



### F7 Identifying Characteristics of the Cervical Spine in Orthodontic Radiographs

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Those who attend will learn how to evaluate the cervical spine in a lateral cephalometric radiograph in terms of the stage of skeletal maturation, and be able to recognize some of the more common congenital, developmental, degenerative and traumatic anomalies that may be helpful in making an identification.

This presentation will impact the forensic community and/or humanity by informing odontologist and others working in human identification about key information that may be available from dental orthodontic records that is currently being over looked.

Human identification through the use of radiographs requires the presence of preexisting antemortem films that include landmarks with unique characteristics. Lateral cephalometric radiographs used in orthodontic diagnosis contain many landmarks besides the teeth and jaws that are suitable for identification purposes. Schuler in 1921 reported that radiographs of frontal sinuses could be useful in identifications. The sphenoid bone's clivus, anterior cranial base, sinus, and sellae tursica have been shown to develop unique radiographic outlines and relationships. Hyoid bone anatomy, cranial volume, and various orthodontic cephalometric measurements have also been studied for their forensic identification value. This presentation will focus on the cervical spine and its potential use in human identification.

The atlas, C1, is essentially a ring with prominent articular processes called the lateral masses. Three chondrification centers of the atlas appear during the second month of fetal life. Ossification of these centers occurs with fusion posteriorly at 3-5 years of age and anteriorly at 9 years. The bodies of the axis and the dens arise from separate ossification centers. C1, C2, & C7 are the most anatomically variable of the cervical vertebrae. A list of some of the conditions that will be reviewed are listed below.

Congenital absence of the posterior arch of the atlas: A report in 1987 mentions only 35 reported cases, and a case report of familial incidence [mother & daughter] has been reported.

Occipitalization of the atlas: This congenital anomaly is characterized by fusion of the posterior arch of atlas to the occiput.

Basilar Invagination or Impression (Cranial settling): Abnormal protrusion of the upper cervical spine (dens) into the foramen magnum, as a result of congenital malformation or acquired disease.

Bony ring of the vertebral artery [Kimmerle Anomaly, Pons Posticus]: Bilateral grooves for the vertebral artery convert into bony foramina [possibly by ossification of the oblique ligaments of the atlas]. This bony ring has been found in studies to exist both as complete or incomplete foramen and be present either unilaterally & bilaterally. The incidence of finding this structure varies from between 5% to 30%. The bony ring has been seen in the skeleton in children as young as 2 & 4 years. Longitudinal growth study data showed first signs between 3.5-16 yr old, and complete bridging as young as age 6 and finishing as late as age 24yr.

Spina bifida occulta: non-union of the posterior ring. It most commonly affects C1, L5, S1 and transitional regions.

Ossiculum terminale: Fusion of the tip of the odontoid to the body should occur by age twelve.

Subdental synchondrosis: This is a linear lucency at the base of the dens. The dens usually fuses with the body of C2 somewhere between ages 3 and 6 years. However, a thin remnant of the synchondrosis may be seen on the lateral view for many years thereafter.

Os odontoideum: This is a condition where the axis and odontoid fail to fuse.

Klippel-Feil Syndrome: Caused by fusion or by no segmentation. It is present from birth. The most common feature is the blocking or fusion of vertebrae with consequent reduction in the length of the cervical spine and shortening of the neck. Fusions between C1 & C2 are most frequent.

Cervical rib: The C7 segment becomes "thoracized." A cervical rib reflects hyperplasia of the transverse process' secondary center of ossification.

Rheumatoid arthritis: A chronic, progressive, systemic inflammatory disease primarily affecting synovial joints. The cervical spine is affected in about 50% of patients with rheumatoid arthritis.

Hangman's fracture: Nowadays this refers to bilateral fracture of the posterior arch of C2 leading to spondylolysis with eventual associated anterior spondylolisthesis of C2 over C3 due to disc and longitudinal ligaments associated lesions.

#### **Human Identification, Cephalometric Radiograph, Cervical Spine**