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STUDY METHODS OF ORTHODONTIC PATIENT'S BONE AGE STAGE ON CONE-BEAM COMPUTER TOMOGRAPHY

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Abstract. The use of cone-beam computed tomography (CBCT) in orthodontic practice is a modern diagnostic method and one of the stages of its analysis is aimed at studying the peak growth of the patient's body and ossification of the palatal suture. **The purpose of the study.** To analyze modern methods of assessing the stage of bone age of an orthodontic patient by CBCT. **Results.** The method of J.A. McNamara and L. Franchi "Cervical Vertebral Maturation" is used for assessment the shape of the bodies of the second (C2), third (C3) and fourth (C4) cervical vertebrae. It bases on the morphology of the C2-C4 bodies, 6 stages of their development can be determined. Assessment of the ossification of the palatal suture is used when planning the maxillary expansion. There are 5 stages of ossification of the median palatal suture, which will determine the choice of the method and appliances for upper jaw expansion. **Conclusions.** The use of CBCT in orthodontic diagnostics allows the orthodontist to obtain the maximum amount of data on the state of the dentition and make the prescription of orthodontic treatment more accurate.

Key words: cervical vertebral maturation, CBCT, orthodontics, median palatal suture, maxillary expansion.

Introduction. Bone age assessment is the best method for determining a child's biological age, i.e., the level of development. Previously, bone age was determined based on an X-ray of the non-dominant hand and wrist. In healthy children, the next nuclei of ossification appear at a clearly defined time. On this basis, standards for calendar age and gender could be determined.

The use of CBCT in orthodontic practice is a modern diagnostic method and one of the stages of its analysis is aimed at studying the peak growth of the patient's body and ossification of the palatal suture and consists of two steps: assessment of bone age by the morphology of the cervical vertebrae and ossification of the palatal suture.

The purpose of the study. To analyze modern diagnostic methods of assessing the stage of bone age of an orthodontic patient by CBCT.

Material and methods. We searched web-based databases to identify relevant articles. For this review, we considered publications on the assessment of cervical vertebral maturation and maturity of the median palatal suture on CBCT.

Results. The morphology of the cervical vertebrae is used to assess the bone age and the possibility of starting orthodontic treatment during the period of active growth of the child (puberty) in order to promote the development of the jaws.

Most often, the method of J.A. McNamara and L. Franchi "Cervical Vertebral Maturation (CVM)" is used for assessment. This diagnostic method uses data obtained after studying the shape of the bodies of the second (C2), third (C3) and fourth (C4) cervical vertebrae. Based on the morphology of the C2-C4 bodies, the lower border of the vertebral bodies is assessed and it is determined whether they are flat or concave (i.e., the presence of a visible notch), 6 stages of their development can be determined.

The first stage: The lower borders of all three vertebral bodies (C2-C4) are flat. The peak growth of the lower jaw will begin in an average of 2 years. *The second stage:* The concavity is present at the lower border of the body of the second cervical vertebra (C2). The peak growth of the mandible will start in an average of 1 year. *The third stage* is the most favorable for starting treatment of children in adolescence. The beginning of the pubertal growth spurt for the CS3 stage is identified by the presence of concavity at the lower border of the C2 and C3 bodies and the rectangular shape of the C3 and C4 bodies. The growth of the lower jaw will peak within the next year. *The fourth stage:* concavity is present at the lower border of the bodies of the second, third and fourth cervical vertebrae (C2-C4). The bodies of C3 and C4 are rectangular and elongated in width. [2, p. 964]. The growth of the lower jaw peaked 1-2 years ago. *Stage V.* Concavities are present on the lower boundary of bodies C2, C3, and C4. At least one of the vertebrae (C3 or C4) is square. The peak of growth of the lower jaw ended 1 year ago. *Stage VI.* At least one of the vertebrae (C3 or C4) is rectangular in shape, elongated in height. The peak growth of the lower jaw ended 2 years ago.

Usually, stages 1 and 2 are considered prepubertal, 3 and 4 are considered peripubertal, and 5 and 6 are considered postpubertal in time [1, p.133].

Assessment of the ossification of the palatal suture is used when planning the maxillary expansion. There are 5 stages of ossification of the median palatal suture, which will determine the choice of the method and appliances for upper jaw expansion (Fig. 1).

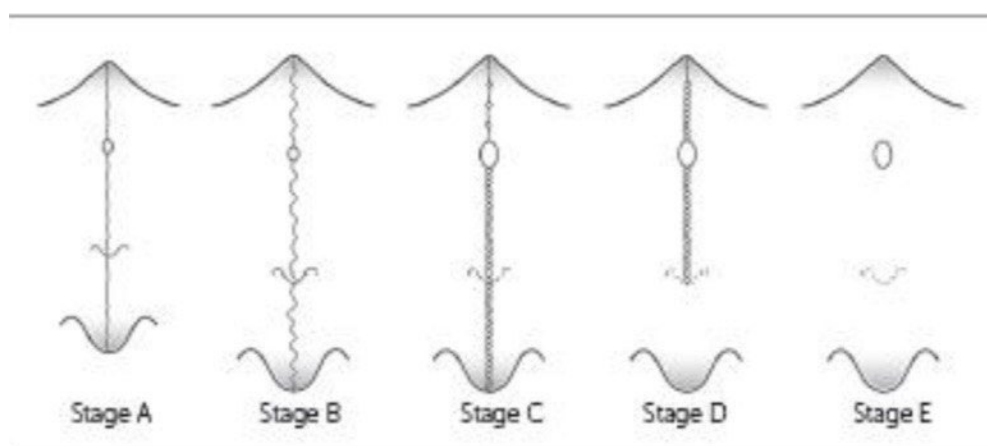


Figure 1. Stages of maturity of the median palatal suture

Source of the figure: [3, p.763].

Stage A - the median palatal suture is almost straight; the suture line is of high density without interdigitation or with slight interdigitation.

Stage B - the palatal suture becomes irregular in shape and looks like a high-density jagged line.

Stage C - the median palatal suture looks like 2 parallel, jagged high-density lines that are close to each other, separated by small low-density gaps in the maxillary and palatal bones. At stage C, it is possible to use a fixed appliance for rapid palatal expansion (RPE) of the upper jaw.

Stage D - complete fusion of the palate, but the suture is still visible in the upper jaw in the form of 2 high-density lines separated by small low-density gaps.

Stage E - the median palatal suture is no longer visualized in the upper jaw area. The bone density in the suture area is the same as in other parts of the palate [3, p.761]. At stages D and E, SARPE (Surgically Assisted Rapid Palatal Expansion) and MARPE (Miniscrew Assisted Rapid Palatal Expander) may be recommended.

Conclusions. The use of CBCT in orthodontic diagnostics allows the orthodontist to obtain the maximum amount of data on the state of the dentition, reasonably predict the results of treatment, taking into account the anatomical features of each patient, and make the prescription of orthodontic treatment more accurate. Therefore, CBCT should be an integral part of the orthodontist's work.

References:

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