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DIGESTIVE DISORDERS IN THE ORAL CAVITY

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Abstract

The progress made in fundamental medical research over the past decades, the scientific acquisitions in the field of genetics, molecular biology and biochemistry in relation to the explosive development of investigative technologies have revolutionized the clinical approach to many pathological entities, practically opening a new era in the evolution of clinical medicine. Dental medicine, as a science, feels the massive impact of the needs for knowledge and re-launches the interest of research in all its subspecialties. From this perspective, these are legitimized not only through the crisis in managing the immense volume of information, but also through the openings offered to the framework of conceptualizing and defining the identity of this branch of medicine, related to the need to particularize the specific problems in this discipline. Digestion is a fundamental process in the survival of an organism. It begins in the oral cavity, where the bolus is formed, and continues in the stomach, forming the chyme, which then reaches the small intestine and transforms into the chyle. Through mastication, the surface of food increases, thus the enzymes are able to act more easily on the substrate. The first enzymes to act on food are the salivary ones - salivary amylase, lingual lipase. Mastication is regulated through the contact of food with receptors in the oral cavity. These will send impulses by way of the trigeminal nerve towards the centre of mastication - located in the bolus. From the bolus, they will start the signals on the efferent pathway (trigeminal, hypoglossal and facial nerves) that will reach the masticatory muscles. Mechanical digestion (mastication) can thus begin. Mechanical digestion in the oral cavity results from mastication. During mastication, the food is manipulated by the tongue, crushed by the teeth and mixed with saliva. Concomitant with mechanical digestion, the chemical digestion takes place through the action of saliva. There are two types of salivary glands in the oral cavity: large glands - parotid, sublingual, submandibular and small glands - disseminated throughout the oral cavity. Within 24 hours, up to 1.5 liters of saliva are secreted, 99% of which is represented by water. The remaining 1% consists of enzymes, mucus, nitrogen content. After finalizing mastication, deglutition begins. This mechanical process consists of thrusting the bolus from the mouth towards the stomach, using the esophagus.

Keywords*: dental medicine; digestion; oral cavity; mastication; mechanical digestion*

Introduction

Research has demonstrated the dependence of digestive processes on the activity of the upper segments of the nervous system and the reciprocal link between the different parts of the gastrointestinal tract: the digestion in the oral cavity influences the function of the bowel and the other way around. This coordination of functions is achieved with the help of the nervous regulation mechanism.

The excitation from the interoceptors of the gastrointestinal system reaches the central nervous system, exerting a reflex action on the digestive organs, as well as on other systems, such as blood circulation and respiration.

Moreover, a field was discovered for the first time which, until recently, was completely unknown, namely that of the influence of the reflex-conditioned activity on the digestive function, thus demonstrating the dependence of the digestive process on the function of the cerebral cortex.

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The process of inhibition and excitation in the cerebral cortex has been shown to influence the secretory and motor functions of different segments of the gastrointestinal system. Therefore, changes in the activity of the cerebral cortex and of the subcortical region are reflected in the activity of the gastrointestinal system.

Digestive disorders can occur in various regions of the gastrointestinal system. Moreover, the gastrointestinal tract - as a system that fulfils barrier functions - can become, under pathological conditions, a gateway for the entry of germs of infections and toxic substances inside the human body.

The gastrointestinal system also has an excretory function, through which the various metabolic products are eliminated: cholesterol, certain nitrogenous compounds, mineral substances, as well as substances with toxic action infiltrated or produced in the body. The disorders of the functions of the gastrointestinal system occur as a result of disturbances at the level of the digestion, resorption and excretory functions. In the intestinal wall, the processes of synthesis of various substances, proteins and fats take place. This synthetic function of the intestinal wall is disturbed under pathological conditions, which is negatively reflected on nutrition and metabolism at the level of the body as a whole.

The majority of the pathological changes found in the gastrointestinal system can be characterized as secretory, motor and resorption disorders. In most cases, these disorders are closely connected: pathological changes in the secretory function of the gastrointestinal system are reflected on the motor function and the other way around.

Disorders related to the feeling of hunger and thirst

The feeling of hunger is determined, to a great extent, by the periodic contractions of the empty stomach and by the transmission of the excitement caused by these contractions, through related pathways, to the brain.

By introducing a rubber balloon connected to a manometer inside the stomach during the feeling of hunger, the acceleration or weakening of gastric contractions are recorded. The latter can be inhibited by reflexes leaving from the teguments and from various segments of the gastrointestinal system. The hunger contractions of the empty stomach and consequently the feeling of hunger can be alleviated by chewing indifferent substances, through deglutition motions, smoking, pressing the abdomen.

These gastric contractions are regulated by the nerve impulses that are transmitted toward the stomach through the vagus and splanchnic nerves. They are also dependent on disorders at the level of the chemical and physico-chemical properties of the blood, which automatically influence the activity of the central nervous system. This dependence results from the experiences by which transfusing to a dog blood collected from another dog that was previously fed with meat inhibits the gastric hunger contractions and leads to the production of gastric juice secretion.

Hyperorexia or the *exaggeration of hunger* occurs in some digestive disorders (duodenal ulcer, intestinal parasites) and may be *motivated*, like in the case of *polyphagia* in diabetes mellitus, or *unmotivated*, like in the case of *bulimia*, where the sensation of hunger reappears immediately after consuming food [1-3].

Acoria occurs when the sensation of satiety is missing, even though important amounts of food are consumed; it can occur in *psychoneuroses* or some *brain tumors*.

Anorexia is manifested by the absence of the feeling of hunger and can be *total* (for any type of food) or *selective* (only for certain foods: meat, in various types of cancer). Anorexia can occur in digestive disorders - malabsorption syndrome, gastritis or extradigestive disorders - cancer, psychosis.

Sitophobia is the situation in which the appetite is present, but the patient refuses to eat for various reasons: the *fear of pain* induced by the consumption of foods, occurring in various

conditions of the oral cavity, pharynx, esophagus or stomach, from the *desire to lose weight* or *other causes* - hunger strike [4, 5].

Anorexia nervosa is manifested through a psycho-neurotic disorder and occurs in young women, being characterized by *anorexia*, *amenorrhea* (lack of menstrual cycle), *emaciation* (weight loss in which adipose tissue is lacking), *hypotension* and *low basal metabolism*.

Parorexia affects appetite. It usually occurs in some physiological states - pregnancy or pathologies - psychopathies and is manifested through the desire to consume unusual foods ("cravings" in pregnancy). A particular form of parorexia is *pica*, manifested through the desire to consume some substances that are difficult to digest - chalk, lime. The need to consume substances that are not considered foods (fecal matter) is called allotriophagy [3, 6, 7].

The feeling of hunger is assumed to occur as a result of changes in the function of the corresponding region of the diencephalon. The excitation of this region can be caused by related impulses from the periphery of the body, as well as directly, by blood, the modified composition of which influences the central nervous system [8-12].

In certain diseases, an imperious hunger is accompanied by cephalalgia and general asthenia, the so called bulimia. The consequence of pathological hunger is the increased consumption of food in bulimic patients, a condition called polyphagia. It occurs due to increased or denatured metabolism (Basedow's disease, diabetes mellitus), in neuroses, brain damage and in the case of an accelerated transit.

The decrease in appetite, called anorexia, is observed in infectious diseases, gastroenteritis, cachexia, avitaminosis accompanied by nervous system function disorders, during which the secretion of digestive juices is diminished. Sometimes there is a distorted appetite, called paroxysm, when the patient manifests a tendency to consume non-food substances.

Thirst is a sensation that arises from the lack of water in the body, by insufficient intake or excessive elimination. Thirst is especially pronounced in case of a massive administration of sodium chloride, following the intense dehydration of the body after profuse sweating, vomiting, diarrhea, intense diuresis, haemorrhages, etc. Pathological, exaggerated thirst, called polydipsis, occurs in diabetes insipidus and mellitus, due to the polyuria typical of these diseases (increased diuresis).

There are two explanations as regards the origin of the feeling of thirst. Some authors believe that the general dehydration of the body causes the excitation of the sensory nerve endings, which are projected reflexively on the pharyngeal region. From this perspective, the sensation of dryness in the oral cavity and the pharynx that accompanies thirst is a secondary phenomenon. In favour of this conception, the observations made on an esophagotomized dog can be cited - the water flows through the dog's sectioned esophagus and does not enter the body; the dog stops drinking water only after it is introduced inside its the stomach [11].

The sensation of thirst can also arise reflexively, depending on the dryness of the mucous membrane of the mouth and the pharynx due to diminished salivary gland secretion. For this reason, thirst can depend on factors that cause the driness of the oral mucosa; for example, it can be determined by the inhalation of air at a relatively high temperature, by an extended conversation, as well as by the inhibition of the salivary secretion by strong emotions (fear).

At the basis of thirst are both factors - both the reflex from the mucosa of the oral and pharyngeal cavity, as well as the decrease of the water concentration in tissues. The sensation of thirst is produced at the level of the central nervous system

Polydipsia is the exaggerated need to drink fluids and can normally arise in states of dehydration as a result of which the body has lost significant amounts of water through the digestive system - vomiting and diarrhea or the renal system - polyuria from diabetes mellitus; ***potomania*** is characterized by an exaggerated need to consume fluids in large quantities even though the sensation of thirst is lacking. Potomania could be the consequence of neurotic states or hypothalamic lesions. ***Oligodipsia*** is manifested through the decreased need to drink fluids,

being the consequence of hypothalamic lesions or cellular hyperhydration. ***Dipsophobia*** is the repulsion toward water and is a characteristic sign of *rabies*.

Digestive disorders in the oral cavity

In the oral cavity, chewing disorders can occur - the first stage in the process of digestion. Chewing food reflexively intensifies gastric juice secretion. Gastric juice is secreted reflexively following the excitation of the mucosa in the oral cavity, as well as by the pathway for the reflex conditioned response to the appearance and smell of the food (the reflex phase). Disorders related to the chewing and processing of food in the oral cavity are reflected on the function of the stomach.

After mastication is completed, *deglutition* begins; this mechanical process consists in thrusting the bolus from mouth toward the stomach, using the esophagus. Deglutition takes place in three phases - *oral, pharyngeal* and *esophageal*. The *oral phase* is voluntary and consists in thrusting the bolus from the posterior surface of the tongue toward the oropharyngeal isthmus. The *pharyngeal phase* is involuntary and starts from the moment in which the bolus reaches the pharynx. The *pharyngeal phase* consists of muscular contractions superior of the bolus and their inhibition at inferior level, thus ensuring the unidirectional movement of food. The last phase of deglutition is the esophageal one. It ensures the movement of the bolus alongside the esophagus with the help of the peristaltic waves. This phase is also involuntary [12].

Chewing disorders can be caused by a variety of factors. Following central paralysis, the motor capacity of the masticator system is disturbed, leading to disorders of this act. Most often, however, these disorders occur due to tooth decay, inflammation or gangrene of the dental pulp and tooth loss. The lack of a large number of teeth makes it difficult to fragment food and consequently to swallow it, causing gastric digestion disorders, by the penetration of insufficiently chewed foods into the stomach. Therefore, the inflammation of the gastric mucosa (gastritis) often occurs.

The process of mastication can be affected by the existence of inflammation in the oral cavity (gingivitis, stomatitis), of ulcerative lesions of the oral and lingual mucosa or due to parontosis and prognathism.

Pathological changes in the oral cavity mucosa occur with predilection due to inflammatory processes located on the oral (stomatitis) and gingival (gingivitis) mucosa. These pathological processes are accompanied by chewing disorders, due to the painful sensation that occurs during the breaking down and progressing of the bolus (Fig. 1).

Fig. 1. Aspects of oral stomatitis [14, 15]

The inflammatory processes in the oral cavity occur in the majority of cases as a result of the action of infectious and traumatic agents. Stomatitis is also common due to the elimination through the oral cavity mucosa of salts of heavy metals (mercury, lead) that reached inside the human body. Furthermore, mercurial stomatitis, which occurs during the treatment of syphilis

with mercurial preparations is also known. Chewing disorders can arise as a result of the disruption of the motor activity of the muscular system of the oral cavity based on inflammatory processes localized in the muscles or jaws [13, 14].

Saliva secretion disorders refer to the amount of saliva released and can be of two types: hypersecretion or hyposecretion.

Salivary hypersecretion implies an increase in the amount of the saliva released and can be *physiological* - in case of consumption of spices, smoke or dried foods, and *pathological* - in various oral conditions (stomatitis, tooth decay, tongue cancer), or as a secondary symptom of diseases that affect others organs (middle ear disorders, trigeminal nerve impairment, Parkinson's, gastric and duodenal ulcers). Hypersalivation determines lip lesions and increased gastric pH [15].

Hypersalivation can also be caused by inflammatory processes located in the oral cavity, as well as a series of parasympathetomimetic substances. It influences the formation and moistening of the bolus with mucus(Fig. 2).

Fig. 2. Oral aspects of hypersalivation [16]

It causes the neutralization of gastric juice by the saliva swallowed, the decrease of the intensity of digestion and the occurrence of rotting and fermentation processes at the level of the stomach.

Salivary hyposecretion can be physiological in various emotional states and pathological in dehydration, fever or certain drug treatments. Salivary hyposecretion determines the drying of the mucosa of the tongue and mouth, speech disorders, tooth decay and favours oral infections [17].

Decreased salivary secretion can occur further to reflex disorders of the function of the salivary glands, as well as due to hydric metabolism disorders. During febrile processes, salivary secretion is usually diminished, while the reflex-conditioned salivary secretion is particularly decreased (Fig. 3).

Powerful pain sensations, as well as negative emotions, often cause changes in the function of various segments of the gastrointestinal system, in the present case, the sensation of dryness in the mouth, diminished gastric juice secretion. At the basis of all these changes lies the impaired function of the central nervous system.

The decrease in salivary secretion is also noticed as a result of dehydration due to profuse sweating, significant hemorrhage, prolonged diarrhea, as well as following the action of substances that paralyze the parasympathetic nerves (atropine) [18-21].

Decreased salivary secretion makes the act of chewing and deglutition difficult and contributes, as a result of the intense development of bacterial flora, to the appearance of fermentation and rotting processes in the oral cavity. Salivary hyposecretion can cause the

retention of certain metabolic products in the body that are normally eliminated through saliva, as well as of series of substances introduced from the outside (mercury, lead, copper).

Fig. 3. Oral aspects of salivary hyposecretion [18]

Deglutition disorders are represented by the *dysphagia syndrome* - difficulty to swallow food. The causes are manifold and are divided according to their localization, into three groups - *oropharyngeal dysphagia* (the difficulty of passing the bolus from the oral cavity to the esophagus), *transport dysphagia* (characterized by the sensation of blocking food at the level of the esophagus) and *esogastric dysphagia*.

Normally, dysphagia affects solid foods, however, there is a particular type of dysphagia - paradoxical dysphagia, which hinders the passage of liquid foods and less so of solid foods (cardiac acalasia) [22-24].

The reaction of saliva, which is usually weakly alkaline, can be changed in relation to the digestion and metabolism disorders. Certain pathological processes, such as diabetes mellitus or fever, often cause increases in the concentration of hydrogen ions in the saliva, with deviation in the sense of acidosis. Changes in the composition and reaction of the saliva can also contribute to tooth decay.

The salivary glands are part of the group of organs that possess a large number of vegetative nerves which send impulses from the central nervous system. As the character of salivary secretion in response to the action of various conditioned excitators is known, the state of reflex-conditioned activity can be appreciated.

Pathological processes also occur in the tonsils. Inflammatory processes of an infectious nature (angina) can occur at this level. These prevent the act of deglutition and influence the secretory processes in the oral cavity [25-27].

It is known that the tonsil system is the gateway for a number of infections. At this level, infectious processes can persist for a long time, causing from time to time repeated general reactions as germs enter the bloodstream.

Some researchers have drawn attention to the teeth (in case of alveolar granulomas) and tonsils as potential outbreaks of latent infection, which then extends to the entire body. These are the so called outbreak infections. From these outbreaks, the body can be invaded with toxins and various products of the biological activity of infectious agents that sensitize the body, making it hypersensitive to the subsequent break-in of these substances into the general bloodstream. On this basis, an allergic condition develops, which constitutes the cause of a series of diseases (rheumatism, chronic septicemia, etc.) Appart from these, there is the possibility of reflex influences on the coronary arteries and the heart, starting from the damaged tonsils [28, 29].

From the oral cavity, the food reaches the pharynx. Tongue paralysis - especially of bulbar origin - makes the access of the food into the pharynx difficult and the use food in solid state impossible [30-32].

The act of deglutition can be hindered by changes in the function of the nervous system. This can be noticed in the lesions of the bulbar and motor nerves that participate in the act of deglutition (bulbar paralysis, brain tumors).

Conclusions

Dental problems such as tooth decay and related complications (pulpitis - inflammation of the nerve, dental abscesses, etc.), through the pain they produce, as well as tooth extractions or the incorrectly executed dental works affect the mastication and digestion of foods, being able to temporarily produce digestive disorders which can become chronic.

The mechanical digestion in the oral cavity results from mastication. During mastication, the food is manipulated by the tongue, crushed by the teeth and mixed with saliva. These result in a soft, flexible and easy to swallow mass of food, bearing the name of **bolus**.

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