

The Study of Median and Lateral Articular Facets of Atlas Vertebra For Dens

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Abstract : As atlanto-axial joints are the most complex joints of the axial skeleton, both anatomically and kinematically, comprehensive knowledge of spinal kinematics is of paramount importance for an understanding of all aspects of clinical analysis of radiographs, in understanding clinical effects of fusion and orthotic prescriptions. In the present study the workers have tried to study median and lateral articular facets of atlas vertebra for dens. The study was conducted with an aim to evaluate the changes occurring with cleft posterior arch of atlas along with lateral atlanto-axial joint. The study was conducted on 200 dried, unsexed adult human atlas and 200 axis vertebrae. In the present study the incidence of cleft posterior arch of atlas is 2%. There is no difference in surface area of the lateral articular facets of both sides in all atlas vertebrae. Smooth lateral articular facets are found on the medial side of the lateral masses of all atlas vertebrae in dried bones as well as in cadaveric dissections. In the present study it is also observed that in the cleft posterior arch of atlas, surface area of median articular facet of anterior arches significantly more than in normal atlas vertebra.

Key-words: Articular facets, Atlas, Dens, Atlanto-axial joints

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INTRODUCTION: Movements responsible for the rotation of the head occur at the atlanto-axial joints. The cervical spine especially atlanto-axial joint is remarkable in its ability to provide optimal (rotation) positioning of the head for the key sense organs of the vision and hearing through a wide range of head & neck movements. Therefore the communication depends upon the integrity of the atlanto-axial region.

The biomechanics of rotation is an important frame of reference to have, when we evaluate the various types of rotatory subluxation and dislocations of C1 & C2. Dislocations have been frequently demonstrated in injury, Rheumatoid arthritis, Ankylosing spondylitis, Mongolism and other congenital anomalies of atlas and axis.

The extensive amount of axial rotation of C1 - C2 can sometimes cause clinical problems involving the vertebral artery. Vertigo, nausea, tinnitus and visual disturbances may occur as a result of occlusion of Vertebral artery associated with axial rotation of the atlas. As atlanto-axial joints are the most complex joints of the axial skeleton both anatomically and kinematically, comprehensive knowledge of spinal kinematics is of paramount importance in understanding all aspects of clinical

analysis and management of spinal problems. It helps in evaluation of radiographs, in understanding of clinical stability, spinal trauma, scoliosis, the clinical effects of fusion and orthotic prescriptions

MATERIAL AND METHODS: The present study was conducted with an aim to evaluate the changes occurring with cleft posterior arch of atlas along with lateral atlanto-odontoid articulation and biomechanical consideration of this joint.

The present study was conducted on 200 dried, unsexed, adult human atlas and 200 axis vertebrae prepared by maceration from collection of Department of Anatomy, B. J. Medical College. The following observations were recorded.

- Presence of cleft posterior arch.
- Surface area of median and lateral articular facets of atlas vertebra for dens.
- Surface area of articular facet on anterior aspect of dens.

Measurement of articular areas : The surface area of articular surface was measured by using thin, semitransparent micropore adhesive plaster. Leucoplast was carefully applied to the articular facets on atlas and dens. And the area was outlined with

the sharp, dark pencil. After removing the leucoplast, the area, outlined was cut and fixed on graph paper. Since leucoplast is semitransparent, squares beneath are easily visible with unaided eye. The squares within the outline of facet were counted near its margin and the squares covering half or more than half and less than half were counted.

RESULTS: observations are tabulated below.

TABLE: I :Surface area of median articular facet in normal atlas vertebra and vertebra with cleft posterior arch.

SR. NO.	Value	Normal vertebrae	Vertebrae with cleft post-arch
1	No. of	196	4
2	Mean surface area(sq. m.m.)	17.35	107.75
3	standard Deviation (sq.	17.81	6.22
4	Range(sq. m.m.)	31-120	100-117

TABLE: II Surface area of Lateral articular facet of atlas vertebrae (for dens)

SR. NO	Value	Atlas vertebra	
		Right side	left side
1	No. of	196	196
2	Mean surface area(sq. m.m.)	28.47	28.33
3	Standard Deviation (sq.	11.07	10.35
4	Range(sq. m.m.)	6-50	7-52

TABLE: III Surface area of Lateral articular facet of atlas vertebra with cleft posterior arch.

SR. NO.	Value	Cleft Atlas vertebra	
		Right side	left side
1	No. of	4	4
2	Mean surface area(sq. m.m.)	26.75	25.75
3	Standard Deviation (sq.	7.05	6.26
4	Range(sq. m.m.)	16-34	20-35

TABLE:IV Surface area of articular facets on anterior aspect of Dens

SR	Value	Surface area (sq. m.m.)
1	No. of	200
2	Mean surface	74.9
3	Standard	16.03
4	Range	33-118

Non- Metrical observations:

(A)Dissection: In cadaveric dissection, a presence of smooth facets on the medial aspects of the lateral masses of all atlas vertebrae is observed. They are seen ventral and superior to the attachment of the transverse ligament. The transverse ligament of atlas seems like a thick stout band which stretches transversely across the back of the dens of the axis and passes laterally and slightly forward on either side and is attached to the anterior part of the medial aspect of the lateral masses. The site of attachment of the ligament is observed as the roughness along the medial margin of the inferior articular facet of the atlas.

(B) CT- SCAN: Well defined lateral articular facets were observed on the medial aspects of the right and the left lateral masses in CT SCAN of 4 adult persons. The den faces these smooth facets during the right and left rotations. This close apposition suggests lateral atlanto- odontoid articulations.

DISCUSSION:

(a) Incidence of cleft posterior arch of atlas vertebra: Mahdi Hasan, Dhanrajsinh and Sanjeev shukla¹ reported 2.9 % cases of cleft psterior arch of atlas. Prescher² reported 4% cases. Bifid and hypoplastic posterior arch of atlas has been reported by Jain V.K.³ et al in 12.58% of patients . Turek⁴reported 5%~caseTof cleft atlas. In present study , incidence of cleft posterior arch of atlas is 2%.

(B) Median articular facet of atlas: Mahdi hasan, Dhanrajsingh and Sanjeev shukla¹ reported mean surface area of median articular facet of atlas as 70.52 Sq.mm., which was significantly increased to 146 Sq.mm. in cases of posterior arch of atlas. Ebrahim, Yang, Biyani and Yeasting⁵ reported the mean surface area of the median articular facet of

the atlas as 58.24 Sq.mm. In the present study the mean surface area of the median articular facet in the normal atlas is 77.35 Sq. mm. And in cases of the cleft posterior arch of atlas it is 107.75 Sq.mm. The difference of the surface area between the normal and cleft atlas is statistically significant

(C) Lateral articular facets of atlas: Although the lateral articular facet of the dens has been described by Turek⁴ and Mahadi hasan¹, no text – book of anatomy⁶⁻¹⁴ has mentioned to date the occurrence of the articular facet for dens on the inner aspects of the lateral mass of atlas.

In the present study, cadaveric dissection and CT scanning showed a smooth area on the medial side of the lateral mass. Normally site of attachment of muscles and ligaments should be rough but these smooth areas indicate articular surface. Cadaveric dissection also showed that the site of the transverse ligament is not over this smooth area but it is below and behind this area. CT scanning showed that during rotation the dens faces towards these smooth areas. So from these observations it can be hypothesized that there may be lateral atlanto - odontoid articulations. In the present study surface area of these smooth lateral articular facets are 28.33 sq. m.m on left side and 28.47 sq. mm on right side.

CONCLUSION: In the present study, the incidence of cleft posterior arch of atlas vertebrae is 2%. In the cleft posterior arch of atlas vertebrae surface area of the median articular facet of the anterior arch is significantly more than in normal atlas vertebra. There is no difference in surface area of the lateral articular facets of both sides in all atlas vertebrae. It is found that the articular areas of the median facets of the anterior arch of atlas and facet on the anterior aspect of dens are congruent. Radiographic findings suggest that the total width and cortical thickness of the anterior arch increase significantly in cleft posterior arch due to stress imposed on it. Smooth lateral articular facets are found on the medial side of the lateral masses of all atlas vertebrae, in dried bones as well as in cadaveric dissections. The site of attachment of transverse

ligament is below and behind the lateral articular facets.

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