■ ANNOTATION

Assessment of performance in orthopaedic training

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The reliable measurement of performance is a problem faced by training authorities world-wide. At a recent international orthopaedic conference, none of a group of experienced orthopaedic educators could report significant progress on this issue.

The current Record of In Training Assessment (RITA) process which relies on simple assessment forms filled in by trainers and trainees is regarded widely as inadequate and lacking in objectivity. More robust evidence is needed.

The Orthopaedic Competence Assessment Project (OCAP), a combined initiative of the Education Committee of the British Orthopaedic Association and the Specialist Advisory Committee (SAC) in Trauma & Orthopaedics was given the remit to improve training through a competency-based portfolio of coaching and assessment tools. These instruments had to be easily understood by a range of trainers and trainees, not time-consuming and simple to apply.

OCAP recognises the need for a battery of tools to address the different aspects of performance. These have been described by Miller¹ who refers to different levels of assessment which are best tested in different ways (Fig. 1). In Miller's pyramid, 'knowing' and 'knowing

Fig. 1
Miller's pyramid.

how' are reliably tested in well-defined examination formats and set-piece assessments, such as clinical examinations and orals can monitor 'shows how'. However, 'does' requires real-time assessment and it is to this need that OCAP has responded.

Any assessment needs to be valid and reliable. Validity is well served by real clinical situations. Reliability, which is equally important, requires a tool which is practical, consistent and easy to repeat.

The instruments described below follow the principles of Miller¹ and Norman.² In this arti-

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Fig. 2

Diagram of the Orthopaedic Competence Assessment Project system and tools.

PROCEDURES PROFILE

Procedure	Assessment				
	1	2	3	4	5
Hip					
Slipped upper femoral epiphysis					
Slipped upper femoral epiphysis open reduction		A			G
Slipped upper femoral epiphysis pinning		A			G
THR					
THR cemented		A			G
THR hybrid	A			G	
THR surface replacement	A			G	
THR uncemented		A			G

Fig. 3

An extract from Procedures Profile showing trainee's estimate of their position at start (A) and goal (G) for end of attachment (1, know about; 2, seen; 3, managed with help; 4, managed; 5, confident to manage).

KNOWLEDGE PROFILE

Topic	Progress plan			
	1	2	3	4
Hip				
Clinical assessment				
<ul style="list-style-type: none"> A sound knowledge of clinical assessment of the hip, lumbosacral spine and knee. Particular reference should be paid to the gait, the Trendelenburg sign, limb length, loss of movement and deformity at the joint 			A	G
<ul style="list-style-type: none"> The trainee needs to be well informed of current opinion regarding aetiopathogenesis, clinical presentation and appropriate investigation of: <ul style="list-style-type: none"> Proximal femoral fractures (intracapsular, extracapsular) and simple fracture dislocations of the hip Osteoarthritis and the inflammatory arthropathies Perthes' disease Slipped upper femoral epiphysis Septic arthritis Osteonecrosis Soft-tissue conditions around the hip (snapping hip, gluteus medius tendonitis, etc) 		A		G
			A	G
		A	G	
		A	G	
		A	G	
		A	G	
		A	G	

Fig. 4

An extract from Knowledge Map showing trainee's estimate (A) of their position at start and agreed goal (G) for end of attachment (1, knows of; 2, knows basic concepts; 3, knows generally; 4, knows specifically and broadly).

cle, we describe the instruments, their validation and how reliability might be ensured.

OCAP instruments (Fig. 2)

The package consists of two types of instrument: agenda setting/coaching, and assessment.

The agenda-setting instruments of the trainer profile have been piloted and found to be acceptable in two large training programmes in the United Kingdom. The assess-

ment instruments are also complete in terms of validity, but reliability studies are ongoing. The personal effectiveness instruments which coach and test generic skills are at an early stage of development.

How OCAP works. In advance of an attachment, trainers and trainees exchange information about themselves. A trainee's portfolio is shared with the trainer who provides a personal profile for the trainee. This profile is easily formatted from a database of 'knowledge' and 'procedures' and

Table I. List of performance-based assessments

1	Clinic activity in trauma and orthopaedics
2	Debridement of a wound
3	Carpal tunnel decompression
4	Digital and palmar fasciectomy
5	Diagnostic arthroscopy and simple arthroscopic procedures
6	Total knee replacement
7	First ray surgery to the foot
8	Total hip replacement
9	Lumbar discectomy
10	Compression hip screw for intertrochanteric fracture neck of femur
11	Hemiarthroplasty intracapsular fracture neck of femur
12	Application of limb external fixator
13	Operative fixation of Weber B fracture of ankle
14	Fixation of patella fractures by tension band wiring
15	Fixation olecranon fractures by tension band wiring
16	Intramedullary nailing for femoral or tibial shaft fractures
17	Tendon repair
18	Closed management of fractures

outlines the surgical training available in an attachment. The profile describes the procedures the trainer performs regularly and the knowledge base to underpin this activity. Both parties then meet at the start of the attachment and draw up a learning agreement of which the key objectives are: to identify the trainee's level of knowledge and experience; to set realistic goals and expectations for the attachment; to agree the knowledge which should be acquired

during the attachment and to define those aspects of the trainee's performance to be assessed at the end of the attachment.

The agreement needs regular review by both parties, including a formal review at mid-attachment. However, plans may have to change according to circumstances. For example, a target may become unrealistic due to unforeseen circumstances such as ill health or prove to be overly optimistic. At the end of the attachment, the goals need to be compared with achievement. This comparison provides evidence for the summative RITA.

Figure 3 is an extract from a Procedures Profile showing a trainee's estimate (A) of their position at start of attachment and the goal for the end of the job (G).

Figure 4 is an extract from a Knowledge Map which similarly compares a trainee's estimate of their position at the start and finish of an attachment.

Performance-based assessments

A cornerstone of OCAP is the collection of performance-based assessments. These are formal, structured assessments of clinical activity (including surgical performance). They take a holistic approach, including understanding a problem, communicating, planning, operating and ensuring clear post-operative instructions.

Performance-based assessments identify and capture relevant activity, which is performed in sufficient numbers

Table II. The core content of performance-based assessments

I	Consent
C1	Demonstrates sound knowledge of (contra) indications
C2	Demonstrates sound knowledge of complications of surgery
C3	Demonstrates awareness of specific problems at surgery generated by the disease being treated
C4	Explains the peri-operative process to the patient and/or relatives and checks understanding
C5	Explains likely outcome and time to recovery and checks understanding
II	Pre-operative planning
PL1	Demonstrates recognition of anatomical and pathological abnormalities and operative strategy to deal with these
PL2	Ability to make reasoned choice of appropriate device (if any) using appropriate investigations e.g. x-rays
PL3	Checks equipment and device requirements with operating room staff
PL4	Where applicable ensures the limb is marked
III	Pre-operative preparation
PR1	Ensures proper and safe positioning of the patient on the operating table
PR2	Ensures devices e.g. diathermy and tourniquet are deployed safely
PR3	Arranges for and deploys supporting equipment e.g. imaging intensifiers effectively
PR4	Adequately prepares a sterile operating field
IV	Exposure and closure
E1	Demonstrates knowledge of optimum skin incision
E2	Demonstrates respect for soft tissues including skin
E3	Achieves an adequate exposure and identifies all structures correctly
E4	Completes a sound reconstruction
E5	Protects the wound properly with dressings and splints
V	Intra-operative technique
IT1	Follows a logical sequence or protocol for the procedure
IT2	Adheres to hospital protocols and policies
IT3	Anticipates and responds appropriately to variation
IT4+	See individual performance-based assessments for detail
VI	Closing the loop
CL1	Ensures the patient is transferred from operating table to bed
CL2	Construct a clear operation note, retaining the equipment documentation and checking x-rays where appropriate
CL3	Gives documented and sensible post-operative instructions
CL4+	See individual performance-based assessments for detail

Table III. An example of a logbook correlation

	A	STS	STU	P	T	Total exposure in years 1 to 6	Total actually performed in years 1 to 6
All elective in Deanery X	353	314	137	190	7	1001	641
All elective in Deanery X	391	223	84	247	20	965	554
1 Clinic activity in trauma and orthopaedics							
2 Debridement of a wound							
3 Hand – carpal tunnel decompression	4	6	4	40	6	60	50
4 Hand Dupuytren surgery	9	7	1	4	0	21	12
5 Knee arthroscopy with procedure	24	21	23	38	1	107	82
5 Knee arthroscopy	9	10	11	17	1	48	38
5 Shoulder and elbow – shoulder arthroscopy with procedure	10	7	1	1	0	19	9
5 Shoulder and elbow – shoulder arthroscopy	2	2	1	1	0	6	4
6 Joint replacement knee	51	39	5	12	1	108	56
7 Foot and ankle – hallux valgus surgery	13	10	1	7	1	32	18
7 Foot and ankle – lesser toe surgery	5	6	2	6	0	19	14
7 Foot and ankle – midfoot and hindfoot surgery	13	5	1	3	0	22	9
8 Joint replacement hip	62	38	4	12	1	117	54
9 Spine – discectomy	7	2	0	0	0	9	2
9 Spine – decompression	6	2	0	0	0	8	2
10 Trauma – hip fractures (intracapsular)	8	13	7	59	8	95	79
11 Trauma – hip fractures (extracapsular)	3	6	7	47	10	73	60
12 Trauma – application of external fixator	5	5	1	5	1	17	11
13 Trauma – ORIF* ankle	5	10	4	33	4	56	47
14 Trauma – ORIF patella	1	1	0	2	0	4	3
15 Trauma – ORIF olecranon	1	2	1	5	1	10	8
16 Trauma – femoral nails	6	9	3	8	1	27	20
16 Trauma – tibial nails	3	6	1	6	1	17	13
17 Hand – tendon repair	3	3	1	13	1	21	17
18 Trauma – MUA† + Kirschner wiring	3	4	8	59	8	82	71

* ORIF, open reduction and internal fixation

† MUA, manipulation under anaesthesia

A, assisted; STS, surgeon with trainer scrubbed; STU, surgeon with trainer present but unscrubbed; P, surgeon with trainer available but not in the operating room; T, teaching junior surgeon

often enough to allow reliable measurement. They allow data capture through observations of a series of similar events. This is akin to the mini clinical examination and history taking skills (CEX) and simple practical procedures such as establishing an intravenous line which are based on work by Norcini et al.³ They found that snapshots of clinical activity can be used reliably provided about 15 similar but unrelated events are assessed by properly trained observers. The Royal College of Physicians expects about 40 CEX's to be provided over the five years of Higher Medical Training (personal communication).

OCAP uses a Delphi method (consensus of an expert group) of validating performance-based assessment. We identified 18 activities which were felt by a nominated group of experts to be representative of trauma and orthopaedic surgery. These include work in the wards and clinics, and commonly performed operations (Table I). Each operation is split into domains, including consent, common to pre-operative planning, preparation and surgical technique. Each domain has further components, the majority being all the performance-based assessments and all can be related to the outcomes defined in 'Good Clinical Practice'.⁴ In each domain the trainee is required to demonstrate evidence of knowledge and skills (Table II).

In order to validate the performance-based assessment and its domains, meetings of trainers and trainees took

place in two regions of the United Kingdom. These were followed up by postal questionnaires. The overwhelming response was that the instruments are relevant, easily usable and supported the impression of the Delphi groups, confirming that the identified performance-based assessments are realistic.

More recently we correlated the current performance-based assessment with the frequency of activity reported in the National Trauma and Orthopaedic Log Book.⁵ Table III shows that in general the Delphi method of identifying commonly performed procedures is confirmed. However, there are problems ensuring that the procedures are performed often enough to permit reliable interpretation of data. For example, there was strong consensus that the application of an external fixator contains unique competencies. However, trainees seldom encounter this procedure outside a specialist attachment. As Sher et al⁶ point out, unless all training opportunities are used it would be difficult adequately to assess competence in many procedures.

The strengths of OCAP include a consolidation sheet which not only lists procedures but also maps the domains of competency (Fig. 5). This permits a training director to record experience of core procedures and identify progress in the domains. For example, a trainee may be performing well technically but be consistently identified as a poor communicator. Such observations, especially when made

[illegible]