

## การประเมินทักษะการผ่าตัดทางการบาดเจ็บทางออร์โธปิดิกส์ของแพทย์ประจำบ้านออร์โธปิดิกส์

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กลุ่มงานออร์โธปิดิกส์ โรงพยาบาลขอนแก่น

### Formal Assessment of Orthopaedic Trauma Surgical Skills (FAOT) for Orthopaedic Residents

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**หลักการและวัตถุประสงค์:** เพื่อแสดงถึงขั้นตอนในการประเมินและผลการประเมินทักษะในการผ่าตัดทางการบาดเจ็บทางออร์โธปิดิกส์ของแพทย์ประจำบ้านออร์โธปิดิกส์ โดยการใช้ “Formal Assessment of Orthopaedic Trauma Surgical Skills (FAOT) for Orthopaedic Residents”

**วิธีการศึกษา:** นำเครื่องมือประเมิน FAOT มาใช้ในการประเมินทักษะในการผ่าตัดการบาดเจ็บทางออร์โธปิดิกส์ในแพทย์ประจำบ้านออร์โธปิดิกส์ทั้งหมด 12 ราย ในช่วงระหว่างเดือนพฤศจิกายน พ.ศ. 2558 ถึง เดือนตุลาคม พ.ศ. 2559 และทำการเปรียบเทียบผลการสอบในช่วงก่อนและหลังทำการศึกษา

**ผลการศึกษา:** แพทย์ประจำบ้านออร์โธปิดิกส์จำนวน 12 ราย (ปี 2-4 จำนวน 3, 4 และ 5 ราย ตามลำดับ) สามารถผ่านเกณฑ์การประเมินในช่วงก่อนผ่าตัดด้วยคะแนนเฉลี่ย 81.0 หัวข้อประเมินที่ได้คะแนนมากที่สุดและน้อยที่สุด คือ ข้อบ่งชี้ในการผ่าตัดและการให้ข้อมูลผู้ป่วย โดยได้คะแนนเฉลี่ย 9.2 และ 7.4 คะแนน ตามลำดับ คะแนนเฉลี่ยในช่วงผ่าตัดเท่ากับ 87.7 คะแนน ส่วนที่ได้คะแนนมากที่สุดและน้อยที่สุด คือ แบบบันทึกการผ่าตัดและขั้นตอนการผ่าตัด โดยได้คะแนนเฉลี่ย 18.7 และ 16.4 คะแนนตามลำดับ ผลคะแนนสอบเฉลี่ยหลังทำการศึกษากับ 76.1 ± 8.3 คะแนนซึ่งมากกว่าผลคะแนนสอบเฉลี่ยก่อนทำการศึกษา (75.7 ± 9.8 คะแนน) โดยมีค่าความแตกต่างของค่าเฉลี่ยเท่ากับ 0.47 คะแนน (ช่วงเชื่อมั่น 95% ระหว่าง -3.22 ถึง 2.29) แต่ไม่มีนัยสำคัญทางสถิติ ( $p = 0.717$ )

**Background and Objectives:** To demonstrate the process and evaluate the outcomes of the newly-developed “Formal Assessment of Orthopaedic Trauma Surgical Skills (FAOT) for Orthopaedic Residents” for evaluating orthopaedic trauma surgical skills during orthopaedic residency training.

**Methods:** The FAOT assessment tool was designed and applied for the evaluation of orthopaedic trauma surgical competency of orthopaedic residents at Khon Kaen Hospital, consisting of preoperative and intraoperative parts, in which 12 residents participated between November, 2015 and October, 2016. Comparisons of both pre- and post-study in-training examination scores were reported.

**Results:** Twelve orthopaedic residents; three of second-year, four of third-year, and five of fourth-year residents were enrolled. Each passed the minimal passing level of the preoperative parts with a mean score of 81.0. The highest and lowest scores were the description of indication for surgery, and the giving of patient information, with mean scores of 9.2 and 7.4 points, respectively. The mean score of the intra operative part was 87.7; and the highest and lowest scored parts were the operative notes report and the steps of operation, with mean scores of 18.7 and 16.4 points, respectively. The mean post-study in-training examination score (76.1 ± 8.3) was slightly higher than the pre-study (75.7 ± 9.8) with 0.47 mean difference (95% CI, -3.22 to 2.29) but there was no statistical significance ( $p = 0.717$ ).

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**สรุป:** เครื่องมือประเมินทักษะการผ่าตัดทางการบาดเจ็บทางออร์โธปิดิกส์สามารถนำมาใช้ประเมินศักยภาพด้านการผ่าตัดของแพทย์ประจำบ้านออร์โธปิดิกส์ได้อย่างมีประสิทธิภาพ

**Conclusion:** The FAOT assessment tool was effectively applied for the evaluation of surgical skill competency of each orthopaedic resident.

**Keywords:** orthopaedic trauma, assessment tool, surgical skill

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## Introduction

Orthopaedic trauma is generally a common clinical situation that the orthopaedist encounters in daily practice<sup>1</sup>. Orthopaedic trauma is also the main subject of international orthopaedic residency training programs throughout Thailand<sup>2,3</sup>. The competency-based surgical training is one of the highest level milestones for orthopaedic training, and successful surgical training significantly affects the post-training practice of orthopaedic trauma<sup>2,4,5</sup>.

According to the recommendations of advancing resident assessment<sup>6</sup>, there exists a set of recommended tools for assessing the operative performance necessary to achieve the required professional level of surgical training. Previously, the objective operative or procedural skill assessments were initiated and introduced in medical education, through various disciplines<sup>7-16</sup>. Accordingly, operative skill assessment has become an important component in the curriculum, and has been successfully conducted and evaluated in several orthopaedic training programs<sup>17-19</sup>. Aim of operative skill assessment is to increase potential of the surgical skill development of orthopaedic residents, which required for their daily practice in the future. The applicable and formal assessment tool able refers to the chance and quality of surgical skill development. However, a formal operative assessment is still required within the Thai Board Orthopaedic training curriculum<sup>3</sup>. Therefore, this "Formal Assessment of Orthopaedic Trauma (FAOT) surgical skills for orthopaedic residents", which is a Directly Observed Procedural Skills (DOPS) tool, was designed for the workplace-based assessment of the resident's surgical skills. The purposes of this study are to demonstrate the process and evaluate the outcomes of FAOT applied to orthopaedic trauma surgical skills

evaluation during orthopaedic residency training, at the department of Orthopaedics of Khon Kaen hospital.

## Methods

### Study design

This descriptive study demonstrated the process, and retrospectively evaluated the outcome of the FAOT assessment tool for orthopaedic trauma residency training in Khon Kaen Hospital, Khon Kaen, Thailand.

### Participants

The participants were 12 of second-to fourth-year in-training orthopaedic residents at the Department of Orthopaedics, Khon Kaen hospital, Thailand; enrolled within the Orthopaedic Trauma Unit between November, 2015 and October, 2016.

### Study procedure

The FAOT assessment tool was initially designed and created by the orthopaedic trauma team. The overall process for applying this tool is shown in Figure 1. The FAOT is divided into two components: preoperative (Fig. 2) and intraoperative (Fig. 3) evaluation for separately assessing individual residents. Patients with single injury fracture and recommended operations were selected under-supervisory conditions, and enrolled for this assessment (Table 1), corresponding with the training year of each individual resident.

The preoperative evaluation assessed the resident's core knowledge and the preoperative planning process, as outlined in the evaluation form, shown in Figure 2. A minimal passing level of eighty percent was required for residents to pass to the next intraoperative evaluation part.

**Table 1** Recommended operations corresponding with the year of resident training for each participant.

Year of Resident	Recommended Operations
2	<ul style="list-style-type: none"> <li>- Plating of tibial shaft</li> <li>- Plating of distal radius (extra-articular)</li> <li>- Plating of both bones of forearm</li> <li>- TBW or cerclage wiring of patella</li> <li>- External fixation of tibia or femur</li> <li>- Plating of femoral shaft</li> </ul>
3	<ul style="list-style-type: none"> <li>- Nailing of femur</li> <li>- Nailing of tibia</li> <li>- Plating of distal radius (intra-articular)</li> <li>- Plating of humeral shaft</li> </ul>
4	<ul style="list-style-type: none"> <li>- Cephalomedullary nailing of peritrochanteric fracture of femur</li> <li>- Hemiarthroplasty of femoral neck fracture</li> <li>- CRIF/ORIF of supracondylar fracture of distal humerus</li> <li>- Locking plating of any difficult fracture or MIPO</li> </ul>

The surgical procedure was performed by the resident under supervision of the well-oriented orthopaedic trauma staff. Surgical competences were evaluated through five main aspects via the intraoperative evaluation form, shown in Figure 3. Following the satisfactory procedural outcome, immediate consultation provided two-way feedback, in which the results of both evaluations were revealed personally to the individual resident. The in-training examination scores were collected and compared, as with the pre- and post-study materials.

#### Assessment tools

Peer scores of the preoperative and intraoperative evaluations were collected, calculated, and compared via FAOT evaluation by staff members. The staff's, as well as the resident's satisfaction, were individually reviewed through a questionnaire.

#### Statistical analysis

Descriptive statistics were used to summarize the baseline characteristics and peer scores of preoperative and intraoperative parts through frequency, percentage, mean, and standard deviation. Shapiro-Wilk was used for testing of normal distribution of pre- and post-study in-training score. In case of normal distribution data, a paired t-test was used to compare the scores of in-training examination of the pre- and post-study, and reported with 95% confidence interval (CI) and p-value of less than 0.05 was considered as the statistical significance.

#### Results

The FAOT was designed and created for the evaluation of the surgical competency of orthopaedic residents. Twelve orthopaedic residents were selected for this study. All of them were male; three were second-year, four were third-year, and five were fourth-year residents. Baseline demographic data of the participants and selected surgical procedures are given in Table 2. Preoperative evaluations were performed at an average 5.5 days prior to the date of procedures, and each resident successfully reached the minimal passing level (with a mean score of 81.0), detailed in Figure 4. The highest and lowest scored parts were the description of indication for surgery and the giving of patient information, with mean scores of 9.2 and 7.4 points, respectively. All surgical procedures were successfully conducted without complication, with a mean (intraoperative) score of 87.7, shown in Figure 5. The highest and lowest scored parts were the operative note report and the steps of operation, with a mean score of 18.7 and 16.4 points, respectively. The pre- and post-study in-training scores were normal distribution data, which tested by Shapiro-Wilk ( $p = 0.478$ ,  $p = 0.77$ , respectively). The mean post-study in-training examination score ( $76.1 \pm 8.3$ ) was higher than that of the pre-study ( $75.7 \pm 9.8$ ), with a 0.47 mean difference (95% CI, -3.22-2.29), having no statistical significance ( $p = 0.717$ ).

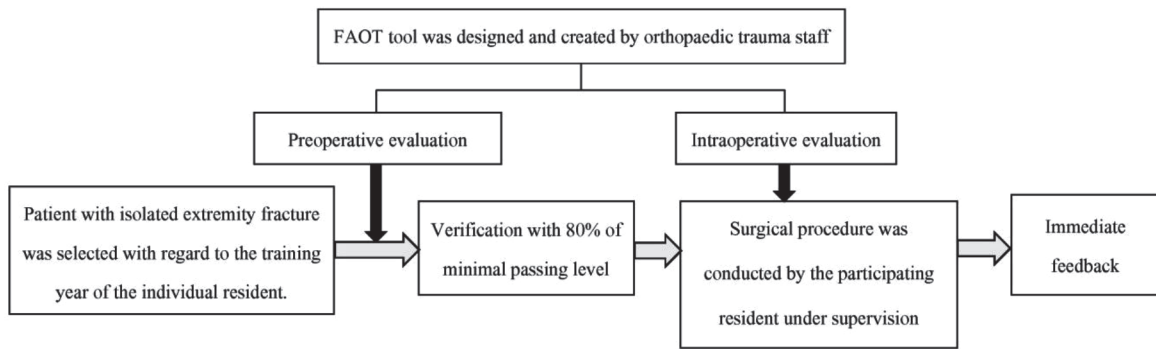


Figure 1 The FAOT assessment tool process for evaluating surgical competencies of orthopaedic residents.

**Formal Assessment of Orthopaedic Trauma Surgical Skills (FAOT)  
for Orthopaedic Residents**

**Preoperative part**

**Operation:** \_\_\_\_\_

	Part	Point (10)
1.	Patient informed, Communication	
2.	Patient assessment, Case selection	
3.	Preoperative order	
4.	Classification of the fracture	
5.	Indication for surgery	
6.	Alternative choice of treatment	
7.	Implant selection	
8.	Templating	
9.	Surgical approach selection	
10.	Procedure (step by step)	
<b>Total (100)</b>		

**Comments:** \_\_\_\_\_

Figure 2 The FAOT preoperative evaluation form for orthopaedic residents. Initial requirement to verifying the participant's core knowledge and preoperative planning skills by assessed through the FAOT preoperative checklist.

**Formal Assessment of Orthopaedic Trauma Surgical Skills (FAOT)**  
**for Orthopaedic Residents**  
**Intraoperative part**

**Operation:** \_\_\_\_\_

	Part	Point (@20)
1.	Patient positioning	
2.	Sterile technique & Patient preparation & Surgical approach	
3.	Operation (step by step) <ul style="list-style-type: none"> <li>– Soft tissue handle</li> <li>– Stop bleeding</li> <li>– Reduction technique</li> <li>– Fixation technique</li> <li>– Proper instrument using</li> <li>– Proper fluoroscope using</li> <li>– Wound closure</li> </ul>	
4.	Operative note report	
5.	Communication skills	
<b>Total (100)</b>		

Comments :

Figure 3 The FAOT intraoperative evaluation form for orthopaedic residents. Surgical competency was evaluated intraoperatively via this checklist under supervision of the orthopaedic staff, followed by immediate feedback.

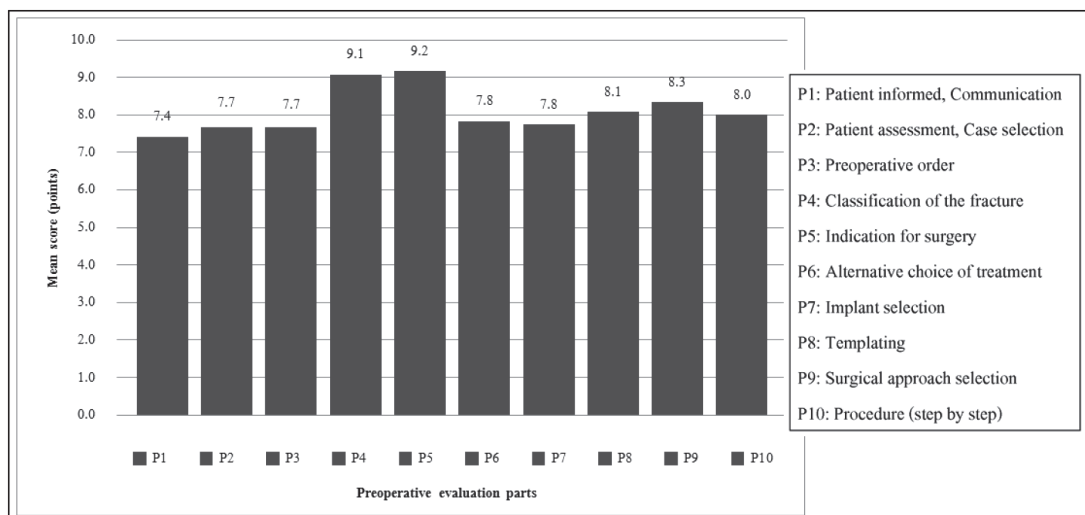


Figure 4 FAOT preoperative evaluation. Outcomes were reported separately for each part (P1-P10).

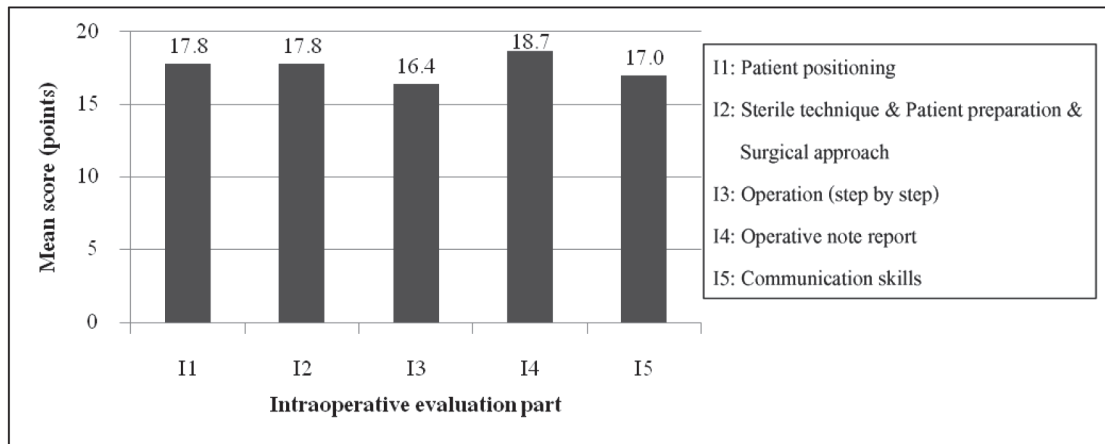


Figure 5 FAOT intraoperative evaluation. Outcomes were reported separately for each part (I1-I5).

Table 2 Baseline characteristics of the participants.

	N
Male gender	12
Year of training of residents	
- second-year	3
- third-year	4
- fourth-year	5
Selected surgical procedures	
- Plating of upper extremity fractures	2
- Plating of lower extremity fractures	4
- Nailing of upper extremity fractures	4
- Others	2

## Discussion

In the present study, the FAOT tool was successfully, systematically created and applied for the evaluation of trauma surgical competency of orthopaedic residents. All resident participants successfully passed through the preoperative evaluation and the subsequent designated surgical procedure, in which the highest and lowest scored parts were identified. The mean in-training examination score proved superior to the pre-study, but there was no statistical significance.

Generally, DOPS is an assessment tool for the evaluation of surgical competency. Several DOPS tools have been developed for the many surgical disciplines; especially in general surgery, obstetrics, gynecology,

and anesthesiology<sup>8,9,13-16,20</sup>. However, few have been created with respect to orthopaedic surgeon's resident training. The ongoing requirement of orthopaedic surgical competency, especially in Thailand, has developed through the use of FAOT. The present study attempts to support the successful application of DOPS for Thai orthopaedic resident training as an introduction to the development of a more effective assessment tool in the future. Study results indicated the strongest and weakest points of surgical competency, which represented the opportunity to improve the individual resident's skill and growth throughout the curriculum. The higher in-training examination scores, achieved through the FAOT assessment tool in this study, was not an accurate representation of the actual FAOT assessment advantage, since the in-training score represents the overall aspects of the resident's knowledge, which was not the goal of this tool, rather than the surgical competency. The small number of participants and corresponding procedures served to limit this study which depended on the routine rotation of the residents. The FAOT assessment tool was basically conducted through a single assessment tool under one assessor for all surgical procedures. Van Heest, et al., introduced the objective assessment of technical skills in three common upper extremity surgeries, which demonstrated the inadequacy of the use of a single assessment tool<sup>17</sup>. Smith, et al., evaluated

the reliability of the surgical skill assessment tools for orthopaedic surgical education in Canada, which further demonstrated the low level of agreement among assessors<sup>18</sup>. Therefore, FAOT requires the necessary quality adjustment, including procedure specific assessment, multi-assessors, and validity and reliability testing. Sample size calculation and determining of power of study are also required for the further study.

### Conclusion

FAOT was successfully introduced for orthopaedic surgical procedure assessment with excellent satisfaction, yet requires further development, especially in the areas of validity and reliability.

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