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Perception and Proprioception in Relation to Masticatory Act

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ABSTRACT

Perceptionis the consciousmentalregistration of a sensorystimulus. It involves interpretation of often ambiguous, insufficient, or overwhelming information in the light of your knowledge, beliefs, goals and expectations. Proprioception means" awareness of oneself"[2].It keeps us aware of the position of the body, extremities, mandible etc proprioceptor impulses participate in reflex adjustments. They are group of enteroreceptors that provide information regarding the position of parts of body in space and the receptors of posture and movements .They are highly specialized types of mechanoreceptor (consist of the terminal dendrites of sensory neurons and are encapsulated in structures of connective tissue or free) responding to tension or movement included by associated structures.

Key word: Perception, proprioception,Stimuli.

INTRODUCTION

The senses are our window into the world, and they provide the raw material for building an understanding of the environment.It figures out what is out there and where it is.

Receptors

Receptors are transducers that convert energy present within the stimulus (for example heat, light, energy) into electrical energy by altering the electrical properties of the receptor cell membrane.

Stimulus

It is a change of environment of sufficient intensity to evolve a response in an organism.

Perception

It is the consciousmental registration of a sensory stimulus. It involves interpretation of often ambiguous, insufficient, or overwhelming information in the light of your knowledge, beliefs, goals and expectations.

Proprioception

Proprioception means" awareness of oneself"[2].It keeps us aware of the position of the body,extremities,mandible etc proprioceptor impulses participate in reflex adjustments. They are group of enteroreceptorsthat provide information regarding the position of parts of body in space and the receptors of posture and movements .They are highly specialized types of mechanoreceptor (consist of the terminal dendrites of sensory neurons and are encapsulated in structures of connective tissue or free) responding to tension or movement included by associated structures.

Proprioceptors in the body are Muscle spindles ,Golgi tendon organs , Joint receptors and Free nerve ending.

Joint receptors:Joint receptorsprovide information about the position of the joint and also about how rapidly the position is changing during movement. They consist of nerve endings associated with connective tissue within the joint.

Mastication[3]

Mastication orchewing is a harsh process to which food is subjected preparatory to swallowing.It is beneficial to the body by making digestion easier by increasing surface area and distrusting the indigestible cell walls ,.preventing excoriation of the alimentary canal by making food safer. It also facilitatesemptying of the mouth.

Mastication occurs only when food is present in a small fraction of a 24 hours period. Oralbehaviour also occurs during the rest of the day i.e. when speaking, swallowingsaliva, wetting thelips clenching grinding or expressing emotion

Masticatory system[2] includes

i) jaws and TMJ
ii) Teeth
iii) Neuromuscular apparatus

The mandibular muscles constitute the active part of the system and the teeth jaws and TMJ the passive parts (also influence muscle contraction patterns)

TMJ

The TMJ is the articulation between the **condyle** of the **mandible** and the squamous portion of the temporal bone.The position or movement of a joint the slow adapting proprioception endings in the capsule and ligament provides the most important information about the accurate relationships within the joint.The muscles acting on at the TMJ are more fundamental to mandibular movement than the ligaments. Joints movement takes places by means of learned coordination of muscles groups.

In course of time pathological or adaptive changes of TMJ due to impaired dental efficiency influencing the outcome of temporomandibular disorders.

TMJ Proprioception[4]:

The receptors in the human TMJ play important key role in identification of mandibular position when the teeth are not occluded. Storeybelieved that the size discrimination was entirely a function of receptors in TMJ.Wyke stated that TMJreceptors provide the greater afferent activity regarding perceptual awareness of joint position and movement.

Muscles of mastication[2]

There are four muscles of mastication they are Masseter muscle, Temporal, lateral and medial pterygoid.

Muscle proprioception.[4]

Muscles of mastication has muscle spindles but Matthew believed that their primary function was subconscious rather than conscious nervous control of contraction.More than twenty muscles are involved in the process of mastication Masseter muscle is the primary bite force generator for chewing and swallowing.

The masseter muscle is, under normal conditions, a very powerful, forceful muscle for both mastication and stabilization during deglutition. The TMJ provides the fulcrum against which the masseter and other muscles of mastication can perform work.

Types: a) Based on slow or rapid changes.

Slow adapting (i.e. tonic) Receptors which provide information regarding steady states of the body, such as blood composition and body position and body position.	Rapid adapting (i.e. phase) Receptors which provide information regarding states that are continuously changing . Ex-receptors be in our joints has been flexed but also how rapidly it was flexed and even if that velocity change .

Teeth

Canine response[4]

- Different author did study on animals and concluded that canines are most sensitive of all oral structures followed by gingival tissues[9].
- Bonaguro[4] study on human being and found that patients could detect the smallest relative differences in forces applied to the teeth with their maxillary canine although the canine had a optimal functional range than maxillaryincisors.Kawamura studied by applying manual stimulation to incisors and canine and molars and concluded that neurons for canine where densely distributed and the sensory information from individual teeth had its own specific receptive sites in the trigeminal nucleus.

Directional sensitivity

Jerge[4] reported the receptors in periodontal membrane are directionally sensitive.Kawamuraapplied pressure to stimulus in cats teeth and found that specific sites in bulbar and spinal trigeminal nuclei responded to the pressure to the teeth from a specific direction. Wagers and smith[4]noted that the receptors around the teeth responded more to force in one direction than another.

Directional proprioception

Kawamura[4] found that patients with natural teeth could discriminate differences better at 2mm range than could patients with denture.Langer and Michman[4] observed that patients with previous experience could discriminate the different grades of hardness better than new dentures

Tactile sensitivity of teeth to load

Munch[4] reported a load of 1.5 Gm was perceived in human dentition.

Nafkoo[4] determined that the proprioceptive ability was lowered significantly by application of light orthodontic forces on teeth. Manly [4]found that sensitivity if anterior teeth to axial load was about ten times as great as the posterior teeth. The teeth exhibited 2-5 times greater sensitivity to lateral than axial load.

Effect of local anesthesia on teeth proprioception

Shiiala[4]tested patients for effect of local anesthese and found slight difference .so they concluded saying that the sensory receptors were not completely desencitised

Location of dental receptor sites

Hannam andpfaffman[4]both felt that the majority of receptors giving rise to impulses came from periodontal membrane.

Neuromuscular apparatus[6]

Mandibular movements are initiated in brain .To control oral motor functions like chewing , biting ,speech etc. the CNS relies on information from sensory organs in the orofacial structures.The nerve endings in the oral mucosa and proprioceptors in periodontia , muscles and TMJ constitute the sources of reflex control of jaw movements.

The CNS as the originator of all active muscle movement impacts on the occlusion in three ways[5]

1) during growth and development
2) during normal function
3) excessive function

The control of mastication by central pattern generator has been divided into identifiable processes[5]ieGeneration of rhythm or timing that controls the duration of chewing cycleand the activation of burst generators which are of premotor neuron cells that control the activation or inhibition of motor neurons

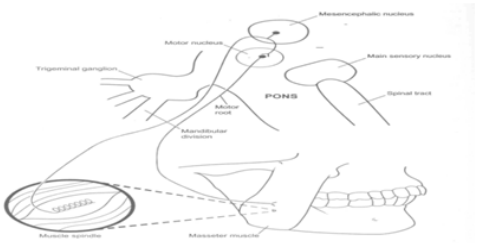
b) Based on stimuli received from external and internal environment.

They provide information about our external environment .	'They provide information about our internal environment.
They are located near the body surface.	They are located in blood vessels and in viscera and also referred as viscera receptors.

Central and Sensory Regulation of Chewing[7]: Some peripherial sites influence motor neurons relatively directly by action on "chewing centers" itself others do it so by indirectly affecting the indirect projection to one or more of the high centers(such as sensorimotor cerebral cortex) that regulate the motor neuron via the chewing centre. Broken lines denotes less direct central pathways.

Proprioceptive responses from jaw muscles are control by Mesencephalic nucleus and activation of jaw muscles is mediated by trigeminal motor nucleus.

Proprioception in mastication



Perception in mastication

The sensory modalities responsible for perceiving texture and mouth feel can be divided into 3 distinct groups ie mechanoreceptors in the superficial structures of the mouth such as the hard and soft palate, tongue and gums ,periodontal membrane and surrounding the roots of the teeth; muscles and tendons that are involved in mastication.

When food is introduced into the mouth, it is positioned and pressed against the palate by the tongue, from which information about the surface textural characteristics is obtained.

Oral health-related quality of life[9]

One of the most immediate and important functional consequences of many oral disorders is a reduction in chewing ability . The ability to chew is not only an important dimension of oral health , but is increasingly recognized as being associated with general health status, because the ability to chew food may affect

Impaired chewing ability is perceived as a serious oral health impairment, and has been found to be related to many other oral health problems when assessed with broad concepts such as (OHRQoL).Oral conditions such as infected or sore gums, loose teeth, toothache pain, and fewer functional tooth units have been

Periodontal ligament

The periodontal ligament provides the means by which the forces exerted on the tooth are transmitted to the bone that supports it in case of patient who needs the complete denture is deprived of periodontal ligament and the entire mechanism of force transmission is altered .

In edentulous patient the periodontal ligament membrane have been lost but the sensory nerve endings in the mucosa are substitute for the proprioceptors of periodontium and are responsible for signals to muscles.Edentulous patients has lost the neuroperiodontalfunction but he retains the neuromuscular,neuroarticular functions.The area of mucosa available toreceive the load from cd is limited when compared with the corresponding areas of support available for natural dentition

Maximum forces of13 to 16lb(6 to 8 kg) during chewing has been recorded with complete dentures wearers maximum bite forces appear to be five to six times less for complete denture wears than those with natural dentition

Patients with prosthesesfrequently limit theloading of supporting tissues by selecting food that does not requiredmasticatory effort exceeding the tissue tolerance. Tryde[5]found that patientswith complete denture experience a significant decrease in retention following application of anaesthesia to the tissues .Brill et al[5]believed that loss any natural tooth perception can be compensated by composite results of sensory signal from joints and receptors in denture foundation. The pronounced differencebetween persons with naturalteeth andpatients with complete denture in functional context:

The mucosal mechanism of support by periodontium[8]

Movement's complete dentures during mastication

The progressive changesin maxillomandibular relations and the eventual migration of dentures andthe differentstimuli tosensory motor system.

Possibleinteractions among variouscomponents of masticatory system incontext of a change in the mechanism of occlusal support

Advancing age may delay the central processing of the nerve impulse as well as the functional motor units and the fast muscle fibres and decreases the cross sectional area of the masseter and median pterygoid muscles. Older people tend to have poor motor coordination and weak muscles.

The presence of inanimate foreign objects in the edentulous mouth is bound to elect in the central motor system,which intern influences the cyclic masticatory stroke pattern.Both the exteroceptors and proprioceptors are probably affected by size shape, position pressure and mobility of the prosthesis.The tactile stimuli that arises from the contact of the prosthesis which with the richly innervated are probably ignored after a short time.

Edentulous patients expect and are expected to adapt to the denture more or less instantaneously. That adaptation must take place in the context of patients or else systemic emotional and psychological states. Articulation of the craniomandibular complex in vertibrates is genetically patterned, primilarly for the mastication of food stuffs.

The mechanism of human's craniomandibulararticulations have been extensively studied by Bakke.The occlusal stability keeps the masticatory fit, enabling the masticatory system to meet its functional demands and the best occlusal stability with the mandible in the intercuspal position.

Perception in mastication

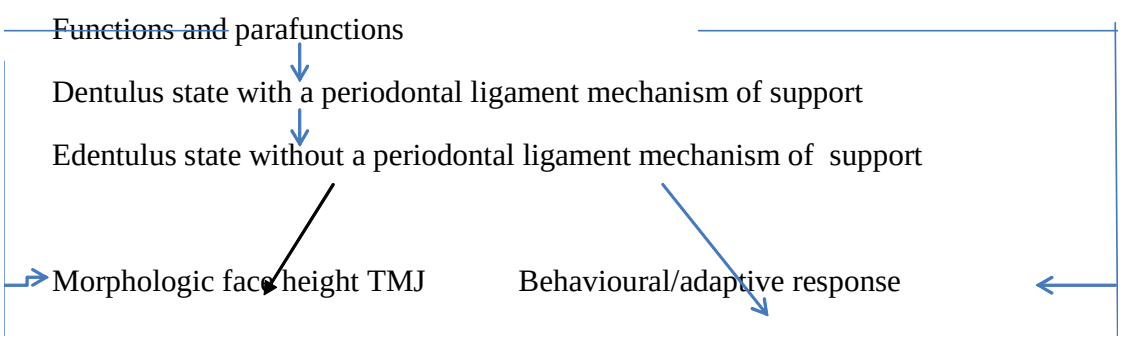
Oral studies of perception dimensional two types:[3]that discriminates changes in thickness and that determined minimal thickness perceived between incisor and occlusal surfaces of the teeth.

Manly et al[5] compare three groups of patients regarding size judgement ofpastic disks held between incisal; edges of anterior teeth the group contains patient of natural dentition and complete denture.And concluded that there is no significant difference found andsize judgment was propablity accomplized by proprioceptive sensation from TMJ and masticatory muscle.

Kauuamur concluded that patients with natural teeth could discriminate differences better than patients with dentures.

Langer states that patient with previous dentures experience could discriminate differences grades hardness than new denture wearer.

There was an average agreement between thepreferred sides in the first and all chewing cyclesof the hard food, while no such



agreementexisted for the soft food. This may indicate thatthe laterality evoked by the hard food is moreprobable to be towards the same side on whichthe first chews occurred; the side with thehigher force needed to masticate a hard food.

It is the textureperception during but not before the initiationof mastication which plays the main role indetermining the preferred side for chewing.texture perception prior to the actualchewing process is probably not strongenough to affect the start of mastication, so, inmost cases the pattern of mastication mighthave a fixed beginning, insensitive to texturesignals, possibly starting with a specialized sidefor sensing food texture, or probably the sidewhich is more comfortable and more effectivefor chewing.

Osseoperception[10]

Osseoperception has been defined as the conscious perception of external stimulitransmitted via a bone-anchored prosthesis by activation of neural endings and/or receptors in the periimplant environment such as the bone and more likelythe periosteum .[11,12] It is statedas part of an overall sensory-motor integration of the endosseous implants in the human body.

Patients with implant supported prostheses have improved tactile discriminative capabilities and report improved motor function in comparison with those wearing complete dentures, although their sensory and motor capabilities do not appear to match those of dentateindividuals.

CONCLUSION

Jaw movements are initiated and control by the brain and modified by the reflexes that largely origin from the nerve ending in the oral mucosa ,proprioceptors in the periodontia muscles and TMJ.

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