

Application of a novel headrest system for odontoid screw fixation

Technical note

JONATHAN S. HOTT, M.D., VIVEK R. DESHMUKH, M.D., STEPHEN M. PAPADOPOULOS, M.D., AND ROBERT F. SPETZLER, M.D.

Division of Neurological Surgery, Barrow Neurological Institute, St. Joseph's Hospital and Medical Center, Phoenix, Arizona

✓The authors describe a unique headholder device adapted to facilitate the placement of anterior odontoid screws. The patient's head is affixed in the headholder equipped with an articulating arm that can be placed in a paramedian fashion. This configuration rigidly fixates the head and provides an unencumbered open-mouth view of the odontoid using radiographic images, thus making screw placement easier.

KEY WORDS • odontoid fracture • screw fixation • headholder

ANTERIOR odontoid screw fixation is an effective technique for the treatment of odontoid fractures.^{1–4} One of the key challenges in this approach is obtaining adequate biplanar and fluoroscopic views of the fracture site. Positioning and adequate visualization can be the rate-limiting steps of this procedure. Frequently, the Mayfield headholder fixation system (Codman, Inc.) is used to immobilize the patient during the procedure; however, a conventional clamp can impede direct fluoroscopic visualization of the surgical anatomy. In addition, oblique application of the headholder frequently complicates surgical positioning. We have developed a variation of the headholder device that offers an unencumbered view of the odontoid process. In contrast to existing headholders, the Spetzler Headrest System (V. Mueller, Cardinal Health) has three articulation ports (Fig. 1).

Surgical Technique

The patient is positioned supine on the operating room table, and his or her head is placed in three-point fixation using the Spetzler Headrest System. The fracture fragment is reduced under fluoroscopic guidance, and the alignment is such that the trajectory for placing the odontoid screw is optimal. At this point, the articulating arm of the headholder system is affixed to a paramedian position on the headholder (Fig. 2). Biplanar fluoroscopy is established in the standard fashion. Gauze is placed in the patient's mouth adjacent to the endotracheal tube to hold the mouth open. Consequently, the endotracheal tube is displaced laterally. The ideal fluoroscopic position is established for open-mouth (Fig. 3) and fluoroscopic views. The surgical technique for odontoid screw placement proceeds as previously described.

Illustrative Case

This 27-year-old man experienced neck pain after being involved in a motor vehicle crash. Plain x-ray films revealed that he had sustained a Type II odontoid fracture. The treatment options were discussed, and the patient chose to undergo halo immobilization therapy. Upright and supine radiography performed with the patient in external halo immobilization revealed mobility at the fracture segment, indicating that the halo immobilization had failed. At this point we decided to perform odontoid screw fixation. The integrity of the transverse ligament was confirmed by magnetic resonance imaging.

The patient underwent positioning for odontoid screw fixation as described in *Surgical Technique*. During the procedure, the Spetzler Headrest System was placed within the existing halo ring to provide three-point fixation. Standard adult pins were applied at a torque pressure of 60 lbs to the halo ring. The procedure to place the odontoid screws was uncomplicated. In the immediate postoperative period, upright and supine x-ray films obtained in the patient while in a Miami-J collar (Jerome Medical) confirmed stability of the fracture.

We have since used the novel cranial fixation device in three patients who have undergone odontoid screw fixation. During each procedure, visualization of the surgical field with an open-mouth odontoid view was excellent. All three patients underwent successful placement of the odontoid screw and experienced satisfactory outcomes.

Discussion

Optimal fluoroscopic imaging in anteroposterior and

Application of a novel headrest system

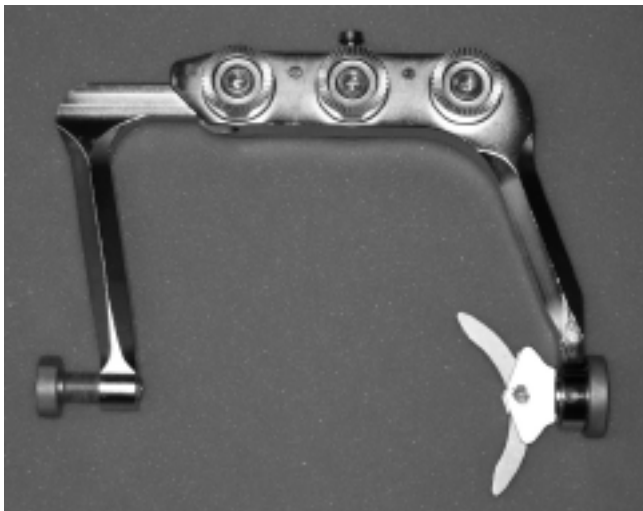


FIG. 1. Photograph showing the headholder with options for a central port and two paramedian ports for the articulating arm attachment.

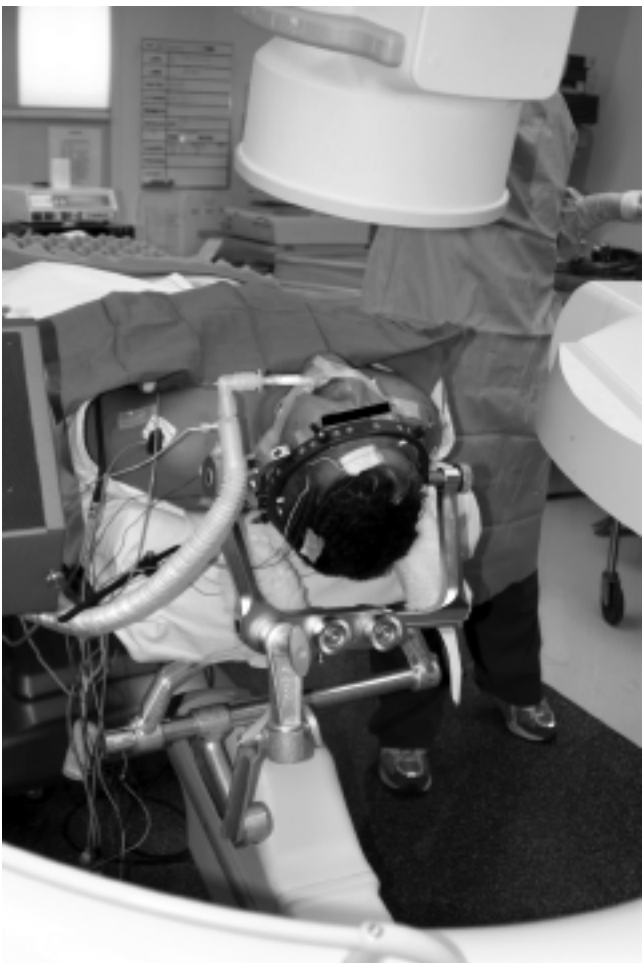


FIG. 2. Photograph of a patient in an external halo orthosis who had an unstable Type II odontoid fracture. The headholder was fixed at three points in the rungs of the halo ring. The articulating arm was affixed in a paramedian port on the headholder. In this setup, the articulating arm is outside the field of view when an open-mouth x-ray film is obtained.

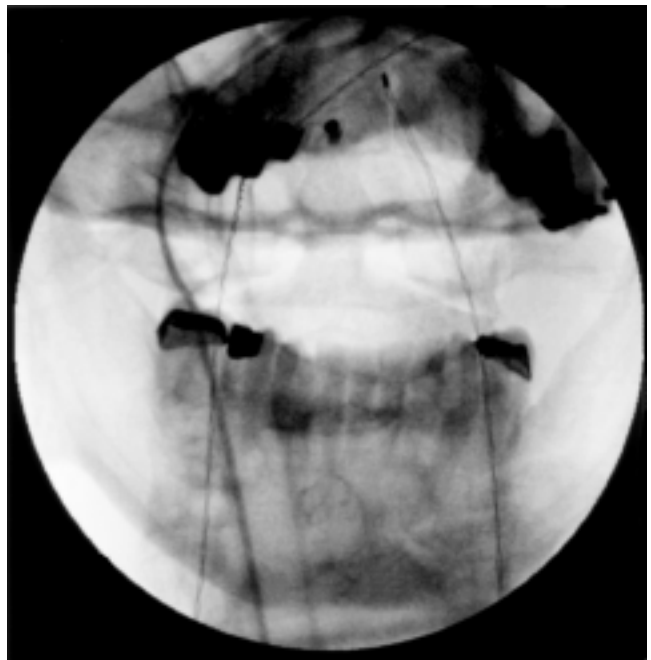


FIG. 3. Open-mouth x-ray film obtained in the patient affixed in the headholder, showing an unencumbered view of the odontoid process.

lateral views is key for the successful placement of odontoid screws. Techniques that improve visualization of the odontoid may help decrease the incidence of morbidity associated with the procedure while simultaneously improving the accuracy of screw placement. In our experience with this headholder, an unencumbered open-mouth view can be obtained by positioning the articulating arm in a paramedian fashion. This system can be used with standard Mayfield attachment devices and is readily adaptable to any operating room setup.

References

1. Apfelbaum RI, Lonser RR, Veres R, Casey A: Direct anterior screw fixation for recent and remote odontoid fractures. *J Neurosurg* **93** (2 Suppl):227–236, 2000
2. Dickman CA, Sonntag VKH, Marcotte PJ: Techniques of screw fixation of the cervical spine. *BNI Quarterly* **9**:27–39, 1992
3. Hott JS, Henn JS, Sonntag VK: A new table-fixed retractor for anterior odontoid screw fixation: technical note. *J Neurosurg* **98** (3 Suppl):294–296, 2003
4. Subach BR, Morone MA, Haid RW Jr, McLaughlin MR, Rodts GR, Comey CH: Management of acute odontoid fractures with single-screw anterior fixation. *Neurosurgery* **45**:812–820, 1999

Manuscript received July 18, 2005.

Accepted in final form September 22, 2006.

Current address for Dr. Deshmukh: George Washington Medical Faculty Associates, Washington, DC.

Address reprint requests to: Robert F. Spetzler, M.D., c/o Neuroscience Publications, Barrow Neurological Institute, 350 West Thomas Road, Phoenix, Arizona 85013. email: neuropub@chw.edu.