SNI

SURGICAL NEUROLOGY INTERNATIONAL

OPEN ACCESS

For entire Editorial Board visit : http://www.surgicalneurologyint.com

Editor: **James I. Ausman,** MD, PhD University of California, Los Angeles, CA, USA

*SNI: Skull Base*

Technical Note

# A modified transcondylar screw to accommodate anatomical skull base variations

R. F. Ghaly, A. Lissounov

Ghaly Neurosurgical Associates, Aurora, Illinois, USA

E-mail: *R. F. Ghaly - rfghaly@aol.com; A. Lissounov - L_alexei@hotmail.com
*Corresponding author

Received: 31 October 16 Accepted: 19 March 17 Published: 05 June 17

## Abstract

**Background:** Occipitocervical instability may be attributed to congenital, bony/ligamentous abnormalities, trauma, neoplasm, degenerative bone disease, and failed atlantoaxial fixation. Indications for occipitocervical fixation include the prevention of disabling pain, cranial nerve dysfunction, paralysis, or even sudden death.

**Methods:** The screw trajectory for the modified transcondylar screw (mTCS) is optimally planned utilizing a three-dimensional skull reconstructed image.

**Results:** The modified mTCS technique is helpful where there is a loss of bone, such as after prior suboccipital craniotomy and/or an inadequate occipital condyle. The new proposed technique is similar to the classical transcondylar screw placement but follows a deeper course along the bony lip of foramen magnum toward clivus from a dorsolateral approach.

**Conclusion:** The modified mTCS technique allows for direct visualization and, therefore, helps to avoid damage to the hypoglossal nerve and lateral aspect of brain stem.

**Key Words:** Clivus, occipital condyle, occipitocervical fixation, transcondylar screw

**Access this article online**

**Website:** www.surgicalneurologyint.com

**DOI:** 10.4103/sni.sni_433_16

**Quick Response Code:**

## INTRODUCTION

The modified transcondylar screw (mTCS) is helpful in cases lacking bone following suboccipital craniotomy and/or an inadequate/incompletely formed occipital condyle (OC). This technique is similar to the classical transcondylar screw placement for occipitocervical fusion but involves deeper placement of the screw utilizing the dorsolateral approach along the bony lip of the foramen toward the clivus [Figure 1]. However, this new mTCS technique requires careful perioperative three-dimensional (3D) imaging of the skull to determine the optimal clival trajectory. The addition of intraoperative imaging, intraoperative hypoglossal nerve monitoring, neuronavigation, and neural guard technology help limit morbidity.

## MATERIALS AND METHODS

Utilizing a posterior approach through the occipital condyle toward the posterior–inferior region of clivus,[3] The intraosseous screw trajectory follows the inner rim of the foramen magnum. It is performed under direct vision



**How to cite this article:** Ghaly RF, Lissounov A. A modified transcondylar screw to accommodate anatomical skull base variations. Surg Neurol Int 2017;8:98.
http://surgicalneurologyint.com/A-modified-transcondylar-screw-to-accommodate-anatomical-skull-base-variations/

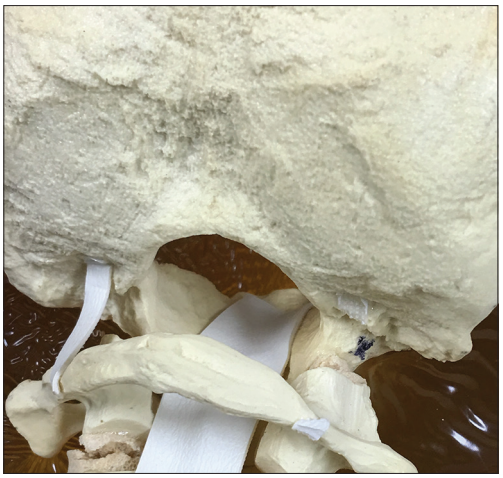

**Figure 1: Posterior–inferior view of occipital bone. Posterior–lateral approach for a modified transcondylar screw is marked with black marker in the absence of occipital condyle. Entry of the screw is similar steps as transcondylar screw under guidance of intraoperative navigation and preoperative CT scan**

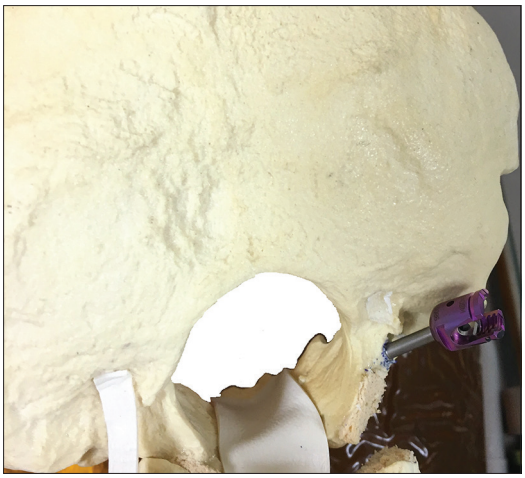

**Figure 2: Length of the transcondylar screw should be sufficient to reach a clivus**

allowing protection of the neural structure on either side of the cervicomedullary junction [Figure 2]. The optimal mTCS's points of entry and trajectory are optimized utilizing a 3D computed tomography (CT) construction of the skull base. In addition, intraoperative monitoring includes navigation neural guard technology to alert the surgeon regarding the screw's potential proximity to neural structures (e.g., hypoglossal nerve monitoring) and soft tissues.

## RESULTS

This alternative application of modified transcondylar screw (mTCS) to the occipital condyle proved to be injury-free. There were no hypoglossal nerve, jugular bulb, and carotid or vertebral artery injuries.[6] It proved valuable in cases where the surgeon had to resect generous portions of occipital condyle during a "transcondylar approach" for ventral posterior fossa tumors/aneurysms. It provided direct visualization and with continuous monitoring avoided damage to the hypoglossal nerve and/or lateral aspect of brain stem. Critical to the success of this technique was the utilization of a 3D-CT skull image to determine the appropriate screw trajectory.

## DISCUSSION

Classical techniques, such as occipital condyle screw[2,7] or occipital cervical plate,[1] are often sufficient for occipitocervical stabilization. However, these traditional fusion techniques fail due to screw "pull-out" from occiput,[4] screw fracture, and subaxial delayed instability with degenerative changes.[5] These risks are greater with osteoporosis or osteopenia and in extensively instrumented constructs.

The mTCS was helpful in cases where adequate bone volume was lacking, either following prior suboccipital craniotomy or inadequate OC. Utilizing this mTCS technique with the perioperative 3D-CT skull image for appropriate screw trajectory planning, the authors avoided hypoglossal nerve damage, inadvertent brain stem injury, and nerve tissue irritation.

### Financial support and sponsorship
Nil.

### Conflicts of interest
There are no conflicts of interest.

## REFERENCES

1. Grob D, Dvorak J, Panjabi M, Froehlich M, Hayek J. Posterior occipitocervical fusion. A preliminary report of a new technique. Spine 1991;16:17-24.
2. Hong JT, Takigawa T, Sugisaki K, Espinoza Orías AA, Inoue N, *et al*. Biomechanical and morphometric evaluation of occipital condyle for occipitocervical segmental fixation. Neurol Med Chir (Tokyo) 2011;51:701-6.
3. Ji W, Wang XY, Xu HZ, Yang XD, Chi YL, Yang JS, *et al*. The anatomic study of clival screw fixation for the craniovertebral region. Eur Spine J 2012;21:1483-91.
4. Leggon R, Lindsey RW, Doherty BJ, Alexander J, Noble P. The holding strength of cannulated screws compared with solid core screws in cortical and cancellous bone. J Orthop Trauma 1993;7:450-7.
5. Menezes AH. Occipitocervical fixation. World Neurosurg 2010;73:635-7.
6. 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;21:540-6.
7. Uribe JS, Ramos E, Youssef AS, Levine N, Turner AW, Johnson WM, *et al*. Craniocervical fixation with occipital condyle screws: Biomechanical analysis of a novel technique. Spine 2010;35:931-8.