):1832. https://doi.org/10.3390/microorganisms11071832.
6. Darveau RP, Tanner A, Page RC. The microbial challenge in periodontitis. Periodontol 2000. 1997;14:12-32.
7. Mithra N, Shishir S, Gowrish S, Vandana S. Effect of ultrasonic scaling on surface roughness of four commercially available composite resin Class V restorations: an in vitro study. Imper J Interdiscip Res. 2017;3(3):1105-9.
8. Chatterjee A, Baiju CS, Bose S, Shetty SS. Clinical uses and benefits of ultrasonic scalers as compared to curettes: a review. J Oral Health Community Dent. 2013;7(2):108-13.
9. Wadhawan F, Langa G, Pimental R, Martins S. Comparison between hand and sonic/ultrasonic instruments for periodontal treatment: a systematic review with meta-analysis. Int Acad Periodontol. 2020;22(4):187-204.
10. Drisko CH. Root instrumentation. Power-driven versus manual scalers: which one? Dent Clin North Am. 1998;42(2):229-44.
11. Guttiganur N, Mahapatra P, Agrawal A. Past and present status of ultrasonic scaling: from then to now—a mini-review. Res Rev Health Care Open Access J. 2021;6:000244. https://doi.org/10.32474/RRHOAJ.2021.06.000244.
12. Oda S, Nitta H, Setoguchi T, Izumi Y, Ishikawa I. Current concepts and advances in manual and power-driven instrumentation. Periodontol 2000. 2004;36:45-58. https://doi.org/10.1111/j.1600-0757.2004.03674.x.
13. Patil M, Baburaj MD, Pimpale S. Comparative evaluation of manual and ultrasonic scaling and root planing with and without calculus softening agent using scanning electron microscope (SEM): an in vitro study. Acta Sci Dent Sci. 2025;9(2):41-7. https://doi.org/10.31080/ASDS.2025.09.1974.
14. Zhang X, Hu Z, Zhu X, Li W, Chen J. Treating periodontitis: a systematic review and meta-analysis comparing ultrasonic and manual subgingival scaling at different probing pocket depths. BMC Oral Health. 2020;20(1):176. https://doi.org/10.1186/s12903-020-01117-3.
15. Zarandi A, Mostafa Poor Y, Kashefi Mehr A. Comparing effectiveness of two scaling methods: hand and ultrasonic instruments in patients with periodontitis disease. International Journal of Dental Sciences and Research. 2016;4(4):76-78. https://doi:10.12691/ijdsr-4-4-4 .
16. Zafar MS. Comparing the effects of manual and ultrasonic instrumentation on root surface mechanical properties. Eur J Dent. 2016;10(4):517-21. https://doi.org/10.4103/1305-7456.195162.
17. Patel JK, Rai JJ, Shah NK. Comparative evaluation of hand scaling versus ultrasonic scaling in the treatment of chronic periodontitis: a comparative study. Int J Sci Res. 2018;7(5):24-7.
18. Gagnot G, Mora F, Poblete MG, Vachey E, Michel JF, Cathelineau G. Comparative study of manual and ultrasonic instrumentation of cementum surfaces: influence of lateral pressure. Int J Periodontics Restorative Dent. 2004;24(2):137-45.

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