Efficacy of a Laser-Guided Technique for Cup Positioning in Total Hip Arthroplasty

Tetsuro Nakamura, M.D., Masanori Fujii, MD, PhD, Toshihiko Hara, MD.
Department of Orthopaedic Surgery, Kyushu Kosei Nenkin Hospital, Kitakyushu, Japan.

Disclosures:

Introduction: Acetabular component malposition negatively affects the outcome of total hip arthroplasty (THA) through increasing dislocation rates, implant impingement, bearing surface wear, and the number of revision surgeries [1]. It may be difficult even for experienced and large-volume arthroplasty surgeons to consistently achieve a correct acetabular component orientation using conventional methods. Inappropriate patient positioning has been reported to be one of the causes for malposition of the acetabular component. Here we introduce a new method using a laser-guided technique for accurate patient positioning and acetabular component placement in THA.

Methods: We reviewed 50 consecutive patients (50 hips) who underwent primary THA with a laser-guided technique (Fig. 1) for the treatment of hip osteoarthritis between December 2011 and September 2012. We set up a control group of 49 consecutive patients (52 hips) who underwent conventional THA without a laser-guided technique from August 2010 to April 2011, representing the period before the introduction of the technique. The two groups were similar in terms of age: The mean age at the time of surgery was 69.7 years (52 to 89) in the laser-guided group and 69.3 years (50 to 82) in the control group.

Surgical technique: All surgeries were performed using a posterolateral approach with cementless acetabular components and cementless stems (PerFix HA; Kyocera, Osaka, Japan). After fixing the patients to the operating table in the lateral decubitus position, X-ray evaluation of the pelvic tilt was performed. The pelvic position was corrected to reproduce the functional pelvic tilt that was determined preoperatively with reference to the laser beam (Fig. 2). The Acetabular component was inserted with reference to the laser beam (Fig. 3). Our targeted acetabular component orientation was 40° of inclination and 20° of anteversion in the laser-guided group, and 45° of inclination and 20° of anteversion in the control group.

Evaluation of cup position: Based on the postoperative AP radiographs, the inclination and anteversion of the acetabular components were measured. We determined the absolute value of the “error” as a difference in the cup inclination and anteversion angles of the acetabular component between the pre-operative target angle and the post-operative radiographic angle.

Results: The average inclination and anteversion angles of the acetabular component were 40.6±3.6° and 19.6±4.2° in the laser-guided group and 49.8±6.4° and 16.0±6.5° in the control group, respectively. The mean absolute value of the error (inclination/anteversion) was significantly reduced in the laser-guided group compared to that in the control group (p < 0.005): 3.0±2.1°/3.1±2.8° in the laser-guided group and 6.4±4.8°/6.2±4.4° in the control group (Fig. 4).

Discussion: Setting the accurate reference line is one of the most important factors for achieving proper acetabular component placement in THA. Based on the accurate reference line, surgeon could correct the pelvic position in the lateral decubitus position and could improve the accuracy of the positioning of the acetabular component. The result of study showed that the laser-guided technique provides a reliable reference during surgery and results in significant improvement of the accuracy in positioning of the acetabular component.

Significance: The laser-guided technique was proven to be useful for accurate positioning of the acetabular component in THA.

Acknowledgments: None.

Fig. 1 A laser beam device was attached to the ceiling of the operating room. The direction of the laser beam was set to match with the coordinate axis of the operating room.

Fig. 2 Correction of the pelvic position was performed with reference to the laser beam preoperatively by moving and tilting the operating table in (a) sagittal plane, (b) coronal plane and (c) transverse plane.
Fig. 3 Intraoperative acetabular component positioning was performed with reference to the laser beam.

ORS 2014 Annual Meeting
Poster No: 0903