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Evaluation of orthopaedic residents from SOCLE phase to osteosynthesis simulation: feedback from the AO course

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Introduction: **In 2019, the French College of Orthopaedic and Traumatology (CFCOT) made the AOTrauma course entitled "Basic Principles of Fracture Treatment" mandatory for all orthopaedic residents during the first year of their educational program i.e. during the SOCLE phase (common base phase). The objective of the evaluation was to determine which factors influenced the results of the practical work, according to the characteristics of the students and their experiences in laparoscopy or in arthroscopy in the operating theatre or on the simulator for arthroscopy.**

Material and methods: **In 2019 a total of 121 residents were included, corresponding to the full promotion. They filled out a preliminary questionnaire giving information on their general characteristics. Eight different workshops were evaluated. The grading of skills was as follows: "A" for "acquired", "B" for "in progress" and "C" for "not acquired". The data was collected on a computerized spreadsheet. The statistical analysis used the Welch test, the Chi2 test and the Fisher test.**

Results: **The average "A" percentage across all workshops was 87.8%. Factors predictive of a good result were experience in laparoscopy as the main operator ($p = 0.014$) and male sex ($p = 0.014$).**

We observed that the residents who had not performed arthroscopy in clinical practice had done more training on simulators than the others ($p = 0.044$). Residents who had performed at least one arthroscopy as a main operator were predominantly female ($p < 0.001$).

Discussion: **The interest of this study lies in the novelty of the analysis of the results of a whole promotion of residents in the SOCLE phase in osteosynthesis simulation.**

Conclusion: **This novel evaluation deserves to be repeated by refining the evaluation tools before and during the course. It allowed us to know the weak points of the students during the simulated learning.**

INTRODUCTION

Historically, the training of orthopaedic and trauma surgery residents was based on the following: the senior surgeon with the technical knowledge and experience teaches the younger, inexperienced surgeons[1].

However, learning skills varied depending on the place of residence and the surgical departments where the residents were based, since practices are often a matter of "schools" and teachers.

Since November 2017, the reform of the third cycle of medical studies in France and change of regulation have induced changes in the residency. The changes concern the introduction of safety rest and limitation of the working hours of residents to 48 hours per week[2,3]. This regulation has reduced the time spent in the operating room and thus the opportunities to train in contact with their elders.

In this context, the development of simulation machines appears as an indispensable solution to train all residents in a more equal and standardized manner throughout France and later maybe throughout the whole of Europe.

Numerous studies have shown the value of simulation to improve learning and technical acquisitions, in arthroscopy[4,19] and in orthopaedic and trauma surgery[20-25].

One of the wishes of the Haute Autorité de Santé (HAS) (The HAS is an independent public authority which contributes to the regulation of the healthcare system through the quality of its services) is to standardize surgical practices, with the aim of ensuring

that practitioners are efficient when they are called upon to take care of a patient as a senior surgeon.

In addition, residents have always had access to additional non-mandatory training, most often organized and financed by laboratories that supply the implanted medical devices. Since July 2019 the 24th , such funding has been prohibited for residents[2].

For many years the AOTrauma course entitled "Basic Principles of Fracture Management for Residents" has been held annually in Lyon (France). AO Trauma is a foundation dedicated to the teaching of traumatology for more than 50 years. It has been involved in teaching throughout the world through the organization of numerous basic or advanced traumatology courses. In 2019, the French College of Orthopaedics and Traumatology (CFCOT) made this course compulsory for all orthopaedic residents in the first year of their educational program i.e the SOCLE phase.

In France, a decree issued in 2016 modified the organisation of the 3rd cycle of medical studies. The 3rd cycle is now organised in three phases:

Phase 1, known as the "foundation" phase (SOCLE phase), aims to provide the student, in one year, with the culture and the basics of the specialty.

Phase 2, "deepening", lasts 2 or 3 years during which the future doctor studies all the fields of the specialty.

Phase 3, "consolidation", aims to perfect the knowledge and skills acquired by the student during the previous phases. This course aims to encourage the student's autonomy in order to gradually prepare him/her for the reality of his/her future practice.

The French College of Orthopaedics and Traumatology recommends that students in the SOCLE phase acquire the following five skills :

- mastering instrumental manipulations and drilling and screwing in bone surgery
- mastering the main approaches to the limbs
- mastering arthroscopic triangulation
- learning to handle microsurgical instruments
- mastering the preparation and removal of plaster castings.

The AO course correspond to phase 1, namely the acquisition of the basic principles of osteosynthesis.

MATERIAL AND METHOD

In March 2019, in a previously unheard-of way, all French SOCLE phase residents were evaluated and graded on their osteosynthesis on saw bones.

The objective of the evaluations was to determine which factors influenced the results of the practical work, according to the students' characteristics and their experiences in the operating theatre and on the simulator(s).

Cohort

123 orthopaedic residents were enrolled in the first year of the SOCLE phase in the discipline of orthopaedics-traumatology.

All of them participated in the AOTrauma course entitled "Basic Principles of Fracture Treatment for Residents". This course took place when they were in their first semester of residency.

Of the 123 students, 2 students with incomplete records were excluded from the analysis. So 121 students were able to be included in the analysis.

Student questionnaire (Figure 1)

The questions concerned general data on the one hand and surgical data on the other.

All the students completed a questionnaire providing general information: surname, first name, sex, the dominant hand. They had also to answer whether or not they played video games, whether or not they played a musical instrument, whether they played one or more sports, whether they did or not DIY, whether they felt they had good or bad spatial orientation, whether they liked driving manoeuvres or not.

In terms of surgery, residents were asked to answer the following questions: the number of hours spent on the arthroscopy simulator, their laparoscopic experience, the number of arthroscopies performed in the operating theatre as a main operator or as an operating assistant. The percentage of trauma activity was registered.

Organization of the course

The theoretical courses were oriented towards the basic principles of osteosynthesis. Apart from the theoretical courses, there were eight osteosynthesis simulation workshops or practical works (PW). Before each workshop, a video showed and explained the osteosynthesis technique. Then the students were asked to reproduce in pairs the same open reduction and internal fixation (ORIF) exercise on saw bones while they were evaluated. The 15 evaluators were all experienced senior surgeons experienced in teaching trauma and osteosynthesis. The competency was assessed during the following eight PW :

PW 1 "Internal fixation with plates and screws - absolute stability".

Questionnaire SOCLE phase

AOTrauma Course March 4-6, 2019

Last name First name

Email address Tel

FACULTY of registration

Date of birth: Sex: Male / Female

Dominant side: Right-handed / Left-handed / Ambidextrous

Trauma activity % volume of activity: 100% / 75% / 50% / 25% / no trauma

- Do you currently play video games? Yes / No

If yes, how often? daily - 1x/week - <1x/month - occasionally

- Do you currently play a musical instrument? Yes / No

If yes, which one?

- Do you currently play any sports? Yes / No

If yes, which one?

- Do you enjoy driving maneuvers? Yes / No

- Do you feel you have good spatial orientation? Yes / No

- Do you like DIY? Yes / No

- Which of the following skills do you feel you have: Plumbing / Painting / Electricity / Masonry / Woodworking / Gardening / Sewing / None

- Have you ever had training on a simulator? Yes / No

- If yes, which one? Arthroscopy / Laparoscopy / Traumatology / Prosthetic surgery

- If yes, how many hours? (specify if several types)

- In the operating room, have you ever participated in arthroscopies? Yes / No

As an operating assistant? 1 to 5 - 5 to 10 - >10 - >50

As a principal operator? 1 to 5 - 5 to 10 - >10 - >50

- In the operating room, have you ever participated in laparoscopies? Yes / No

As an operating assistant? 1 to 5 - 5 to 10 - >10 - >50

As a senior operator? 1 to 5 - 5 to 10 - >10 - >50

Fig. 1 — Questionnaire SOCLE phase.

PW 2 “Principles of Internal Fixation Using a Locking Screw Compression Plate”.
PW 3 “Medullary nailing of tibial shaft fractures after reaming.”
PW 4 “Surgery after planning a fracture of the forearm bones”.
PW 5 “Trochanteric Fracture Fixation with Compression Plate Screws”.
PW 6 “Olecranon fracture tension-band”
PW 7 “Osteosynthesis of malleolar fractures.”
PW 8 “External fixation of tibial fractures in different settings and ensuring their stability”.

Organization of the course

Before the course, the evaluators had been briefed on how to evaluate each workshop according to a list of objectives to be achieved.

During the course each evaluator evaluated all the workshops, but the same residents only once. The evaluation results were recorded at the end of each practical training session on a digital spreadsheet to avoid loss of information and to build a database of results.

The evaluator simultaneously graded 12 students, grouped in pairs around a round table with six stations (Figure 2). Several tasks were asked of each PW and

Fig. 2

subsequently graded. The grade for each task was either "A" for "acquired," "B" for "in progress," or "C" for "not acquired (Figure 3). For each exercise, the resident had to complete a number of objectives. He/she got a grade A when the task was completed perfectly, a grade B when the task was partially completed and a grade C when the task was not correctly completed.

Objectives were announced and outlined before each PW. There were 10 objectives per PW. Even though the workshops were done in pairs of residents, the evaluation was always individual.

Interpretation of the evaluation

The analysis compared the scores and characteristics of the residents based on their arthroscopic experiences both in simulation and (in real life) in the operating room. An "A" was considered a good grade, and a "B" or "C" was considered an inadequate grade. B and C corresponded to an incomplete achievement. Each student had a percentage of "A" on each practical work and a percentage of "A" overall.

Statistical analysis

The identities have been anonymized. The data were integrated in an Excel™ spreadsheet. The statistical analysis used the Welch test, the Chi2 test and the Fisher test. Mann Whitney test was also used for statistical analysis.

RESULTS

Individual characteristics

Among the 121 residents, there were 25 females and 96 males. 110 of them were right-handed, eight were left-handed, and three were ambidextrous. Of these, 44 played video games, 23 played a musical instrument, 80 played at least one sport, 98 enjoyed driving a car with driving manoeuvres, 105 felt they had good spatial orientation and 109 enjoyed crafts (Table I).

Training grounds

Among the 121 residents, six were in a department with 100% trauma activity, 26 with 75% trauma activity, 53 with 50% trauma activity, 34 with 25% trauma activity and two residents didn't have any trauma activity (Table II). 11 residents declared having experience in laparoscopy.

Arthroscopy residents' experiences

Seven residents of 121 had never seen arthroscopy in the operating room.

Planning surgery for forearm bone fracture

Resident's first and last name:

Instructor evaluation: A=acquired, B=in progress, C=not acquired

Planification	Note
Study of x-rays to understand bony injury, AP & lateral.	
Overlay outlines of fracture fragments on uninjured bones. Compare bones injured and uninjured side, AP & lateral. Draw in position of fracture lines (starting from stable ends)	
Overlay implant template, determine size of plate. Draw in screw placement, determine screw sequence. Trace outline of all fractured bone fragments, AP & lateral. Determine plate position	
List the surgical procedure step by step	

Simple radial fracture: compression LCP 3.5, absolute stability	Note
Bend the plate considering correct plate placement	
Insert first neutral screw applying the correct steps and sizes	
Insert second compression screw in correct hole applying the correct steps and sizes	
Insert oblique lag screw applying the correct steps and instrument sizes	
Insert cortex screws at both ends of plate applying the correct steps	

Complex ulnar fracture: LCP 3.5 as internal fixator, a technique with relative stability	Note
Fixation of plate to distal fragment using the reduction forceps	
Insert bi-cortical LHS in the end hole of the plate proximally using drill guide and drill bit. Insert screw using torque limiting screwdriver without final tightening	
Insert distal screw – fully tighten by hand until "click". Tighten proximal screw until "click"	
Insert additional two LHS close to fracture	

Fig. 3

Some 114 residents had previously been surgical assistants on arthroscopies in the operating theatre. Of these, 18 residents had done between one and five surgical assists, 32 had six to 10 surgical assists, 57 had 11 to 50 surgical assists, and seven had more than surgical 50 assists.

A total of 29 residents had been the primary operator of an arthroscopic procedure at least once (Table III).

A total of 54 residents (45%) had already trained at least once in the arthroscopic simulator, with an average of 5.56 hours of practice in this subgroup.

Evaluation

On average, the percentage of A grading in all PW was 87.8% (Table IV).

Influence of the arthroscopy simulator experiment

The overall score and the scores at each PW were not different between the residents who had already used the arthroscopy simulator and those who had never used a simulator ($p > 0.05$) (Table V).

Residents who had never seen an arthroscopy in the OR were more likely to have had simulator experience ($p = 0.044$) (Table V).

Residents who had never used the arthroscopy simulator have done more surgical assists than the others ($p < 0.01$) (Table V).

Table I. — Individual characteristics.

Female	n= 25 (21%)
Male	n= 96 (79%)
Right-handed	n= 110 (90,9%)
Left-handed	n= 8 (6,6%)
Ambidextrous	n= 3 (2,4%)
Play video games	n= 44 (36%)
Do not play video games	n= 77 (64%)
Play a musical instrument	n= 23 (19%)
Do not play a musical instrument	n= 98 (81%)
Play a sport	n= 80 (66%)
Do not play sports	n= 41 (44%)
Enjoy driving maneuvers	n= 98 (81%)
Do not like driving	n= 23 (19%)
Think they have good spatial orientation	n= 105 (87%)
Think they have poor spatial orientation	n= 16 (13%)
Like to do-it-yourself	n= 109 (90,1%)
Do not like do-it-yourself	n= 8 (9,9%)

Table II. — Average rate of traumatology activity in the resident's departments of assignment.

100% Trauma	n=6 (5%)
75% Trauma	n= 26 (21%)
50% Trauma	n=53 (44%)
25% Trauma	n=34 (28%)
0% Trauma	n=2 (2%)

Table III. — Arthroscopy residents' experiences.

Have never seen an arthroscopy in the operating room	n=7 5.8%
Operating assistance	
1 à 5 times	n=18 14.9%
6 à 10 times	n=32 26,4%
11 à 50 times	n=57 47.1%
> 50 times	n=7 5.8%
Primary operator	
Yes	n=29 24%
No	n=92 76%

Table IV. — Assessment results : ratio of 'A' grades in the practical works (PW).

Ratio of A	mean (standard deviation)	median [Q25-75]	min	max	n
PW 1	0.908 (0.189)	1.00 [0.900; 1.00]	0.0909	1.00	121
PW 2	0.889 (0.148)	0.929 [0.857; 1.00]	0.357	1.00	121
PW 3	0.826 (0.257)	1.00 [0.750; 1.00]	0	1.00	121
PW 4	0.904 (0.138)	1.00 [0.846; 1.00]	0.444	1.00	121
PW 5	0.906 (0.126)	1.00 [0.818; 1.00]	0.455	1.00	120
PW 6	0.791 (0.240)	0.875 [0.500; 1.00]	0.250	1.00	121
PW 7	0.855 (0.166)	0.900 [0.750; 1.00]	0.300	1.00	121
PW 8	0.892 (0.174)	1.00 [0.833; 1.00]	0.167	1.00	121
Total	0.878 (0.0724)	0.886 [0.857; 0.922]	0.603	0.988	121

Of the 54 residents who have already worked on the simulator, those who had never seen an arthroscopy in the OR have spent more hours in the simulator, on average 9 hours vs. 5.12 hours ($p = 0.017$) (Table VI).

The scores of each PW and the overall score did not correlate with the number of hours spent on the simulator in this subgroup ($p > 0.05$).

Gender, hand dominance, playing a musical instrument, sports, crafts, video games, enjoying driving, or feeling well-oriented in space did not have a significant influence on the practice of arthroscopy on the simulator ($p > 0.05$).

Effects of clinical experience of arthroscopic practice in the OR

Residents who had never seen arthroscopy in the OR had lower scores on PW 1 ($p = 0.025$). There was no significant difference between these two groups for the other PWs and on the overall score ($p > 0.05$) (Table VII).

The scores for each PW and the overall score were not influenced by the number of surgical assists performed in arthroscopy ($p < 0.01$). For the other PWs there was no significant performance difference between the two groups (skilled or not for arthroscopy) (Table VIII).
Female residents were more likely to have had performed at least one arthroscopy as a main operator ($p < 0.001$). These residents obtained the highest scores in PW 7 ($p = 0.014$) (Table IX).

Factors influencing the overall rating

The 11 residents who have already been main laparoscopy operators had better scores than the others ($p = 0.014$) (Table X).

The women scored lower than men ($p = 0.014$) (Table X).

Gender habits

Men liked DIY ($p = 0.017$), video games ($p < 0.01$) and driving more ($p = 0.022$), played more musical instruments ($p = 0.042$) and felt they had better spatial orientation ($p = 0.022$). In contrast, women did more arthroscopies as main operator ($p < 0.001$) (Table X).

Table V. — Influence of the arthroscopy simulator experiment.

	Have already worked with a simulator (n = 54)	Have never worked with a simulator (n = 67)	n	p	test
Ratio of A score PW 1, mean	0.900 (±0.196)	0.915 (±0.184)	121	0.66	Welch
Ratio of A score PW 2, mean	0.880 (±0.154)	0.897 (±0.143)	121	0.54	Welch
Ratio of A score PW 3, mean	0.791 (±0.287)	0.854 (±0.228)	121	0.2	Welch
Ratio of A score PW 4, mean	0.894 (±0.146)	0.912 (±0.132)	121	0.5	Welch
Ratio of A score PW 5, mean	0.904 (±0.117)	0.907 (±0.135)	121	0.89	Welch
Ratio of A score PW 6, mean	0.792 (±0.245)	0.791 (±0.237)	121	0.99	Welch
Ratio of A score PW 7, mean	0.836 (±0.158)	0.870 (±0.172)	121	0.27	Welch
Ratio of A score PW 8, mean	0.902 (±0.165)	0.883 (±0.182)	121	0.54	Welch
Ratio of A score total, mean	0.869 (±0.0733)	0.885 (±0.0714)	121	0.22	Welch
The overall 'A' score and the scores at each PW did not differ between the residents who had already used the arthroscopy simulator and those who had never used a simulator ($p > 0.05$).					

Table VI. — Influence of the arthroscopy simulator experiment.

	Have already worked with a simulator (n = 54)	Have never worked with a simulator (n = 67)	n	p	test
Have seen an arthroscopy in the OR	48 (89%)	66 (98.5%)	114	0.044	Fisher
Have never seen anarthroscopy in the OR	6 (11%)	1 (1.5%)	7	-	-
No arthroscopic operating assistance	6 (11%)	1 (1.5%)	6	<0.01	Fisher
1–5 arthroscopic operating assistance	13 (24%)	5 (7.5%)	19	-	-
6–10 arthroscopic operating assistance	16 (30%)	16 (24%)	32	-	-
11–50 arthroscopic operating assistance	17 (31%)	40 (60%)	57	-	-
> 50 arthroscopic operating assistance	2 (3.7%)	5 (7.5%)	7	-	-
Residents who had never seen an arthroscopy in the operative room (OR) were more likely to have had simulator experience ($p = 0.044$). Residents who had never used the arthroscopy simulator had done more surgical assists than the others ($p < 0.01$).					

Table VII. — Hours spent on the arthroscopy simulator.

	Mean (standard deviation)	median [Q25–75]	min	max	n	p	test
Have seen arthroscopies in the OR	5.12 (±4.96)	3.50 [1.00–6.00]	1.00	20.0	48	0.017	Mann–Whitney
Have never seen arthroscopies in the OR	9.00 (±4.98)	8.00 [5.25–10.0]	5.00	18.0	6	-	-
Of the 54 residents who had already worked on the simulator, those who had never seen an arthroscopy in the operative room (OR) had spent more hours in the simulator, on average 9 hours vs 5.12 hours ($p = 0.017$).							

Table VIII. — Effects of clinical experience of arthroscopic practice in the OR.

Ratio of A for each PW	Have seen arthroscopies in the OR (n = 114)	never seen arthroscopies in the OR (n = 7)	n	p	test
PW 1	0.920 (±0.171)	0.709 (±0.344)	121	0.025	Mann–Whitney
PW 2	0.892 (±0.142)	0.847 (±0.231)	121	0.83	Mann–Whitney
PW 3	0.833 (±0.249)	0.714 (±0.366)	121	0.6	Mann–Whitney
PW 4	0.902 (±0.139)	0.930 (±0.111)	121	0.68	Mann–Whitney
PW 5	0.902 (±0.128)	0.974 (±0.0687)	121	0.1	Mann–Whitney
PW 6	0.790 (±0.241)	0.821 (±0.238)	121	0.64	Mann–Whitney
PW 7	0.850 (±0.168)	0.929 (±0.111)	121	0.15	Mann–Whitney
PW 8	0.890 (±0.177)	0.924 (±0.136)	121	0.71	Mann–Whitney
TOTAL	0.880 (±0.0705)	0.856 (±0.103)	121	0.61	Mann–Whitney
Residents who had never seen arthroscopy in the operative room (OR) had lower scores on PW 1 ($p = 0.025$). There was no significant difference between these two groups for the other PWs or on the overall score ($p > 0.05$).					

Table IX. — Results according to gender (PW7).

	Have performed at least one previous arthroscopy as primary operator (n = 29)	Never performed arthroscopy as primary operator (n = 92)	n	p	test
Ratio of A (PW7)	0.921 (±0.0991)	0.834 (±0.178)	121	0.014	Mann–Whitney
Males	16 (55%)	80 (87%)	96	<0.001	Chi2
Females	13 (45%)	12 (13%)	25	–	–
Among the females, residents were more likely to have had performed at least one arthroscopy as a main operator with $p < 0.001$).					

Table X. — Factors influencing the overall rating.

	Ratio of A mean (standard deviation)	median [Q25–75]	Min	Max	N	P	Test
as the main laparoscopic operator	0.921 (±0.0687)	0.941 [0.897–0.969]	0.747	0.988	11	0.014	Mann–Whitney
not as the main laparoscopic operator	0.874 (±0.0717)	0.882 [0.856–0.911]	0.603	0.988	110	-	-
Male	0.889 (±0.0620)	0.891 [0.866–0.931]	0.711	0.988	96	0.014	Mann–Whitney
Female	0.839 (±0.0946)	0.869 [0.753–0.893]	0.603	0.976	25	-	-
The 11 residents who had already been main laparoscopy operators had better scores than the others ($p = 0.014$). The women scored lower than the men ($p = 0.014$).							

DISCUSSION

The originality of this work is the real-time evaluation of a whole promotion of residents during the base phase in orthopaedic and trauma surgery. This simulation of osteosynthesis had never been done on this scale before in this discipline. The teaching was supervised by representatives of the French College of Orthopaedic and Traumatological Surgery. This evaluation was possible at the cost of considerable organizational logistics and educational investment.

The results of the assessments highlighted the following points. The women had lower grades compared to the male residents. The interpretation of these results must be cautious because the residents worked in pairs. In contrast, the assessment was individual. In addition, the evaluators were predominantly male, which could be a bias in the evaluation. Walbron et al.[19] analysed, in a prospective work, the progression of the skills of the residents of the 2018 promotion on an arthroscopic simulator. In this cohort, the female residents performed less well at the beginning of their training than their male counterparts, but after several months of training, they had caught up with the skills of the male residents.

The 11 residents who had previously been senior laparoscopic surgeons scored higher than the others. These results are in contrast to those of arthroscopy, as the residents who had previously been main

Table XI. — Gender characteristics.

	Yes/ No	MALE (n = 96)	FEMALE (n = 25)	n	p	test
Enjoy DIY	Y	90 (93.8%)	19 (76%)	109	0.017	Fisher
	N	6 (6.2%)	6 (24%)	12	-	-
have already been a senior arthroscopy operator	Y	16 (17%)	13 (52%)	29	<0.001	Chi2
	N	80 (83%)	12 (48%)	92	-	-
play a musical instrument	Y	22 (23%)	1 (4%)	23	0.042	Fisher
	N	74 (77%)	24 (96%)	98	-	-
like video games	Y	42 (44%)	2 (8%)	44	<0.01	Chi2
	N	54 (56%)	23 (92%)	77	-	-
enjoy driving cars	Y	82 (85%)	16 (64%)	98	0.022	Fisher
	N	14 (15%)	9 (36%)	23	-	-
have a good orientation in space	Y	87 (90.6%)	18 (72%)	105	0.022	Fisher
	N	9 (9.4%)	7 (28%)	16	-	-
Men enjoyed DIY ($p = 0.017$), video games ($p < 0.01$) and driving more ($p = 0.022$), played more musical instruments ($p = 0.042$) and felt they had better spatial orientation ($p = 0.022$). In contrast, women had performed more arthroscopies as the main operator ($p < 0.001$).						

arthroscopy operators did not score better than the others. We have no formal explanation.

In our study, arthroscopic experience, both in the simulator and in real life in the operating theatre, had no influence on the ability to perform osteosynthesis on dry bone.

Studies have shown that simulation improves skills in both arthroscopy[4-18] and dry bone osteosynthesis[20-25]. However, to our knowledge, there is no work comparing arthroscopy to osteosynthesis.

It appears that male residents were more interested in tinkering, video games and driving manoeuvres.

We have found that the residents with the most experience on arthroscopy simulators are those with the least experience in arthroscopy in the operating theatre. Probably, these residents are in a department where there is little to no arthroscopy. They are, therefore, more likely to work on a simulator to train for arthroscopy. Residents who already see, assist and/or perform arthroscopies in the OR are probably less interested in the arthroscopy simulator since they already have the opportunity to train for arthroscopy in the OR.

Residents who have already performed arthroscopies as a primary operator in the OR are more likely to be female. The fact that the population of senior surgeons is predominantly male may be one explanation.

There are limitations to this work. First, the residents were assessed in pairs and the two residents in each pair were most often given the same grade as they performed the tasks of each PW alternatively. Second, the assessors were judging six pairs at the same time, which is quite difficult and may also be a bias. The ideal assessment with one assessor per resident was not possible for logistical reasons. This was not necessary thanks to a good evaluation grid. However, any evaluation difficulties were corrected in real time by the course director and high skilled faculties in learning process.

Finally, the excellent marks obtained may be linked to the relative leniency of the teachers in the face of this first evaluation on such a large scale and the excellent motivation of the learners.

CONCLUSION

Residency training and its organization are improving nationally. The value of training on an arthroscopy simulator and dry bone work has already been demonstrated. Residents who do not have access to the OR increase their skills with the arthroscopy simulator. Women had performed more arthroscopies as senior operators than men in this cohort. Interpretation of the scores is tricky because of several potential biases. This work, which is unprecedented in its scope (training of a full class of base phase residents in osteosynthesis simulation) must be continued in the future by improving and refining the evaluation and scoring tools. The objective is to improve the weak points identified during the evaluation of the workshops.

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