



# Alteration and recovery of arm usage in daily activities after rotator cuff surgery



Claude Pichonnaz, PT, MSc<sup>a,b,\*</sup>, Cyntia Duc, PhD<sup>c</sup>, Brigitte M. Jolles, MD, MSc<sup>b,c</sup>,  
Kamiar Aminian, PhD<sup>c</sup>, Jean-Philippe Bassin, PT, MSc<sup>a</sup>, Alain Farron, MD<sup>b</sup>

<sup>a</sup>Haute Ecole de Santé Vaud (HESAV), School of Health Sciences, Department of Physiotherapy, HES-SO University of Applied Sciences Western Switzerland, Lausanne, Switzerland

<sup>b</sup>Department of Orthopaedic and Trauma Surgery, Centre Hospitalier Universitaire Vaudois (CHUV) and University of Lausanne, Lausanne, Switzerland

<sup>c</sup>Laboratory of Movement Analysis and Measurement (LMAM), Ecole Polytechnique Fédérale de Lausanne (EPFL), Lausanne, Switzerland

**Background:** The objective measurement of dominant/nondominant arm use proportion in daily life may provide relevant information on healthy and pathologic arm behavior. This prospective case-control study explored the potential of such measurements as indicators of upper limb functional recovery after rotator cuff surgery.

**Methods:** Data on dominant/nondominant arm usage were acquired with body-worn sensors for 7 hours. The postsurgical arm usage of 21 patients was collected at 3, 6, and 12 months after rotator cuff surgery in the sitting, walking, and standing postures and compared with a reference established with 41 healthy subjects. The results were calculated for the dominant and nondominant surgical side subgroups at all stages. The correlations with clinical scores were calculated.

**Results:** Healthy right-handed and left-handed dominant arm usage was 60.2% ( $\pm 6.3\%$ ) and 53.4% ( $\pm 6.6\%$ ), respectively. Differences in use of the dominant side were significant between the right- and left-handed subgroups for sitting ( $P = .014$ ) and standing ( $P = .009$ ) but not for walking ( $P = .328$ ). The patient group showed a significant underuse of 10.7% ( $\pm 8.9\%$ ) at 3 months after surgery ( $P < .001$ ). The patients recovered normal arm usage within 12 months, regardless of surgical side. The arm underuse measurement was weakly related to function and pain scores.

**Conclusion:** This study provided new information on arm recovery after rotator cuff surgery using an innovative measurement method. It highlighted that objective arm underuse measurement is a valuable indicator of upper limb postsurgical outcome that captures a complementary feature to clinical scores.

**Level of evidence:** Basic Science Study, Kinesiology.

© 2015 Journal of Shoulder and Elbow Surgery Board of Trustees.

**Keywords:** Shoulder; outcome treatment; kinematics; inertial sensors; daily measurements

This study was funded by the Swiss National Science Foundation (PNR 53), Grant No. 405340-104752/1-2.

Institutional Review Board/Ethical Committee approval was provided by CHUV-UNIL, Commission d'Ethique de la recherche clinique, sous-commission II: Protocole 22/04. All subjects gave written consent before enrollment in the study.

\*Reprint requests: Claude Pichonnaz, PT, MSc, Haute Ecole de Santé Vaud (HESAV), HES-SO University of Applied Sciences Western Switzerland, Physiotherapy Department, HESAV, Beaumont 21, CH-1011 Lausanne, Switzerland.

E-mail address: [claudio.pichonnaz@hesav.ch](mailto:claudio.pichonnaz@hesav.ch) (C. Pichonnaz).

Numerous publications address the psychological, behavioral, and neurologic aspects of lateralization in healthy and pathologic populations. However, measurements of handedness alteration have rarely been used as a treatment outcome method. More specifically, no study has evaluated the transfer of upper limb activities toward the uninvolved side in the field of orthopedic surgery. This study explored the relevance of postsurgical dominant/nondominant arm use proportion in daily life as a functional outcome after rotator cuff surgery.

With a prevalence of 20.7%, rotator cuff tear is a common upper arm condition in the general population.<sup>30</sup> Rotator cuff repair is a frequent surgical procedure, and 1 in every 16 visits for shoulder pain requires surgery.<sup>11,20,21</sup> Although this procedure generally results in reduced pain and functional improvement, it is not known when the patients objectively recover fully normal arm usage in daily life. At an early stage after surgery, the patients avoid movements on the affected side because of physical impairments such as pain, stiffness, and muscle weakness before partially or totally recovering. They very likely transfer some activities to the healthy side, which alters arm usage proportions compared with healthy people.

It is presently unknown how patients recover arm usage in daily life and if sequels or fear-avoidance prevents the return to normal usage in the long term. The presence of an incomplete usage recovery would imply an increased use of the contralateral side. This may interfere with dexterity and contribute to overuse pathologic changes. The long-term overuse of the healthy arm is of importance because degeneration is frequently bilateral and is related to microtrauma.<sup>25,28</sup>

Nowadays, the uncertainties about these issues can be resolved as the modifications of arm use can be easily measured with body-fixed sensors. The miniaturization and low-power consumption enable several hours of measurements in a free environment without movement hindrance.<sup>3</sup> The applicability and reliability of 3-dimensional body-fixed sensors (e.g., inertial sensors) for arm movement analysis have been demonstrated in healthy subjects.<sup>9,10</sup>

As body posture can also be analyzed with use of a sensor on the trunk, a more detailed differentiation of arm activity according to the subject's posture is possible.<sup>23</sup>

Accounting for the dominance of the affected side is crucial in investigating postsurgical alterations of arm usage with body-fixed sensors. Therefore, the uncertainty about the precise degree of asymmetry between upper limbs in daily life must first be resolved to obtain a correct evaluation of postsurgical arm usage alteration. An asymmetry in favor of the dominant side is found to range from 4% to 19% in healthy subjects.<sup>1,9,29</sup> As a consequence, the definition of more precise right-handed and left-handed norms for arm usage proportion is a prerequisite before the application of arm usage as an evaluation method for underuse studies after rotator cuff surgery. To our knowledge, only Coley et al<sup>9</sup> addressed this issue in daily life activities using accelerometers and gyroscopes. The study found that right-handed subjects used their

dominant side 18% and 25% more on average than the nondominant side in standing and sitting postures, respectively. The left-handed subjects used their dominant side only 8% and 18% more in these postures. These norms may be used as references to compare pathologic and healthy subjects and to evaluate the influence of side dominance on arm usage recovery after surgery. However, these data were established with a limited sample (23 right-handed and 8 left-handed subjects), and the sample needs to be increased to obtain more precise estimations.

The feasibility and the value of objective measurement in the subjects' natural living environment using inertial sensors have recently been highlighted for patients scheduled to undergo shoulder surgery.<sup>17</sup> As a matter of fact, objectifying the extent of underuse as a function of the involved side may improve our understanding of the impact of dominance on disability and recovery. Moreover, the definition of normal and abnormal patterns of recovery of arm usage would enable identification of surgical failure and of movement fear-avoidance, which is an important determinant of recovery in shoulder conditions.<sup>27</sup>

Thus, the primary aim of this study was to explore the relevance of arm underuse measurement as an indicator of upper limb postsurgical function. The secondary aim was to use this new metric to investigate the impact of the rotator cuff surgery on arm usage during the first year after surgery. On the basis of the typical function recovery pattern in rotator cuff repair, we hypothesized that the affected arm usage would be significantly lower in the pathologic group than in the healthy group 3 months after surgery. Furthermore, the surgical patients would present a limited deficit after 12 months.<sup>8</sup> It was also hypothesized that the decreased usage would be related to pain, feeling of stiffness, and shoulder function loss.<sup>6</sup>

## Methods

### Study population

A prospective case-control study was conducted. Forty-one healthy subjects and 21 patients surgically treated for rotator cuff tear were evaluated with body-worn inertial sensors for 7 hours of daily activities. The healthy group is the same sample used in the study of Coley et al,<sup>9</sup> which has been increased by 10 additional subjects (6 right-handed and 4 left-handed subjects) (Table I). The patients were assessed at 3, 6, and 12 months after surgery.

Hand dominance was determined according to the patient's perception of the dominant side. The healthy participants were measured for normal usage characterization and had no history of shoulder conditions. The control population was purposefully younger than the patients to avoid bias related to the high prevalence of asymptomatic rotator cuff tears in adults older than 40 years.<sup>26</sup>

Download English Version:

<https://daneshyari.com/en/article/4073464>

Download Persian Version:

<https://daneshyari.com/article/4073464>

[Daneshyari.com](https://daneshyari.com)