

Measurement of Bite Force in Adult Population of North India Using Two Different Bite Force Measuring Devices

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Aim; The aim of the present study is to measure the maximum bite force in the natural dentition with the help of two different bite force measurement devices.

Materials and methods; 100 subjects in each group were randomly selected from the population, aged between 18-60 years. The device was placed in between upper and lower central incisors and patients were asked to bite until the first sign of pain was felt. This exercise was done twice and mean was taken. Same procedure was followed for right and left first molars.

Results; The data proved that maximum bite force was more in young males than in young females. Also bite force tends to decrease as age progresses.

Conclusion; Bite force is more in young males than in young females. Also bite force on the right molars was similar to left molars.

Key words; bite force, incisors, molars, mean, maxillary, mandibular

Introduction; A major indicator of the functional state of the masticatory system is the generated biting force.¹ The ability to bite is a function of the craniomandibular structures, including the muscles of mastication, the temporomandibular joint and the dentition, be it natural or artificial. The magnitude of masticatory force is an indicator of functional status of the masticatory system. The effect of chewing efficiency and bite force on oral health-related quality was evaluated in the field of geriatric and implant dentistry^[1,2]. Measuring the masticatory force of individuals has been widely used to understand the biomechanical principles of masticatory muscles and outcomes of prosthodontics treatments. Also, the masticatory force is very important for diagnosis and treatment of dysfunction and behavior of the stomatognathic system^[3].

Materials and methods; Two bite force measurement devices were prepared for the purpose of the study consisting of two forks and sensor in between. 100 subjects in each group (group A had forks and display as one unit (fig1), whereas group B had forks and display as 2 units (fig2), were randomly selected by minimisation technique from the Out Patient Department of Jamia Millia Islamia, New Delhi. Each patient were informed in advance about the purpose of the study. It was

explained that the biting on the force measuring device should continue only until first signs of pain are felt. Initial measurement was done on central incisor region than on left and right molars.

Method and objectives of the study were thoroughly explained to all participants and written informed consent was obtained. Age, gender, the dominant hand, facial height and Angle's class of occlusion were recorded

With the patient in a seated position and occlusal plane parallel to the horizontal plane, the sensor was placed in the patient's mouth in-between the following teeth in an orderly fashion: 1. Occlusal surfaces of the maxillary right first molar and mandibular right first molar; 2. Occlusal surfaces of the maxillary left first molar and mandibular left first molar 3. Incisal edges of the maxillary and mandibular anterior teeth. The patients were asked to press their teeth in maximum intercuspation. By doing so, the maximum masticatory force in right and left molars, and also in the anterior segment was measured and recorded. Series of three recordings were taken and mean was taken. The rest period of one minute was given between each recording to prevent muscle fatigue. After every 10 measurements, the functions of the device and sensors were tested using a mass with a specific weight.



Fig;1.Bite force recorder for group A



Fig;2 bite force being measured

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Fig 3: Bite force being recorded in group B

Results

This study was performed on 100 subjects in Group A and 100 subjects in Group B. The males and females had a mean age of 18-60 years .

Maximum bite force in males (mean of 56(male)/100 patients) Group A

Central incisors 5.6 kg
First molar (right) 18.4
First molar (left) 20.1

Maximum bite force in females(mean of 44(female)/100 patients) Group A

Central incisors 5.5kgs
First molar(right) 17.1kgs
First molar (left)16.1 kgs

Maximum bite force in males (mean of 60(male)/100 patients) Group B

Central incisors 5.6 kg
First molar (right) 17.2
First molar (left) 16.2

Maximum bite force in females(mean of 40(female)/100 patients) Group B

Central incisors 5.5 kgs
First molar(right) 17.1kgs
First molar (left)16.2 kgs

I. Discussion

In group A subjects among the 100 male patients on which study was conducted in the department ,bite force in males was 5.6 kgs and for females it was 5.5 kgs ,which was almost equal .For right first molar (males)MBF was 18.4 kgs and for right first molar (females) MBF was 17.1kgs. In males for first molar (left side) MBF was 20.1 and for females first molar(left) MBF was 16.1kgs.In group B subjects among the 100 male patients on which study was conducted in the department ,bite force in males was 5.6 kgs and for females it was 5.5 kgs ,which was almost

equal. For right first molar (males) MBF was 17.2 kgs and for right first molar (females) MBF was 17.1 kgs. In males for first molar (left side) MBF was 16.2 and for females first molar (left) MBF was 16.2 kgs. Findings suggest that bite force on the central incisor for both males and females was similar, whereas for molars, bite force was higher for males than for females. Also bite force tends to increase in patients from 20-35 and it reduced after reaching 40 years. Significantly, bite force in both the devices had similar findings.

Several clinical and experimental studies have shown the significant role played by masticatory muscle function in the craniofacial growth.

In 1681, Borelli was among the first to measure the force of mastication using a somewhat similar technique of assessing the bite force by transducer placed between one pair of opposing teeth, leaving the rest of the dentition separated.

Strain gauges were used by Howell and Manly, Floystrand et al., and Bakke et al. for measuring bite forces.^[8] The measurement of bite forces has remained a matter of interest among many researchers. However, there is inconsistency in the findings and maximum value of bite forces presented by different authors.^[7,8] The reasons of this variation may be many such as the device used to record the bite force, its sensitivity, comfort of the volunteer, and psychological state of volunteer. In addition, genetic and ethnic, food habits, and geographical factors may be also responsible for this variation. Individual neuromuscular mechanism may itself be also an important factor for this difference.

The most successful of the entire lot of bite force recorders consisted of metallic face, an electronic instrument, and instant standardization device. This forms the basis of the bite force recorder. To reduce the metallic impact on teeth and to prevent cross contamination, disposable caps for fork were used.

Previous studies have evaluated the effects of several factors such as craniofacial morphology^[10-11], gender weight and height and pattern of occlusal contacts on masticatory loads. Gender differences are the most effective on masticatory loads. According to most researchers, masticatory forces are higher in males as compared to females. This difference is probably due to the difference in muscle strength or size of teeth in males and females^[12]. However, in the study by Abu Alhaja et al, in 2010 no difference was reported in the masticatory forces between males and females. The obtained results revealed that males had a significantly higher masticatory force than females, which confirms previous findings in this regard^[13]. However, Abu Alhaja et al, in 2010 found no significant difference in maximum masticatory forces of men and women. It appears that the effect of gender on the difference in the masticatory forces is attributed to the higher muscular strength in men¹⁵; which per se is due to anatomical differences between the two sexes^[15].

Ferrario et al¹¹, in most masticatory forces were measured to be in the range of 446N to 1200N with very high accuracy and low (3%) error rate. The maximum values are 228N in men and 198N in women. According to M. Manoj Srikanth, et al⁽⁹⁾. The maximum bite force was measured in young healthy volunteers and it was found that the average bite forces in incisor region were 10.6 kg, right molar region 38.5 kg, and left molar region were 40.1 kg⁽¹⁶⁾. In a study of incisal biting forces using a strain gauge gnathodynamometer on a group of young males and females between the ages of 10 and 25 years, Garner and Kotwal¹⁷, reported a mean biting force of 25–01 lb (11-3 kg) ± 14–11 lb (6–4 kg). They found that males bite harder than females and that, in agreement with Worner and Anderson, biting forces increase with age up to adolescence¹². Kshirsagar R¹⁸ revealed that the maximum voluntary bite force measurement in healthy Indian individuals is of the order of 36 kg in the molar region and 15 kg in the incisor region. According to Khan M¹⁹, Bite force is more in young males than in young females. Also bite force on the right molars was similar to left molars.

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Conflict of interest; None

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