Occipital condyle

The occipital condyles are undersurface protuberances of the occipital bone, which function in articulation with the superior facets of the atlas vertebra.

The condyles are oval or reniform (kidney-shaped) in shape, and their anterior extremities, directed forward and medialward, are closer together than their posterior, and encroach on the basilar portion of the bone; the posterior extremities extend back to the level of the middle of the foramen magnum.

The articular surfaces of the condyles are convex from before backward and from side to side, and look downward and lateralward.

To their margins are attached the capsules of the atlanto-occipital joints, and on the medial side of each is a rough impression or tubercle for the alar ligament.

At the base of either condyle the bone is tunnelled by a short canal, the hypoglossal canal.

see Occipital condyle fracture.

Uribe et al., propose a novel OC fixation technique using polyaxial occipital condyle screws for cranial purchase.

The OC junction was exposed posteriorly in silicone-injected cadaver heads. Polyaxial titanium screws (3.5 mm) were inserted bicortically solely into the occipital condyles; C1 lateral masses and C2 pedicles, or transarticularly through C1-C2, followed by fixation to a 3-mm rod. Drilling was guided by anatomic landmarks and fluoroscopy. Computerized tomography scans were obtained. Condylar screw angles and lengths were analyzed with respect to historical morphometric condyle measurements and with respect to neurovascular structures.

The condylar entry point was 4 to 5-mm lateral to the foramen magnum on the axial plane, and 1 to 2-mm rostral to the atlantooccipital joint. The mean angle of medialization was 17 degrees (range: 12 to 22 degrees). In the sagittal plane, the maximal superior screw angulation was 5 degrees. The mean screw length to obtain bicortical purchase was 22 mm (range: 20 to 24 mm). The hypoglossal canal was uninterrupted during its full course. The jugular bulb, carotid, and vertebral arteries were not injured by condyle screw placement. No fractures were identified.

Condyle screws can be placed without injury to neurovascular structures. OC junction fixation using polyaxial occipital condyle screws is feasible and can be considered a salvage technique or an alternative where other fixation techniques are not available [1)].

The segmental occipital condyle screw (OCS) is an alternative fixation technique in occipitocervical fusion. A thorough morphological study of the occipital condyle (OC) is critical for OCS placement.

Zhou et al., set out to introduce a more precise CT-based method for morphometric analysis of the OC as it pertains to the placement of the segmental OCS, and they describe a novel preoperative simulation method for screw placement. Two new clinically relevant parameters, the height available for the OCS and the warning depth, are proposed.

CT data sets from 27 fresh-frozen human cadaveric occipitocervical spines were used. All measurements were performed using a commercially available 3D reconstruction software package. The length, width, and sagittal angle of the condyle were measured in the axial plane at the base of the OC. The height of the OC and the height available for the segmental OCS were measured in the reconstructed oblique sagittal plane, fitting the ideal trajectory of the OCS recommended in the literature. The placement of a 3.5-mm-diameter screw that had the longest length of bicortical purchase was simulated into the OC in the oblique sagittal plane, with the screw path not being blocked by the occiput and not violating the hypoglossal canal cranially or the atlantooccipital joint caudally. The length of the simulated screw was recorded. The warning depth was measured as the shortest distance from the entry point of the screw to the posterior border of the hypoglossal canal.

The mean length and width of the OC were found to be larger in males: 22.2 ± 1.7 mm and 12.1 ± 1.0 mm, respectively, overall ($p < 0.0001$ for both). The mean sagittal angle was 28.0° ± 4.9°. The height available for the OCS was significantly less than the height of the OC (6.2 ± 1.3 mm vs 9.4 ± 1.5 mm, $p < 0.0001$). The mean screw length (19.3 ± 1.9 mm) also presented significant sex-related differences: male greater than female ($p = 0.0002$). The mean warning depth was 7.5 ± 1.7 mm. In 7.4% of the samples, although the height of the OC was viable, the height available for the OCS was less than 4.5 mm, thus making screw placement impractical. For these cases, a new preoperative simulation method of the OCS placement was proposed. In 92.6% of the samples that could accommodate a 3.5-mm-diameter screw, 24.0% showed that the entry point of the simulated screw was covered by a small part of the C-1 posterosuperior joint rim.

The placement of the segmental OCS is feasible in most cases, but a thorough preoperative radiological analysis is essential and cannot be understated. The height available for the OCS is a more clinically relevant and precise parameter than the height of the OC to enable proper screw placement. The warning depth may be helpful for the placement of the OCS [2].

1)
Uribe JS, Ramos E, Vale F. Feasibility of occipital condyle screw placement for occipitocervical fixation: a cadaveric study and description of a novel technique. J Spinal Disord Tech. 2008 Dec;21(8):540-6. doi: 10.1097/BSD.0b013e31816d655e. PubMed PMID: 19057245.
2)
Zhou J, Espinoza Orías AA, Kang X, He J, Zhang Z, Inoue N, An HS. CT-based morphometric analysis of the occipital condyle: focus on occipital condyle screw insertion. J Neurosurg Spine. 2016 Nov;25(5):572-579. PubMed PMID: 27341056.