



BITE IT RIGHT- A REVIEW

Dr Ifzah¹ and Dr Zain Patel²

¹Consulting Pedodontist, Maya Cleft Center, Srinagar.

²Consulting Orthodontist at Pune Dental Centre

Abstract: Bite force is a key predictor of masticatory performance. In dentistry bite force determination can be used to understand the mechanics of mastication, muscle activity and mandibular movements during mastication and masticatory performance to study the influence of physiological factors on changes in occlusal forces. Bite force levels vary with method, sex, age among other variables.

Keywords: Mastication, Bite force, Bite force recording devices

Introduction: Mastication is a developmental function and it usually develops as a learned experience. Adequate mastication provides a stimulus for proper function and development of maxilla and mandible.^{1,2} Masticatory function can be evaluated in terms of the objective capability of a person to fragment solid food or as the subjective response of an individual to questions regarding how well they can break the food down.³

Bite force is considered as an indicator of the functional state of masticatory system.⁴ Bite force can be defined as the forces applied by

masticatory muscles in dental occlusion.⁵ It is exerted by the jaw elevator muscles and regulated by the nervous, muscular, skeletal and dental systems.⁶

Importance of Bite Force In Children: Normal development of the primary dentition is indispensable for establishing a healthy chewing movement in the permanent dentition.⁷ Since the primary occlusion undergoes continuous change and it is adapting to growth and developmental functional patterns, its functional determinants can and must be established to explain and assure appropriate growth and development of the stomatognathic system and to allow a better understanding of the functional aspects of masticatory system development.²

In dentistry bite force determination can be used to understand the mechanics of mastication,⁸ muscle activity and mandibular movements during mastication⁶ and masticatory

For Correspondence:

dentalife@gmail.com

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performance² to study the influence of physiological factors on changes in occlusal forces.^{9,10}

Factors Affecting Bite Force: Age, gender, craniofacial morphology, periodontal support of teeth, dental status, the size, thickness and activity of the masticatory muscles and dental occlusion are some of the individual variations that have an influence on the magnitude of bite force.^{11,12}

Age: Occlusal bite force increases with age from childhood, stays fairly constant from 20 to 40 years of age and then declines.¹³ In children with permanent dentition between the age of 6 and 18 years bite force is significantly correlated with age.¹⁴ Maximum bite force is higher in males than females because of larger jaw dimensions in males.¹⁵ Greater diameter and cross sectional area of type II fibers in the masseter muscle corresponds to greater bite force in males.¹⁶ The hormonal difference in males and females might contribute to the composition of the muscle fibers. Bite force increases throughout growth and development without gender specificity. During the post pubertal period, maximum bite force increases at a greater rate for men compared to women and thus becomes gender related.¹⁷ Bite force was seen to increase significantly with age in girls, with teeth in occlusal contact in boys, and with increasing number of erupted teeth in both genders.¹⁸

Due to different growth intensity of boys and girls: the prepubertal minimum occurs at an average age of 10.5 years and pubertal maximum at 12.5 years in girls, and 11.5 years and 14 years, respectively, in boys, with an individual variation of approximately 4 years due to which boys have a steady and slower growth than girls.^{19,20}

Craniofacial Morphology: The maximum bite force shows a decline with an increase in vertical facial relationships, the ratio between anterior and posterior facial height, mandibular inclination and gonial angle.^{21,22,23} Bite force also reflects the geometry of lever system of mandible. When ramus is more vertical and the gonial angle acute, elevator muscles exhibit greater mechanical advantage.²² Bite force in

long faced individuals has smaller values while in short faced individuals bite force is stronger. This may be attributed to masseter muscles being thicker in short faced individuals than in normal or long faced individuals.²⁴

Periodontal Status of Teeth:

Mechanoreceptors of the periodontal ligament control the loading forces during mastication induced by the masticatory muscles. Individuals with a healthy periodontium have a significantly higher biting ability than those individuals with chronic periodontitis.²⁵ Biting ability and periodontal status show an interaction, however periodontal conditions have a little effect on biting ability.²⁶ Contrary to this it has also been seen that reduced periodontal support did not limit bite force with maximum strength in natural dentition.²⁷

Temporomandibular Disorders:

Temporomandibular disorders are often defined on the basis of signs and symptoms like temporomandibular joint and muscle pain, limited mouth opening, clicking and crepitations.²⁸ Bite force is lower in temporomandibular disorders patients than healthy control subjects. Temporomandibular joint inflammation and/or masticatory muscle pain limit maximum bite force.^{29,30}

Occlusal Contacts: A significant positive correlation is present between the maximum bite force and the number of teeth present.³¹ Due to biomechanics of the jaw elevator muscles and the lever system of mandible occlusal force is greater on the molars than on the incisors.³² The number of occlusal contacts is a strong determinant of muscle action and bite force than the number of teeth present.³³ The correlation between occlusal contacts and bite force is that 'good' occlusal support may result in stronger or more active jaw elevator muscle that can develop higher bite force.⁵

Dental Status: Dental status formed with dental fillings, structure, position and the number of teeth plays an important factor in the value of the bite force. There is a positive correlation between the position and the number of the teeth at both maximal and submaximal bite force.³⁴ The bite force is low in subjects with dental fillings due to adaptive changes caused

by the dental fillings. The bite force in the posterior dental arch is more compared to anterior arch due to increased occlusal contact in posterior arch. Carious teeth also affect the maximum bite force.³⁵

Diet: With the advent of soft, modern food chewing frequency and eating time has decreased. The increasing softness of foods is an environmental factor that might exert strong influence on occlusal force. Bite force affects choice of food. Children with greater bite force tend to opt for harder foods while children with lower bite force tend to opt for softer foods.³⁶

Bite Force Recording Devices: A variety of methods have been used to measure bite force. It is most often recorded by placing one or two transducers between pairs of opposing teeth during clenching.³⁷ Pressure sensitive sheets, thin force sensing resistors, and strain gauges can also be used to record bite force, but their recordings need a far more comprehensive preparation and computer calculation.^{38,32,39} Spring types of devices, electric strain gauges,⁴⁰ and dental prescale⁴¹ are other methods which can be used to record the bite force.

Manly's method is one such method which investigated particle size distribution following food pulverization using peanuts and grains of rice. However it proved difficult to obtain consistent results because the materials used were natural foods (Manly 1950). Adenosine bisodiumtriphosphate (ATP) were used for measurement of masticatory efficiency. The ATP particles were originally designed by Fujiyama in 1972.

Tekscan is a computerized occlusal analysis system which has been utilized in research centered on occlusal analysis, and as occlusal indicators in implantology, aesthetic dentistry as well as temporomandibular joint disorders. However, the limitation of utilizing this device is its cost.⁴²

Occlusal force gauge consists of a hydraulic pressure gauge and a biting element made of a vinyl material encased in a disposable plastic tube. Bite force is displayed digitally. The measuring range of the instrument is from 0 to 1000 Newton. It is easy to use and is portable.

This provides an advantage over the other instruments in terms of use in young children.⁴³

Measurements of maximum bite force are dependent on the motivation and cooperation of the subject. Concern about damage to teeth during the measurement, or ongoing pain and tenderness in the teeth, supporting structures, temporomandibular joint or masticatory muscles have a negative influence on the bite force measurement.⁵

Conclusion: Human occlusal forces have long stimulated interest among researchers, but there are few reports regarding school age children. Studies have been done to compare the masticatory function of children and adults using electromyography of masticatory muscles, recording of mandibular movements and bite force measurement.^{44,7,45} However, there still remains a need to fully understand the magnitude of occlusal bite forces in different dentition stages in children.

In recent years, there is a trend towards softer food, primarily represented by processed food. The increasing softness of foods is an environmental factor that might exert a strong influence on occlusal force.

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