



## Comparative Clinical Evaluation Of Bite Force In Healthy Periodontium And Chronic Periodontitis Patients Following Non-Surgical Periodontal Therapy: A Randomized Controlled Trial

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### Abstract

**Objective:** Chronic periodontitis always cause some abnormal effect on masticatory efficiency of individuals. So some amount of bite force always play an important role in the maintenance of normal health of periodontium. As much number of studies were not performed present study aimed to compare evaluate the bite force values in healthy periodontium and chronic periodontitis patients before and after non-surgical periodontal therapy.

**Materials and methods:**40 subjects were recruited and divided randomly into two groups [20 each healthy and chronic periodontitis] but only 17 healthy and 18 chronic periodontitis participated. Probing pocket depth [PPD], clinical attachment level [CAL] and bite force [BF] were recorded at baseline. Further scaling was performed and values for repeated 1 month post-scaling. Values were noted and subjected to statistical analysis where paired and unpaired t tests were performed for intra and inter group comparisons.

**Results:** Intra group comparison results were non-significant [p=0.083, 0.163, 0.841] for healthy periodontium group while values were statistically significant [p<0.001] for chronic periodontitis group regarding PPD, CAL and bite force [BF]. Inter group comparisons revealed statistical significance for PPD [p<0.001], CAL [p<0.001] and BF [p=0.001] for baseline and 1 month post-scaling

**Conclusion:** Within limitations non-surgical periodontal therapy does not improve the bite force values in chronic periodontitis patients However, further studies with larger study population should be done for better outcome of results.

**Keywords:** Chronic Periodontitis, Bite Force, Mastication, Dentistry

### Introduction:

Nowadays, dental treatments play an important role in maintaining and preserving oral function, especially mastication. Masticatory system is a functional unit which is composed of the teeth, temporomandibular joints and muscles of

mastication, including their respective mechanoreceptors[1]. Masticatory function is defined as the chewing ability of an individual which gets disturbed when the masticatory system progresses from healthy to a diseased state and eventually leads to masticatory dysfunction [2, 3]. This reduced masticatory ability not only affects the overall health

but also causes daily living activities and quality of life to decrease [4, 5]. A number of factors determining masticatory ability are age, gender, number of teeth, bite force, occlusal contact area and bite pressure [6-8]. Other factors influencing masticatory ability are musculoskeletal morphology, temporomandibular joint disorders, periodontal diseases, clinical crown height and loss of attachment apparatus [9, 10].

Periodontitis is defined as an inflammatory disease of the supporting tissues of the teeth caused by specific microorganisms leading to progressive destruction of the periodontal ligament and alveolar bone with increased probing depth, recession, or combination of both [11]. The periodontal ligament consists of sensory mechanoreceptors which provide information about the spatial, temporal relations and occlusal loads to the brain and lead to generation of masticatory forces and jaw movements by regulation of muscle activity through neural signaling [12-14]. Thus, the destruction of periodontal tissues ultimately decrease the total number of mechanoreceptors, affecting the threshold level and reduces the masticatory ability of an individual [15, 16]. Chronic periodontitis being one such slowly progressive and long-lasting form of periodontitis, which negatively affects the biting abilities [10, 17]. Studies done by Alkanet *et al.*, 2006 stated that bite force [BF] and bite pressure [BP] improved one week after periodontal surgery [PS] and on follow up no difference regarding the BF and BP following PS<sup>10</sup> While Johannson *et al.*, [17] 2006 also reported that reduced periodontium also had lower bite force values. On the contrary, studies done by Miyayura *et al.*, 1999, Klienfelder JW *et al.*, 2002 and Morita M *et al.*, 2003 reported no significant differences in the biting ability of subjects with reduced periodontal tissue as compared to healthy controls [18-20].

Periodontal therapy could contribute to tissue regeneration and improvement in these mechanoreceptors function.<sup>21</sup> To the best of author's knowledge, little is known on how basic periodontal treatment would affect the masticatory ability of an individual. Thus present study was aimed to assess the importance of periodontal health in mastication following non-surgical periodontal therapy.

## Materials And Method:

Study Design, Sample Size Calculation, Method of randomization and Patient Recruitment:

Present study was a randomized controlled single blinded clinical trial. Sample size was calculated based on G-Power software 3.0. When power of the study set as 80% with effect size of 0.25 and alpha value of 5% a sample of 36 was sufficient to conduct the study. For better outcome of results a total sample of 40 [20 in each group] were considered for the completion of study. Initially 65 patients were screened from Department of Periodontics, Yogita Dental College and Hospital, Khed, Ratnagiri for the inclusion of study. Out of which 25 were eliminated of them 16 patients didn't meet the criteria of inclusion and 9 patients were not interested to take part in the study. Consort guide lines were followed to as much extent as possible, flow chart was depicted as figure 1. Type of randomization adopted was flip of a coin. Study was performed according to Helsinki declaration 1975 modified in 1983.

Thus, 40 subjects were recruited, study was conducted and followed up-to 1 month. After listening to the protocol 3 patients in control group and 2 patients in test group denied to take part in the study because of satisfaction of previous treatment and didn't turned up for followup as there was no problem. The control group included 17 subjects with healthy periodontium [9 males and 8 females] and 18 patients with chronic periodontitis [10 males and 8 females] served as the test group. Diagnosis was made based on AAP 1999 Classification of Periodontal Diseases and Conditions. Informed consent was obtained from all study participants before starting the study. Preliminary information was recorded for each patient. Initial periodontal treatment [scaling, root planning, and oral hygiene instructions] was completed in all the subjects at baseline after making the measurements.

## Inclusion And Exclusion Criteria:

The following inclusion criteria were used for subject participation in the study: 1] patients ranging from 30-60 years of age; 2] complete dentition; 3] Healthy periodontium [PPD ≤ 3mm]; 4] Chronic generalized periodontitis [PPD ≥ 3mm]; 5] skeletal and dental Class I relationship; 6] patients agreed to the consent; 7] absence of prosthetic restorations and fillings. Exclusion criteria included: 1] Any systemic disease/status such as diabetes or pregnancy and any

medications; 2] Any symptoms of occlusal trauma, masticatory disharmony, or temporomandibular joint disorders; 3] any recent history of occlusal adjustment or orthodontic treatment; 4] any habits like smoking/ alcohol consumption. 5] Cases with gingival recession.

### Periodontal Examination:

Pocket probing depth[PPD] and clinical attachment level [CAL] measurements were done using a University of North Carolina [UNC] 15 probe [Hufriedy Company] at baseline and after 30 days. Measurements were done using prefabricated acrylic stent to avoid any bias. All periodontal examinations were done by the single blinded examiner [Figure 2]. Before making the final measurements examiner was asked to take probing of 10 separate chronic periodontitis patients who were not included in the study 24 hours apart and examiner was considered and allowed to take final study measurements only when he has achieved an accuracy of 90% i.e. more or less equal to that of  $\pm 1$ .

### Measurement Of Bite Force:

Bite force measures were collected at baseline and after 1 month with a strain gauge transducer[Model HE6210 800N; HARIOM ELECTRONICS, Vadodara, Gujrat]. The design of this device consisted of bite plates made from two steel bars, joined by a steel wedge. It works on Strain Gauge based Wheatstone bridge principle. On loading, the metal bite plates undergo deformation, causing change in resistance, which in turn, results in a change in electric potential or voltage. These changes in the potential are recorded and displayed by the potentiometer. Gauze was used as a protective covering to wrap the bite plates for reducing the discomfort of the patient and to avoid any harm to teeth while taking the measurements [Figure 2]. The subject was asked to bite with maximum force [measured in Newtons [N]]. Three repetitions were conducted on the right, left molar regions and in the anterior region with 2 min of rest between recordings. The mean maximum bite force was considered [22].

### Statistical Analysis:

Entire data was gathered in a Microsoft excel spread sheet and subjected to statistical analysis using statistical package for social sciences version 20. IBM Pvt Ltd, Chicago, USA. The change in the

parameters over a period of 1 month in test and control group was analyzed using Paired t test. Intergroup comparison between the changes in parameters was analyzed using Un-paired t test. P value less than or equal to 0.05 or 0.001 were considered to be statistically significant.

### Results:

In the current study there was no statistical significance recorded regarding the means of PPD, CAL and BF from baseline to 1 month after scaling in healthy periodontium group. Whereas statistically significant reduction of PPD [ $p < 0.001$ ], significant gain in CAL and significant improvement in bite force were reported when compared from baseline to 1 month post scaling [Table 1]. During the inter group comparison for healthy periodontium and chronic periodontitis groups there was a statistical significance [ $p < 0.001$ ] recorded for PPD, CAL and BF before scaling while statistical significance was also recorded for PPD and CAL favoring chronic periodontitis group and BF significance [ $p = 0.001$ ] favored healthy periodontium with greater bite force 1 month after scaling [Table 2].

### Discussion:

In the present study no patients lost the follow up and didn't experience any sought of complications like dentinal hypersensitivity due to scaling and root planing. Masticatory efficiency always play a role to maintain a balance in the periodontal apparatus. Thus to estimate this efficiency bite force measurements are the best way of assessing. Studies done by Van der bilt *et al.*, [23], Omar *et al.*, [24] & Luke and Lukas [25] concluded that there was a significant relation with occlusal contacts and masticatory efficiency. Generally studies were previously performed for fixed partial denture and natural teeth, complete dentures and masticatory muscles, TMJ relations trying correlation with bite force. Even studies were reported regarding the bite force estimation before and after flap surgery. Much number of studies were not performed regarding the relation of bite force with scaling and root planing. So this study was performed.

In the control group only supra-gingival scaling was performed to eliminate plaque and calculus deposits so that minor sub-clinical inflammation if present could be reduced and healthy periodontium is

maintained in entire duration of study. Sticking to the concept of critical probing depth by Lindhe *et al.*, [26] 1981 SRP was not performed in control group. Thus, regarding PPD in control group values were non-significantly reduced and a non-significant gain in CAL was also recorded when compared from baseline to 1 month post-scaling.

Regarding the PPD for test group, there was a statistical significant reduction [1.39mm] was reported during intra comparison at baseline and 1 month post-scaling. This is in accordance with Cobb CM and Sottosanti JS [27] 2021 where they concluded that SRP is still critical for periodontitis treatment and moreover after proper re-evaluation if pocket persists surgeon should consider for surgical therapy after appropriate SRP. In case of CAL for test group there was a statistically significant gain in CAL [1.12mm] was reported during intra group comparison at baseline and 1 month post-scaling. Present study results were much better than a systematic review done by Smiley CJ *et al.*, [28] 2015 where they concluded that there was a generalized 0.5mm gain CAL with SRP and if local drug delivery agents were used as adjuncts there was a gain in CAL ranging between 0.2 to 0.6mm. This might be due to deeper pocket depths helped in improved CAL values and varied parameter criteria also might play a role.

Regarding intergroup comparison values were statistically significant for both test and control groups regarding PPD, CAL and BF. These variations might be due to lesser range of variation regarding the values. Present study results were also in accordance with Choi YM *et al.*, [29] 2015 where they concluded that after SRP there was a reduction in PPD and gain in CAL irrespective of type of underlying osseous defects and time periods. But greater improvements were recorded in horizontal defects than vertical defects. These variations in PPD and CAL can also be attributed to body response, effective treatment by periodontist and good patient compliance led to decreased inflammation and improved clinical parameters.

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While coming to bite force, there was statistical significance reported during intra group comparison in test group and values were non-significant for control group when compared from baseline to 1 month post-scaling. But on inter group comparison values were significant favoring healthy periodontium group than chronic periodontitis group indicating that there was no effect of improvement of bite force even after scaling and root planing. This is in accordance with the recent study done by Shankar S and Murugan T [30] 2020 where they concluded that bite force did not show any improvement even after periodontal therapy. Present study bite force results were also in accordance with previous study done by Klenfelder *et al.*, [20] where they concluded that reduce periodontal support does not seem to limit the bite force with maximal strength in natural dentition. These variations might be due to the amount of sample considered, varied inclusion and exclusion criteria etc. Apart from this, due to the movement of teeth away from heavy forces help in withstanding the forces and distributing to underlying alveolar bone. Thus it might be one of the reasons for absence of periodontal support does not show effect on bite force.

Though the study had an adequate sample size, but smaller sample size, short term follow up always limit the study. Long term follow ups with larger sample size, before and after surgical therapies, natural dentition bite force and artificial dentures bite force relation if considered could have helped in better outcome of results.

#### Conclusion:

Within limitations of present study it can be concluded that scaling and root planing always help in improvement of periodontal condition. While it does not show any positivity in improving the bite force after mere scaling and root planing. Thus it can be stated that non-surgical periodontal therapy does not improve the condition of reduced periodontium regarding the bite force values.

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**Table 1 depicts the mean and standard deviations, standard error means of both the groups in case of PPD, CAL and Bite force at different time intervals**

Healthy Periodontium Group		N	Mean	Std. Deviation	Std. Error Mean	P Value
PPD	Before scaling PPD	20	1.76	0.752	0.182	0.083#
	1 month after scaling PPD	17	1.59	0.507	0.123	
CAL	Before scaling CAL	20	1.76	0.752	0.182	0.163#
	1 month after scaling CAL	17	1.65	0.606	0.147	
Bite Force	Before scaling BF	20	416.2047	30.08610	7.29695	0.841#
	1 month after scaling BF	17	416.1394	29.58646	7.17577	
Chronic Periodontitis Group		N	Mean	Std. Deviation	Std. Error Mean	P Value
PPD	Before scaling PPD	20	5.00	0.767	0.181	<0.001 *
	1 month after scaling PPD	18	3.61	0.698	0.164	
CAL	Before scaling CAL	20	5.00	0.767	0.181	<0.001 *
	1 month after scaling CAL	18	3.83	0.924	0.218	
Bite Force	Before scaling BF	20	386.6222	11.06439	2.60790	<0.001 *
	1 month after scaling BF	18	390.1672	10.18183	2.39988	

PPD-Probing Pocket Depth; CAL- Clinical Attachment Level; # non-significant; \* statistical significance  
 p<0.001 indicates statistical significance; N- number of participants

**Table 2 depicts the significant mean and standard deviations along with standard error mean regarding the PPD, CAL and Bite Force for before and after scaling in both the study groups.**

Clinical Parameters Measurements	Group	N	Mean	Std. Deviation	Std. Error Mean	p
Before scaling PPD	Healthy Periodontium	17	1.76	0.752	0.182	<0.001
	Chronic Periodontitis	18	5.00	0.767	0.181	
Before scaling CAL	Healthy Periodontium	17	1.76	0.752	0.182	<0.001
	Chronic Periodontitis	18	4.78	0.732	0.173	
Before scaling BF	Healthy Periodontium	17	416.2047	30.08610	7.29695	<0.001
	Chronic Periodontitis	18	386.6222	11.06439	2.60790	
1 month after scaling PPD	Healthy Periodontium	17	1.59	0.507	0.123	<0.001
	Chronic Periodontitis	18	3.61	0.698	0.164	
1 month after scaling CAL	Healthy Periodontium	17	1.65	0.606	0.147	<0.001
	Chronic Periodontitis	18	3.83	0.924	0.218	
1 month after scaling BF	Healthy Periodontium	17	416.1394	29.58646	7.17577	0.001
	Chronic Periodontitis	18	390.1672	10.18183	2.39988	

PPD-Probing Pocket Depth; CAL- Clinical Attachment Level; BF Bite Force; # non-significant; \* statistical significance; p<0.001 indicates statistical significance; N- number of participants

Figure Legends:

Figure 1 Depicts the CONSORT flow diagram for both test and control groups



CONSORT 2010 Flow Diagram

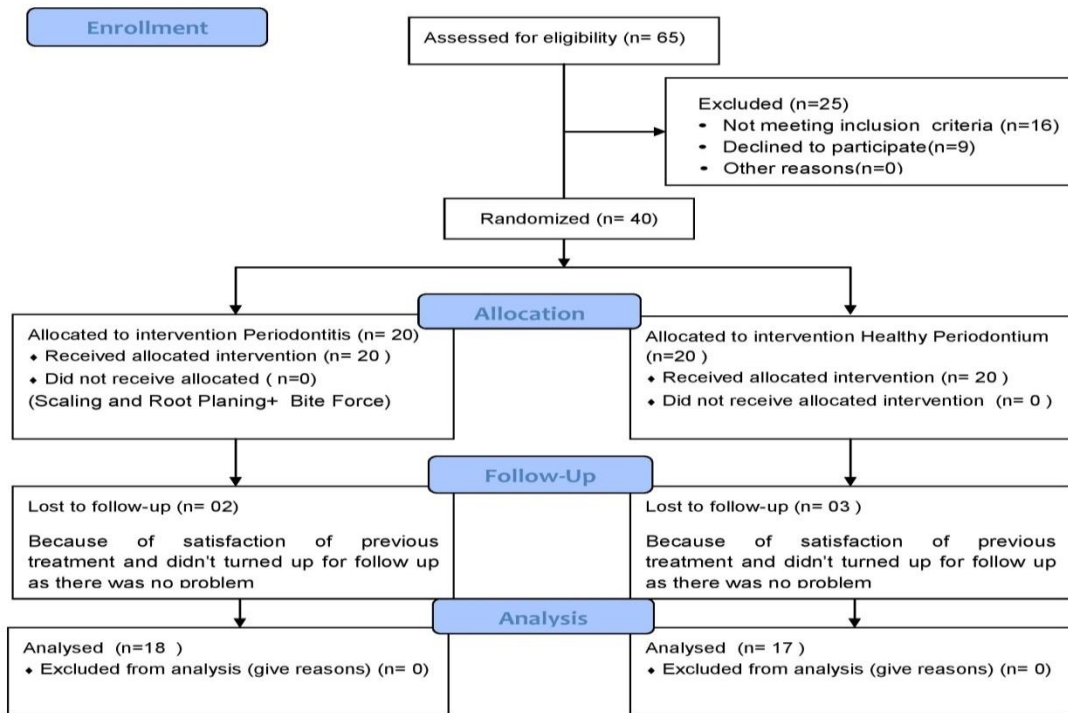




Figure 2: (a, b) and (c, d) depicts the pre and one month post-operative probing pocket depths of healthy periodontium and periodontitis group. (d) Depicts the bite force instrument, (e, f and g) depicts the images of bite force measurements taking.

