COMPARISON OF HAND AND ULTRASONIC INSTRUMENTATION ON PERIODONTAL PARAMETERS IN GHANAIAN PATIENTS WITH MODERATE CHRONIC PERIODONTITIS

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Abstract

Background: The traditional method of treating chronic periodontitis initially is non surgical therapy which involves oral hygiene instructions and mechanical instrumentation using either hand or machine driven instruments. This reduces infection and then subsequent healing of the periodontal tissues with a resultant pocket elimination or reduction.

General Aim: The aim of this study was to determine if hand and ultrasonic instrumentation produce comparable periodontal pocket reduction among Ghanaian patients with moderate chronic periodontitis.

Methodology: The study was an interventional study, spanning a period of 5 months for each patient. Twenty patients with pocket depth 5 – 7 mm between the ages of 30 – 81 years were treated using hand and ultrasonic instrumentation at the University of Ghana Dental School clinic. Periodontal parameters measured include plaque scores, bleeding on probing (BOP) scores, probing pocket depth (PPD), probing attachment level (PAL) and gingival recession. Significance level was set at 0.05.

Results: The mean PPD at baseline for patients treated using hand instrumentation was 5.5mm and was reduced to 3.4mm at fifth session of instrumentation. Ultrasonic instrumentation recorded a reduction of baseline value of 5.5mm to 3.6mm at fifth session. Bothmethods of instrumentation recorded a significant reduction of the mean PPD without a significant difference in the mean reduction between the two methods of instrumentation.

Conclusion: The use of hand or ultrasonic instrumentation produced similar results with respect to reduction in BOP, plaque scores, PPD and PAL

Introduction

Chronic periodontitis is an infectious disease resulting in inflammation within the supporting tissues of the teeth, progressive attachment loss and alveolar bone loss[1] It begins as plaque induced gingivitis, a reversible condition that when left untreated may develop into chronic periodontitis and eventual loss of teeth[2]

Globally, chronic periodontitis is most prevalent in adults but can be observed in children. It has been difficult to determine the level of oral health status of Ghanaians because of limited data. There have been only a few studies on the prevalence of periodontal disease and mostly of only 6 – 12 year old school children covering only a few selected cities[3] Available data indicate a very high proportion (97%) of children with poor oral hygiene defined as percentage with stain or debris on the gingival third of two or more teeth.[4] One study detected relatively few (4%) 12 of year old with shallow periodontal pockets whilst another study detected shallow periodontal pockets (4 – 5mm) in 21% of school children although no deep pockets (6mm) were found[5,6] Mechanical therapy can be achieved by scaling and root planning with hand or engine driven instruments. Studies have shown high success rates of non surgical therapy in the treatment of mild to moderate periodontitis[7,8] It has been demonstrated that hand or ultrasonic and sonic scalers produce similar periodontal healing response with respect to probing pocket depth, bleeding on probing and clinical attachment level[9,10]

Calculus is rough, porous and plaque retentive substance that adheres to the root surface. The goal of periodontal instrumentation is to effectively remove plaque and calculus while causing the least amount of root surface damage. Attempt to completely remove calculus deposits require extensive instrumentation and can result in significant amounts of cementum and dentine loss, thereby inducing dentinal hypersensitivity and increased prevalence of pulpitis.[11] Using the ultrasonic scaler on medium to low power or using the tip of sonic scaler at an angle close to zero degrees to the tooth surface may enable the clinician perform a thorough debridement without excessive damage to root surface[12] The efficacy of a single course of scaling and root planing will be affected by the skill of clinician, time allocated for procedure, inflammatory status of the tissues and anatomy of roots[13,14] The greatest changes with respect to probing depth reduction and gain in clinical attachment can be recorded after 4 to 6 weeks, but gradual repair and

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maturation of the periodontium may occur over 9 to 12 months[15]

The amount of reduction in probing depth is directly related to the initial probing depth[16]

The teeth most affected by periodontal pocketing are the upper molars followed by the lower molars with the least being the canines, suggesting that exceptional care be given to these most susceptible teeth for periodontal disease in order to prevent the development of irreversible damage of the periodontium[17]

Surgical treatment is scheduled according to the results based on re-evaluation following the non surgical therapy to further eradicate the remaining pocket and inflammation to create a healthy environment and to stimulate regenerative potential of periodontium.[18] The aim of the present study is to determine which of the two methods of non surgical periodontal therapy produced the better result in pocket therapy in Ghanaian patients, because the extent to which periodontal pockets depth reduction or elimination in Ghanaian patients with moderate chronic periodontitis can be achieved with non surgical periodontal therapy is not known, so one cannot determine the prognosis with certainty at the start of therapy.

Patients with moderate chronic periodontitis will not be subjected to undue surgeries if it is known that they can respond successfully to treatment with non surgical therapy.

It is expected that the results of this study will provide information regarding which of the two methods of none surgical therapy will produce the better treatment outcome.

Materials and method

The study was a comparative interventional study carried out at the University of Ghana Dental School Clinic, which is a primary referral center in Ghana.

The study population consisted of 20 patients 30years and above referred to the periodontics clinic. The patients were selected consecutively as they were diagnosed of moderate chronic periodontitis.

Inclusion criteria
- Patient should be 30 years old and above.
- The selected patient should have periodontal bone loss of up to one third of the root length.
- Clinical signs of gingival inflammation and probing pocket depths 5 - 7mm with calculus at one tooth site at least, in each quadrant.

Exclusion criteria
- Patients with any past medical history of chronic disease.
- Patients on medication such as antibiotics, antidiabetics, antihypertensives (calcium channel blockers), phenytoin and immunosuppressants that

may modify the disease or the response to treatment.
- Patient undergoing periodontal treatment of any form or has had periodontal treatment in the past 2 years.
- Teeth with defective and sub gingival restorations
- smokers

Method

After recruitment of patient, closed ended questionnaire was administered and basic demographic data on them was documented.

Clinical examination

Periodontal clinical examination was carried out and the following parameters recorded on the periodontal chart at each visit by the investigator for comparison with subsequent records; dental plaque, bleeding on probing, probing pocket depth and probing attachment level and gingival recession. All clinical measurements were taken from mid – buccal and mid – lingual sites and buccal aspect of interproximal contact area for mesial and distal sites of each tooth to the nearest 1 mm using Periowise probes calibrated at 3, 5, 7, 10 mm with 0.5mm diameter and round tip (Henry Schein Dental).

Dental plaque

O'leary's plaque index was used to record plaque after staining with plaque disclosing dye[19] Presence of plaque was recorded if an area of clearly visible stained material was present along the gingival margin and if this material can be removed with the side of the probe. The percentage of surfaces with plaque out of the total number of examined tooth surfaces was calculated. All teeth present were examined. This form allows the patient to visualize his own progress in learning plaque control which has a motivating effect on patients.

Bleeding on probing (BOP)

This parameter is determined if bleeding occurs subsequent to probing. A positive score is recorded for a bleeding pocket. The proportion of bleeding surfaces out of total number of examined surfaces was calculated for each patient at each visit. All teeth present in the mouth were examined.

Probing pocket depth (PPD) and probing attachment level (PAL).

PPD was measured as the distance from the gingival margin to the base of the periodontal pocket. PPD between 5 – 7mm were selected.

PAL was measured by deducting the distance from cementoenamel junction (CEJ) to the gingival margin (GM) from the distance obtained for the corresponding PPD for sites without prior recession,

where there was recession, the distance CEJ to GM was added to the corresponding PPD.

Gingival recession

This distance was taken in areas of gingival recession and was calculated as the distance from CEJ to the GM at initial examination and compared with the distance at subsequent visits.

Radiographic examination

An orthopanthomograph for each patient was examined to assess the overall pattern of bone loss and to detect any anomaly radiographically that might interfere with treatment. Periapical radiographs of selected teeth were also taken for diagnosis and further treatment planning for the patient.

Clinical procedure

Each patient was taken through oral hygiene instructions and motivation. Patients were taught sulcular method of tooth brushing and interdental cleaning either using a dental floss or an interdental brush of the appropriate size. Cleaning technique was tailored according to the patient's needs.

Instrumentation was started a month after oral hygiene instructions, using both hand and ultrasonic instruments. The left and right sides of the jaws were assigned for either ultrasonic or hand instrumentation by simple randomization. The choice of the side of jaws to start with for the first respondent was chosen by a toss of a coin, the left jaws was assigned Head and the right jaws Tail. After the first toss, subsequent toss indicated what method of instrumentation to be assigned to the first selected jaws, ultrasonic was assigned Head and hand instrumentation, Tail. After assigning an instrument to the selected jaws, the second instrument was assigned to the next jaws. This process was applied to subsequent respondents.

Each patient was seen at 5 sessions or visits over a period of 5 months as follows:
1. First session; oral hygiene instruction, motivation and baseline measurements.
2. Second session; a month after first session. Measurements and full mouth debridement using Woodpecker ultrasonic scaler model UDS – J with P3D and P4(Guilin Woodpecker Medical Instrument Co., Ltd) and Gracey 7/8, 11/12, 13/14 (Hu – Friedy) hand instruments.
3. Third session; 2 weeks from the second session. Measurement of periodontal parameters and selective instrumentation
4. Fourth session; 6 weeks from the second session. Measurements of periodontal parameters and selective instrumentation
5. Fifth session; 16 weeks from second session.

Measurements and instrumentation.
Instrumentation consisted of supra gingival scaling, sub gingival scaling and root planing.
Local anaesthesia was given when patient experienced pain during procedure. Instrumentation of surfaces of teeth were done until operator was satisfied that the surfaces have been adequately instrumented.

Reproducibility

Each tooth was instrumented 4 minutes for ultrasonic scaling and 6 minutes for hand scaling. Operator was calibrated, and was found that it took an average of 4 minutes to adequately instrument a tooth using ultrasonic scaling and 6 minutes for hand scaling.

Reproducibility of probing pocket depth was 96% within the limit of 1mm when operator was calibrated using repeated probing in 3 patients. 192 sites were duplicated, 66% of sites were duplicated with no difference, 30% were duplicated with a difference of 1mm and 0.04% of sites with a difference of 2mm.

Data collection and analysis

Data was captured by interviewer administered questionnaire; a periodontal chart (form) was used to record all periodontal parameters taken. A different chat was used at each visit. All the data collection was done by the investigator

Microsoft access database was used to capture data and cleaning done by Excel 2007. The cleaned data was exported into Statistical Package of Social Sciences (SPSS version 16) for analysis.

Means were compared using T- test for two means and ANOVA for more than two means. Significant level was set at 0.05.

Ethical consideration

Ethical approval for the study was obtained from Ethical and Protocol Review Committee of the University of Ghana Medical School. Written and verbal informed consent was obtained from the patient to be recruited into the study. Other conditions that the patients had in their mouths apart from chronic periodontitis were referred to the appropriate departments for management as part of their treatment plan.

RESULTS

Patients between the ages of 30 – 81 years with an average of 53.5 ±12.9 years were selected for the study, 65% of the patients aged between 40- 59 years. A greater proportion of the patients were females (60%). Most of the patients treated had formal education with the majority (50%) having tertiary education.

Age distribution of patients treated

The majority of the patients seeking treatment reported because they had mobile teeth, bleeding gingiva or pain.

Fig 1: Age distribution of patients treated
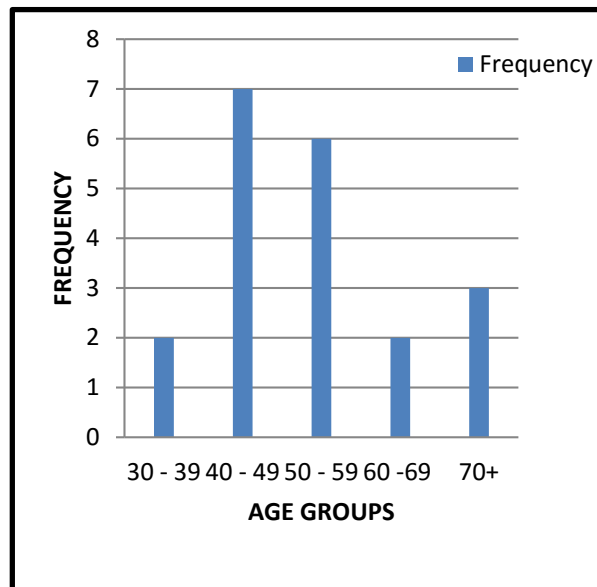
A total number of 289 teeth were involved in the study. Of these teeth molar involvement recorded the highest frequency of 145 teeth (50%), then the premolars which recorded 74 teeth (26%) and the least was the incisors and canine.

Among the teeth affected, a higher percentage of the teeth were maxillary teeth (53%), as compared to the mandibular teeth which recorded 47%.

Mesial and distal sites of the teeth selected were more (95%) than buccal and lingual sites.

Each of the Patients had 4 sessions of instrumentation, 165 teeth, with 248 sites treated by ultrasonic instrumentation and 125 teeth with 190 sites by hand instrumentation.

Dental plaque

The mean proportion of surfaces of teeth with dental plaque at baseline before oral hygiene instruction (OHI) was given was 74.6 ±24.2. One month after OHI, the mean value for the presence of plaque reduced to 70.9 ± 23^3. Comparison of the two means shows a significant difference (p-value = 0.0001) between surfaces of teeth with plaque before and after OHI only.

The mean dental plaque reduced significantly from treatment baseline (75%) to the last session of treatment (19%) for hand instrumentation and from 75.7% to 19% for ultrasonic instrumentation. There was no significant difference between the plaque scores observed using hand or ultrasonic instrumentation, p=0.661. However, each of the two methods of instrumentation resulted in a significant

reduction in plaque levels from baseline and subsequent sessions.

**Fig 2: Comparison of mean plaque reduction with hand and ultrasonic instrumentation**
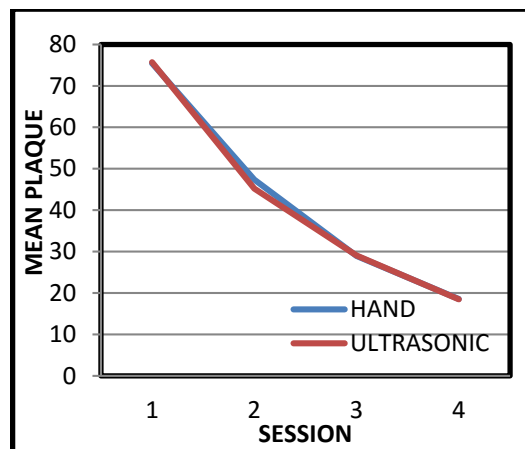
P=0.661

Bleeding on probing, (BOP)

The mean surfaces bleeding on probing before OHI at baseline was recorded at 83.4%, this figure reduced to 83.05% after initial OHI. There was an improvement of the mean percentage surfaces bleeding on probing by 0.35%. Treatment using hand instrumentation recorded a significant reduction of BOP from a mean of 83.9% at first session to 26.6% at the fifth session while the mean reduction for ultrasonic instrumentation was from a mean of 83.8% to 26.2%. A p-value of 0.965 was recorded for the difference in BOP using two methods of instrumentation.

**Fig 3: Comparison of mean BOP with hand and ultrasonic instrumentation**
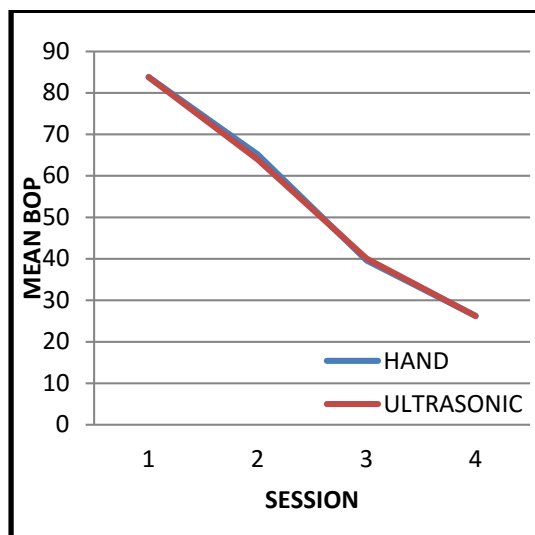
P-value = 0.965

Probing pocket depth, PPD
The mean PPD at baseline for patients treated using hand instrumentation was 5.5mm. This figure was reduced to 3.4mm at fifth session and ultrasonic instrumentation recorded a significant reduction in the mean PPD of 5.5mm at baseline to 3.6mm at the fifth session. There was a significant reduction of PPD by a mean of 2mm.
Analysis of the mean difference of the average PPD between the two methods of instrumentation yielded a p- value of 0.311.

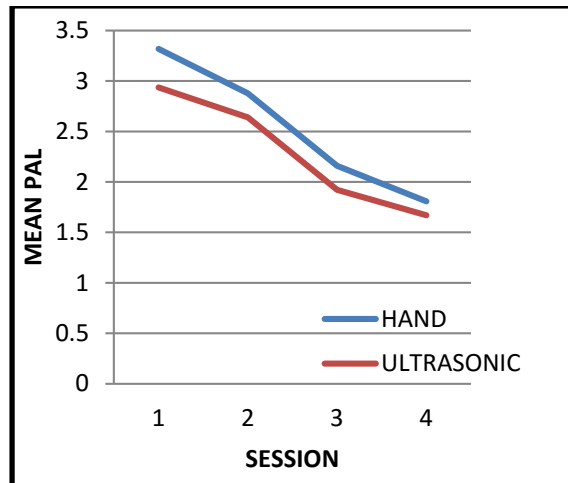**Fig 4 : Comparison of mean PPD reduction with hand and ultrasonic instrumentation**
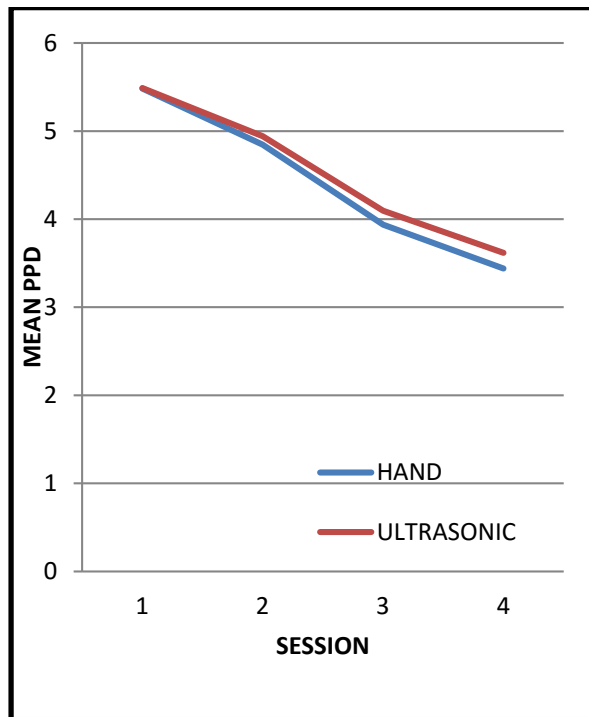
P -value = 0.31

Probing attachment loss, (PAL)
The mean PAL for teeth treated with hand instrumentation was 3.3mm at baseline and then was reduced significantly to 1.8mm. For ultrasonic instrumentation, the value was reduced from a mean of 2.9mm at baseline to 1.6 mm. Comparison of mean differences of the two methods of instrumentation resulted in a p- value of 0.197. There was no significant change in the mean PAL reduction for the two methods of instrumentation.

Fig 5: Comparison of mean PPD reduction with hand and ultrasonic instrumentation


P-value = 0.197
Gingival recession
The mean recession of teeth treated with hand instruments increased from a value of 0.36mm at baseline to 0.44 at last session, there was no significant change from baseline to the last session of instrumentation. The mean value for teeth treated with ultrasonic instrumentation also increased from 0.14mm at baseline to 0.29 at last session. The increase was not significant at the various sessions. However there was a significant difference between the mean recession values of the two methods of instrumentation.

Fig 6: Comparison of mean PAL reduction with hand and ultrasonic instrumentation
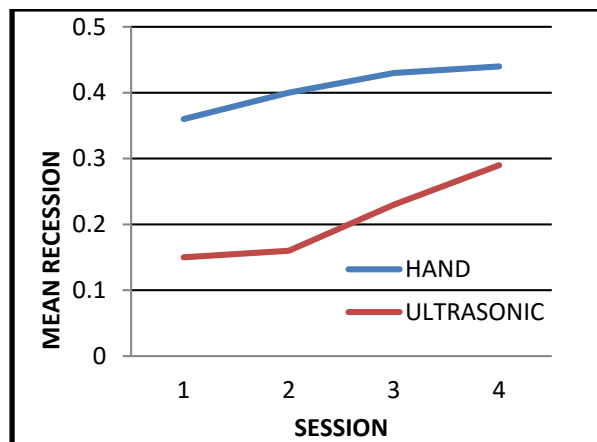
P-value = 0.009

DISCUSSION

The aim of non surgical periodontal therapy is to eliminate dental plaque and calculus from the tooth surface and adjacent soft tissue, if done effectively itwill lead to resolution of inflammation and then beneficial clinical changes in plaque scores, bleeding on probing, probing pocket depth and probing attachment loss. The present study sought to determine if comparable results are obtained using either hand or ultrasonic instruments for scaling and root planing.

A greater proportion of them were females (60%) which might give the impression of higher prevalence among females. This is in contrast to a study in Nigeria which reported a higher prevalence of attachment loss and periodontal pockets in males than in females[20]. The results obtained in the present study may be attributed to better dental clinic attendance behavior among Ghanaian females than male patients.

All the patients recorded significant reduction from a baseline mean plaque score of 75% to 70.9% with OHI measures only for a period of a month, the reduction though statistically significant, was not substantial clinically.

This value further reduced significantly to an average value of 18.6% and 18.5% with hand and ultrasonic instrumentation respectively at the end of 5 months of treatment. The change in plaque score was due to effectiveness of oral hygiene measures and professional removal of plaque and calculus by scaling and root planing.

The mean bleeding scores for the whole group reduced from baseline value of 83.4% to 83.05%, a mean difference of 0.35% after a month of oral hygiene measures. The difference though significant was not substantial as compared with studies by Cercek et al [21] where clinically significant reductions of bleeding scores were realized after 3 months of oral hygiene measures alone. Significant reduction of mean bleeding scores was realized in this study with hand and ultrasonic instrumentation to 26.3% and 26.2% respectively at the end of the four sessions of instrumentation. Individuals with low mean BOP percentages (<10%) may be regarded as patients with low risk for recurrent disease, while patients with mean BOP percentages (> 25%) are considered to be at high risk for re-infection[22] The mean BOP value could possibly be reduced further over time with maintenance therapy as a measure to prevent re-infection. No significant difference in the mean BOP was observed when comparing hand and ultrasonic instrumentation because the two methods produced similar effect on BOP.

The mean PPD was reduced significantly from 5.5mm to 3.4mm for hand instrumentation and that for ultrasonic from 5.5mm to 3.6mm at the last session, a mean difference of 2mm over a period of 5 months of OHI, scaling and root planing. Also, comparing the values of the mean differences between baseline and the various sessions, the highest change was observed at the sixth week. The changes observed were similar to those of Knowles et al (1979), Cercek et al (1983) and Kaldahl et al, 16 where the mean probing depth reduction for moderately deep sites (4 – 6mm) was 1.29 mm versus 2.16 mm for deeper sites (≥7mm), but they observed that little further improvement seemed to take place after 4 – 5 months. There was no significant difference observed in the mean PPD comparing hand and ultrasonic instrumentation. This implies that the clinical effects of either hand or ultrasonic instrumentation on PPD are similar, this is in agreement with earlier studies[7,10,14] The reduction in PPD is as a result of resolution of inflammation leading to shrinkage of the tissues, gingival recession and a gain in clinical attachment in the form of long junctional epithelium.

The mean PAL observed a significant reduction of 1.5mm and 1.3mm for hand and ultrasonic instrumentation respectively over the 5 months period of therapy. A significant difference was observed between values at baseline and sixth weeks and beyond post instrumentation. There was no significant difference in the mean PAL values comparing hand and ultrasonic instrumentation. Reduction of the mean PAL depicts a gain in attachment. The desirable attachment is a connective tissue attachment that was lost to periodontitis but this attachment is usually replaced by epithelial attachment in the form of long junctional epithelium during healing after scaling and root planing. The differentiation of type of attachment can only be verified by histological means.

The two methods showed an increased mean gingival recession over the 5 months period. Hand instrumentation showed a mean increase of 0.08mm while ultrasonic instrumentation recorded 0.14mm. The mean differences of recession at the various sessions of instrumentation were insignificant. Comparing this observation with earlier study by Badersten et al (1981) in which the mean recession increase was 1.5mm (although the results were over 13 months period most of the recessions occurred within 2 – 3 month), values obtained in the present study are far lower. The differences observed between the present study and that of Badersten et al could be due to oral hygiene practices, local and anatomic factors. The significant difference observed in the comparison of the effects of the two methods of instrumentation could be due to differences in trauma produced by the two methods of instrumentation and local factors influencing gingival recession such as tissue biotype and initial gingival inflammation[23,24,25]

The results of the present study demonstrate that improvements which are clinically significant can be obtained after oral hygiene instructions, scaling and root planing in Ghanaian patients with moderate chronic periodontitis. It was also found out from the study that there was no significant difference between the results obtained if either hand or ultrasonic instrumentation was used. These findings were

consistent with those of Torfason et al and Badersten et al. Probing forces were not standardized but within a range and CEJ which is a bit difficult to access when there is no recession was used as reference point for PAL measurements as compared with the use of relative attachment level which offers a significant advantage in terms of reproducibility.

Data from this study must be interpreted within the limitations of the materials and methods utilized.

CONCLUSION

Within the limits of the study, the following conclusions were made;

1. Probing pocket depths between 5 – 7mm can be reduced significantly by a mean of 2mm using OHI measures, scaling and root planing.
2. The use of hand or ultrasonic instrumentation produced similar results with respect to reduction in BOP, plaque scores, PPD and PAL.

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