TO THE ISSUE OF USING ULTRASONIC ECHOOSTEOMETRY FOR THE PURPOSE OF DIAGNOSING THE STATE OF BONE TISSUE

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The search for the most informative and safe methods for assessing the state of bone tissue remains an important area of research in modern dentistry. To monitor the processes of reparative regeneration of the bone tissue of the alveolar processes of the jaws under the influence of treatment, the method of ultrasonic osteometry has been used to date.

To date, one of the most pressing issues. Is searching for the most informative and safe methods for examining bone tissue. To analyze the processes of reparative regeneration of the bone tissue of the alveolar processes of the jaws under the influence of treatment, the method of ultrasonic osteometry has been used to date.

Ultrasonic osteometry is a method of determining the state of bone tissue by determining the speed of passage of ultrasound through the bone, is fast, accurate and not laborious. It is important that ultrasonic vibrations in diagnostic parameters are harmless to the body.

Echoosteometer "EOM-02" consists of the main unit and a set of ultrasonic sensors. The radio pulse generated by the high-frequency generator enters the transmitting piezoelectric transducer, where it is converted into an ultrasonic pulse. This pulse, having passed the measurement site along the bone, excites the receiving piezoelectric transducer and is again converted into a radio pulse. The results of measuring the speed of propagation of an ultrasonic pulse along the bone (m/s) are recorded on the digital display of the device.

The operating frequency of ultrasonic vibrations generated by the radiating sensor in EOM-02 is 150 kHz. Oscillations of this frequency have a wavelength in the bone within 3.5 cm and propagate through spongy and cortical bone tissue. A bone segment 250 mm long was examined with the setting and receiving sensors strictly perpendicular to the bone axis. With this position of the sensors, as shown by calculations and experimental studies, the critical angle of entry of ultrasonic vibrations into the bone is 24-30 degrees, and the propagation of the recorded ultrasonic waves passes rectilinearly over the surface of the bone.

Taking into account the angle of entry of ultrasonic waves into the bone, the sensors were not set closer than the critical distance from each other. This distance depends on the thickness of the soft tissues and should exceed the total thickness of the tissues lying under the sensor by approximately one and a half times. If this rule is not observed, ultrasonic pulses that have passed through the soft tissues will be recorded, and the measurement of the ultrasound velocity in the bone is impossible.

To obtain reliable information, it is not the same angle of ultrasound input and the surface of application of the sensor that is important, but also its full contact with the skin. To eliminate the distortion of results due to soft tissues, the ultrasound velocity can be calculated using the equation: V=S/T-Sm/1540; where Sm is the total thickness of soft tissues according to the sensors, 1540 m/s is the average speed of propagation of ultrasound in soft tissues.

When comparing measurement results with different distances in different patients, the velocity of ultrasound propagation along the bone in m/s should be expressed and calculated using the formula: V=S/T*100000 (10 to the 4th power), where V is the velocity of ultrasound propagation in m/s , S - the length of the studied area of the bone in cm, T - the time of passage of ultrasound on this area of the bone in Mks. So if S=5cm and T=12.4Mks, then V = 5cm*100000/12.4Mks = 4032 m/s. The propagation velocity of ultrasound in soft tissues is within 1500 m/s, in bone tissue it ranges from 2050 m/s to 4750 m/s and depends on the type and area of the bone, as well as on the individual characteristics of the patient.

In connection with the above, to determine the speed of passage of ultrasound directly over the bone of

the lower and upper jaws and assess its echo density, we used the “base increment” method provided in the device, which makes it possible to exclude the influence of soft tissues on the measurement results. When conducting research using this method, three sensors were used, one of which is transmitting, and the other two are receiving. The examined area of the bone was located between two receiving sensors, the distance between which (base) was always constant and strictly fixed (250 mm).

With this method of measurement, accurate data can only be obtained with the same thickness of the soft tissues under the receiving sensors. In the region of the body of the lower jaw, the thickness of the tissues is insignificant and approximately the same throughout, with the exception of the area of attachment of the masseter muscle. The time measured by the “base increment” method makes it possible to calculate the speed of ultrasound propagation directly in a certain area of the bone in the lower and upper jaws. Using the device, measurements were taken when the sensors were installed on the surface of the bone perpendicular to its axis. In this case, the propagation of recorded ultrasonic waves occurs along the bone surface.

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