

EDUCATION

Getting back to the dissecting room: An evaluation of an innovative course in musculoskeletal anatomy for UK-based rheumatology training

Tim Blake^{1,2} | Debbi Marais^{2,3} | Andrew B. Hassell^{4,5,6} | Kay Stevenson⁶ | Zoe Paskins^{4,6}

¹Rheumatology Department, The Dudley Group NHS Foundation Trust, Russells Hall Hospital, DudleyUK

²Education and Research Team, Warwick Medical School, University of Warwick, Coventry, UK

³Social Science and Systems in Health, Warwick Medical School, University of Warwick, Coventry, UK

⁴Arthritis Research UK Primary Care Centre, Primary Care Sciences, Keele University, UK

⁵School of Medicine, Keele University, UK

⁶Haywood Hospital, Staffordshire and Stoke on Trent Partnership NHS Trust, BurslemUK

Correspondence

Tim Blake, Rheumatology Department, The Dudley Group NHS Foundation Trust, Russells Hall Hospital, Pensnett Road, Dudley DY1 2HQ, UK.
Email: timblakewarwick@gmail.com

Abstract

Background The rheumatologist relies heavily on clinical skills to diagnose diverse conditions, something that is correlated with one's knowledge of clinical anatomy. More recently, rheumatology has offered further career flexibility with opportunities to develop skills such as joint injection and musculoskeletal (MSK) ultrasound, both of which require a sound understanding of anatomy. Currently, there are no formal strategies to support competency-based anatomy learning in rheumatology in the UK. This study aimed to evaluate an innovative applied anatomy course utilizing cadaveric material, targeted at clinicians practising in rheumatology and MSK medicine.

Methods A new course was developed for rheumatologists, rheumatology trainees and allied health professionals practising rheumatology and MSK medicine, with the principal focus being on applied MSK anatomy. A questionnaire was given to course attendees and a mixed methods approach of evaluation used. Descriptive statistical data analysis was performed.

Results The course received overall positive feedback and statistically significant improvements in levels of confidence in anatomy (mean 52.35–83.53, $p < 0.0001$), injections (mean 57.65–81.18, $p < 0.0001$), examination of the upper limb (mean 60.59–76.47, $p < 0.0001$) and examination of the lower limb (mean 58.24–77.65, $p < 0.0001$). Course attendees also favoured a peer-assisted and multidisciplinary learning approach.

Conclusions This study lends support for the use of cadaveric material in the teaching of postgraduate anatomy to rheumatologists. It has demonstrated a continual need for hands-on and interactive anatomy training in an ever-advancing digital world. To be successful, cadaveric learning should not be viewed in a purely 'pre-clinical' setting, but instead integrated with postgraduate learning.

KEYWORDS

anatomy, curriculum, education, medical, musculoskeletal, postgraduate, rheumatology

1 | INTRODUCTION

Rheumatologists, like many other medical specialists, make up a diverse group of people who practice clinical medicine with principles of acute and chronic disease management at its core. They are often commended on their ability to diagnose problems at the bedside without over-reliance on elaborate tests (Kalish & Canoso, 2007). Nevertheless, there is growing evidence of deficiencies in the teaching and performance of a competent musculoskeletal (MSK) examination at multiple levels of medical education, including in rheumatology

trainees (Freedman & Bernstein, 2002; Matzkin, Smith, Freccero, & Richardson, 2005; Navarro-Zarza et al., 2014). Moreover, compared to allied surgical specialties such as orthopaedics, anatomy has been sorely neglected in postgraduate medicine, and is an area where rheumatology specialist trainees feel lacking in confidence (Blake, 2014)

It is generally accepted that good doctoring and care are reliant on informed clinical evaluation, which begins with a sound knowledge of anatomy, akin to Goethe's 'was man sieht, man weiss' (what we see, we know) (Savvas & Panush, 2015). One is reminded of Osler's early account of medicine being an 'observation' and the critical importance

of eliciting a history and performing a thorough bedside physical examination (Verghese, Brady, Kapur, & Horwitz, 2011). It is also difficult to teach students how to perform a sound physical examination of the MSK system and instruct them in the pathophysiology of MSK diseases if they lack a 'strong anatomical foundation' (Day & Ahn, 2010).

There are several other advantages of having a sound knowledge of clinical anatomy, defined as 'the application of the knowledge of human anatomy to the diagnosis and care of the patient' (Boon, Meiring, & Richards, 2002). This knowledge can lead to a more insightful understanding of the components of the MSK system, which includes joints, bursae, muscles, tendons, entheses and bones. Such an ability to appreciate these underlying structures can facilitate diagnosis and classification of disease. A good grounding in clinical anatomy is necessary to be able to recognize the signs of regional pain syndromes that make up around 30% of consultations held by rheumatologists. The ability to apply clinical anatomy also enables clinicians to better understand and interpret radiological imaging, as well as obviate the need for unnecessary requests (Kalish & Canoso, 2007).

The Joint Royal Colleges of Physicians Training Board (JRCPTB) curriculum for specialty training in the UK specifies that rheumatology trainees should be able to identify surface anatomy of the MSK system and demonstrate competence in performing common intra-articular injections (Joint Royal Colleges of Physicians Training Board, 2010). However, there are no formalized standards or criterion-referenced assessments for MSK anatomy learning in the UK. Competency in MSK anatomy is assumed rather than verified before gaining accreditation in rheumatology. On a global scale, MSK anatomy has also been identified as a relatively neglected component of postgraduate training in rheumatology (Clawson, Jackson, & Ostergaard, 2001; Freedman & Bernstein, 2002; McLachlan, Bligh, Bradley, & Searle, 2004). The reasons for this are likely to be diverse. It would seem that the major advances in our understanding of the pathogenesis of rheumatic diseases over recent decades have not been paralleled by the acquisition or maintenance of fundamental clinical skills, first and foremost anatomy (Alvarez-Nemegyei, 2012). Rheumatologists are now expected to spend more time revisiting basic clinical sciences, such as immunology, genetics, and molecular and cellular biology that will directly impact on their patients' care.

Approaches to anatomy teaching range from traditional dissection or prosection of human embalmed material to modern problem-based learning programmes that incorporate virtual-reality 3D and 4D imaging and animation, professional life models and plastic models. There are now also several online courses aimed at self-directed study in MSK anatomy (Harvard anatomy musculoskeletal cases, 2016: <https://www.edx.org/course/anatomyx-musculoskeletal-cases-harvardx-at1x>). A workshop model has proven to be successful in parts of the US and Latin America (Torralba, Villaseñor-Ovies, Evelyn, Koolae, & Kalish, 2015). This comprises an interactive programme of teaching using live models and daily examination of patients. It has been proposed that this method may be ideally used in combination with either dissection or computer simulation. A similar successful programme has used a series of hypothetical clinical vignettes as a jump-off point for the examination of live models. In these sessions, attendees gather around a model and observe a region-based clinical examination in which the surface anatomy and dynamic palpation is demonstrated, while selected anatomical drawings are projected to

correlate with the surface and internal anatomy (Alvarez-Nemegyei, 2012; Navarro-Zarza et al., 2014; Saavedra et al., 2015).

In September 2014, the West Midlands Service and Training Committee developed a pilot course targeted at regional rheumatology trainees, using cadaver specimens, with the aim of improving confidence in identifying surface anatomy and intra-articular injection technique. A state-of-the-art world-class anatomy training facility at Keele University was used: previously used for postgraduate courses in surgical specialties, but never for a postgraduate medical specialty. Evaluation of this event showed that attendees valued the collaboration of colleagues and demonstrators on performing injections in an unthreatening environment, so ensuring that practice was fair and equal among trainees, and not dependent on local opportunities and teaching. There were also demonstrable increases in confidence in identifying surface anatomy and performing intra-articular injections (Blake, Paskins, & Hassell, 2015).

Applying lessons learnt from the pilot, a national course was developed with the aim of providing learners with a more comprehensive and goal-directed educational experience on individual aspects of MSK anatomy. The primary outcomes of evaluation were overall satisfaction and confidence of attendees in identifying surface anatomy of joints. Secondary outcomes were confidence of attendees in their ability to perform intra-articular injections, and an extended clinical examination of the upper and lower limb.

2 | METHODS

A course was developed to enable clinicians to benefit from hands-on anatomy demonstration using fresh frozen prosected specimens, cadavers and interactive 3D video simulations, in a modern anatomy training laboratory. Direct teaching was facilitated by experts in anatomy and MSK examination techniques. An overview of the course programme is illustrated in Table 1.

TABLE 1 Course programme

09:30–10:00	Registration
10:00–12:00	Anatomy of the Upper Limb (with demonstration from faculty) Delegates will have the opportunity to handle embalmed cadavers and prosections of the <i>shoulder, elbow and hand</i> in a state of the art anatomy suite with demonstration by expert anatomists, focusing on areas of clinical and functional relevance. This session will be supported by an interactive digital video projection to enrich the learning.
12:00–13:00	Lunch
13:00–15:00	Anatomy of the Lower Limb (with demonstration from faculty) Delegates will have the opportunity to handle embalmed cadavers and prosections of the <i>hip, knee and ankle</i> in a state of the art anatomy suite with demonstration by expert anatomists, focusing on areas of clinical and functional relevance. This session will be supported by an interactive digital video projection to enrich the learning.
15:00–15:15	Tea Break
15:15–16:30	Applied Advanced Examination Techniques (led by Extended Scope Practitioners) This session will allow delegates to revise and practise injection and extended examination techniques to be facilitated by Extended Scope Practitioners and Consultant Physiotherapists.
16:30	Close

2.1 | Anatomy sessions

Anatomy learning was conducted in a timed carousel style fashion with candidates being allocated an equal amount of time to learn about clinically relevant components of the upper and lower limb. The programme was divided into two main sessions, each comprising three individual stations; shoulder, elbow and hand, and hip, knee and ankle. Following anatomy demonstration, attendees were able to immediately apply knowledge learnt in a workshop environment by undertaking supervised injections and clinical examination, being assisted by faculty (made up of expert anatomy demonstrators, experienced consultant physiotherapists and extended scope physiotherapists). The programme was able to provide flexibility according to the learners' needs, for example by having the ability to focus on injection sites or examinations that participants reported as difficult, such as the small joints of the hand and rotator cuff special tests.

2.2 | Questionnaire design

The main objectives were addressed by evaluation of teaching, in the form of post-course questionnaires, to identify patterns and individual responses from course attendees. Free text responses were included to increase the richness of responses and allow for unanticipated benefits (or disadvantages) of the course to be described. The questionnaire is shown in Table 2. The questionnaire was piloted by Keele faculty members, who were asked to make their selections as if they had attended the course. The face validity was evaluated by giving the questionnaire to two independent rheumatology trainees who were not attending the course. No amendments were made to the questionnaire following this process.

To assess long-term effect on outcomes, questions 6–13 were emailed to consenting subjects three months after the training event.

Attendees were asked to complete questions 6, 8 and 10 at registration on the day before any formal learning. These questions were then repeated at the end of the course. The questionnaire was generated in a paper version and inputted manually into online survey development software.

2.3 | Ethics approval and consent to participate

Following instruction on the University of Warwick protocol approval process, a BSREC (Biomedical and Scientific Research Ethics Committee) delegated supervisor review form was completed and approved: reference number REGO-2015-MED-0002.

The Anatomy Suite adhered to a professional code of conduct and licence from The Human Tissue Authority with respect to the use and disposal of human tissue that is regulated by the Human Tissue Act. A detailed facility agreement between the client (chief investigator and Faculty) and Anatomy Suite at Keele University Medical School was made. This agreement included an account of equipment considerations, such as the safe and professional decontamination and sterilization of equipment, and the use of cadaveric material. The facility agreement also incorporated an annex outlining the codes of conduct for the course organizer and attendees. This included rules on personal and protective equipment, general conduct and the use of photography. These rules were repeated at the beginning of the cadaver session on the day.

The training event was subsidized by the British Society of Rheumatology (BSR), and catering provided by Pfizer, so that individual costs could be kept to a minimum. It is important to stress that this event was designed purely for educational purposes and did not seek to make any profit. Moreover, all collaborators were free of any conflicts of interest.

This study ensured that the personal information and responses of all course attendees completing the questionnaire was anonymized, unless they gave specific instruction and consent to be contacted after the training event to undertake further course evaluation. The chief investigator explained at the beginning of the course that data were to be used for evaluation and development of subsequent courses, and that completion of the questionnaire would constitute consent. The questionnaires were to be handed out at the beginning of the session to give a more accurate representation of the pre-course confidence levels, and then completed at the end of the day. Attendees were encouraged verbally to complete the questionnaires.

Various strategies were put in place to ensure anonymity and confidentiality with respect to the feedback:

- Questionnaires were completed without the presence of faculty
- The layout of the room facilitated completion of the feedback in a private manner without any fear of colleagues being privy to their views and answers
- The results of the feedback were kept in a secure locker within the department of Musculoskeletal Medicine and Primary Care Research at Keele University
- Subsequent analysis of the results was to be undertaken by the chief investigator of this project with an interest in MSK anatomy and Medical Education.

In terms of promoting diversity and reducing discrimination and bias, there were no reports of respondents feeling restricted or disadvantaged because of learning difficulties, dyslexia or language barrier when completing the questionnaires. It was felt that the free text box could promote open, honest and non-threatening feedback, which may not have occurred in a focus group or interview setting. The reassurance that the questionnaire was anonymized may have led to improved accuracy as well as reliability, since true feelings and opinions that may not necessarily be in alignment with the norm or the current state of affairs can be expressed and represented due to perceptions of a 'safer environment'.

2.4 | Data and statistical analysis

Data collection and interpretation were performed manually, and then further descriptive data analysis was performed using Microsoft Excel v16.0 and IBM SPSS Statistics for Windows, v22.0 (IBM Corp., Armonk, NY, USA). Means were calculated from the numeric percentage rating scales. A paired *t*-test was used to compare before and after scores for measured levels of confidence in identifying surface anatomy, performing intra-articular injections, and undertaking an extended clinical examination of the upper and lower limb. *P*-values of ≤ 0.05 were considered to indicate statistical significance. Thematic analysis was performed on all free text responses by the lead author to generate themes and a focus for future curriculum development.

TABLE 2 Questions included in the feedback questionnaire

1. Which of the following best describes your current occupation or level of training?
 - Specialist rheumatology trainee
 - Specialist orthopaedic trainee
 - Locum Appointed for Service/Locum Appointed for Training
 - Consultant Rheumatologist
 - Allied Health Professional: please state...
 - Other: please state...
2. Did you find the use of cadaver specimens to be a useful way to learn about anatomy of joints and the musculoskeletal system? (please circle)
 - Very useful
 - Useful
 - Indifferent
 - Not useful
 - Not at all useful
3. Did you find the use of cadaver specimens to be a useful way to learn about intra-articular injection techniques? (please circle)
 - Very useful
 - Useful
 - Indifferent
 - Not useful
 - Not at all useful
4. Prior to this training day, how had you received any joint injection training? (please tick all that apply)
 - Self-directed learning
 - Plastic/rubber models
 - Multi-media computer-assisted learning
 - Direct observation of colleagues/seniors
 - Practising on patients
 - Practising on healthy volunteers
 - Taught course/seminar
 - Other: please specify...
5. How did the cadaver style learning compare to any previous experiences of anatomy or joint injection training, with respect to the following? (please select from: significantly better, better, indifferent, worse, considerably worse)
 - Personal engagement
 - Social interaction
 - Technical skills
 - Demonstration
 - Efficiency of learning (learning material covered in the allotted time)
 - Enjoyment
6. Please indicate your degree of confidence in identifying surface anatomy of joints PRIOR to the training day on a scale (please select)
 - 0-10-20-30-40-50-60-70-80-90-100%
7. Please indicate your degree of confidence in identifying surface anatomy of joints FOLLOWING the training day on a scale (please select)
 - 0-10-20-30-40-50-60-70-80-90-100%
8. Please indicate your degree of confidence in performing intra-articular injections PRIOR to the training day on a scale (please select)
 - 0-10-20-30-40-50-60-70-80-90-100%
9. Please indicate your degree of confidence in performing intra-articular injections FOLLOWING the training day on a scale (please select)
 - 0-10-20-30-40-50-60-70-80-90-100%
10. Please indicate your degree of confidence in performing an extended examination of the upper limb PRIOR to the training day on a scale (please select)
 - 0-10-20-30-40-50-60-70-80-90-100%
11. Please indicate your degree of confidence in performing an extended examination of the upper limb FOLLOWING the training day on a scale (please select)
 - 0-10-20-30-40-50-60-70-80-90-100%
12. Please indicate your degree of confidence in performing an extended examination of the lower limb PRIOR to the training day on a scale (please select)
 - 0-10-20-30-40-50-60-70-80-90-100%
13. Please indicate your degree of confidence in performing an extended examination of the lower limb FOLLOWING the training day on a scale (please select)
 - 0-10-20-30-40-50-60-70-80-90-100%
14. Overall, did you find the session to be a worthwhile and an effective use of your time with respect to learning about musculoskeletal anatomy and injection techniques?
 - Yes
 - No
15. Cadaveric anatomy/prosection should become a regular part of training (at least every 2 years) for clinicians practising and studying rheumatology and musculoskeletal medicine? (please circle)
 - Strongly agree
 - Agree
 - Neither agree nor disagree
 - Disagree
 - Strongly disagree
16. Any other comments or suggestions to make on this topic? (free text)

3 | RESULTS

3.1 | Summary of results from questionnaires

There were 17 attendees on the course, all of whom completed the first part of the survey. Figure 1 displays demographic data for the levels of occupation or training of the respondents. There were two (11.8%) attendees who identified themselves as 'Other' (one General Practitioner with a specialist interest in rheumatology and one Foundation Year 1 Doctor). Six of the respondents (35.29%) gave consent and took part in the follow-on questionnaire.

3.2 | Overall perceptions

All respondents (100%) stated that they found the session to be worthwhile and an effective use of their time with respect to learning about MSK anatomy and injection techniques. Moreover, 14 (82.4%) subjects selected 'strongly agree' to question 15 ('cadaveric anatomy/prosection should become a regular part of training for clinicians practising and studying MSK medicine'). The remaining three (17.65%) chose 'agree' for this question.

3.3 | Prior experiences of joint injection training

Figure 2 reveals how respondents had received any prior joint injection training, with the majority (15, 88.24%) stating that they had learnt by direct observation of their colleagues/peers. No respondents felt the training course rated less favourably than previously experienced injection training (Figure 3). Thirteen (76%) respondents favoured a cadaveric learning style with respect to technical skills, demonstration and efficiency of learning (learning material covered in the specified time). Fifteen (88.24%) recorded that cadaver specimens provided a 'very useful' way to learn about the anatomy of joints and the MSK system, whereas two (11.76%) felt it was 'useful'. Seventeen (100%)

found that cadaver specimens were a useful way to learn about intra-articular injection techniques.

Table 3 demonstrates direct comparison data of confidence ratings given before and after the teaching event, and the statistical analysis that followed.

3.4 | Follow-on study

When reviewing the comparison data at the three-month mark, as compared to the original data, the mean ratings were recorded as 85.0 (vs 83.53), 85.0 (vs 83.53), 75.0 (vs 76.47) and 76.67 (vs 77.65), with respect to identifying surface anatomy, performing injections and clinical examination of the upper and lower limbs, respectively.

3.5 | Summary of qualitative data

Twelve of the respondents completed the free text section of the questionnaire. In general, the free comments gave positive and encouraging feedback in relation to the content and delivery of the anatomy course. There were three key themes to emerge from analysis of the qualitative data, described below.

Participants discussed the perceived benefit of having human material to practise intra-articular injections on and having skeletons/models alongside the embalmed specimens:

'This was an excellent training event... and much better than using rubber models. It was really helpful to have human specimens to practise certain injections on (temporomandibular joint).'

'Using frozen specimens to practise and learn joint injection techniques was immensely useful.'

'Useful to have the skeletons/models alongside the specimens.'

Learners reported that they enjoyed the social aspect of the course with the opportunity to learn not only from faculty but also other delegates who may have come from a different clinical environment, level of training, knowledge or skill to theirs. They particularly

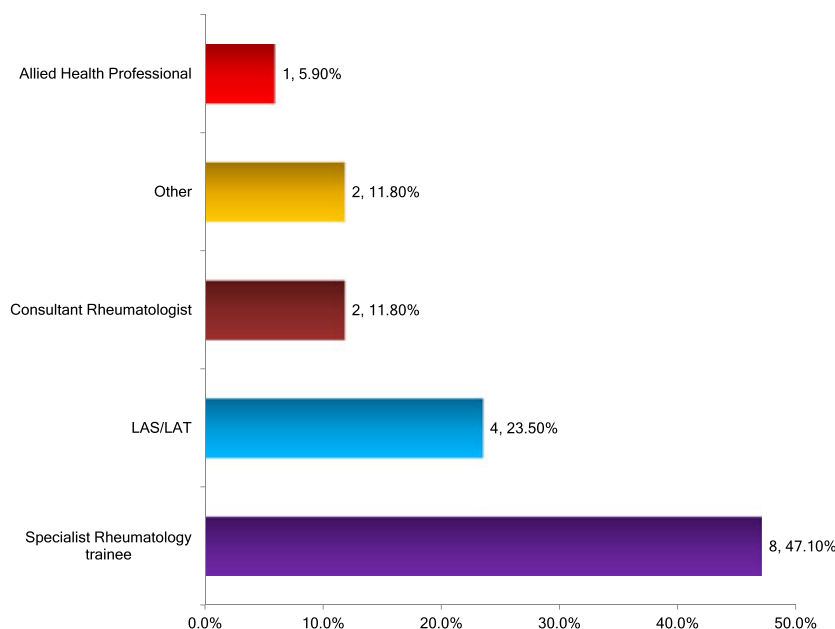


FIGURE 1 Level of occupation/training. [Colour figure can be viewed at wileyonlinelibrary.com]

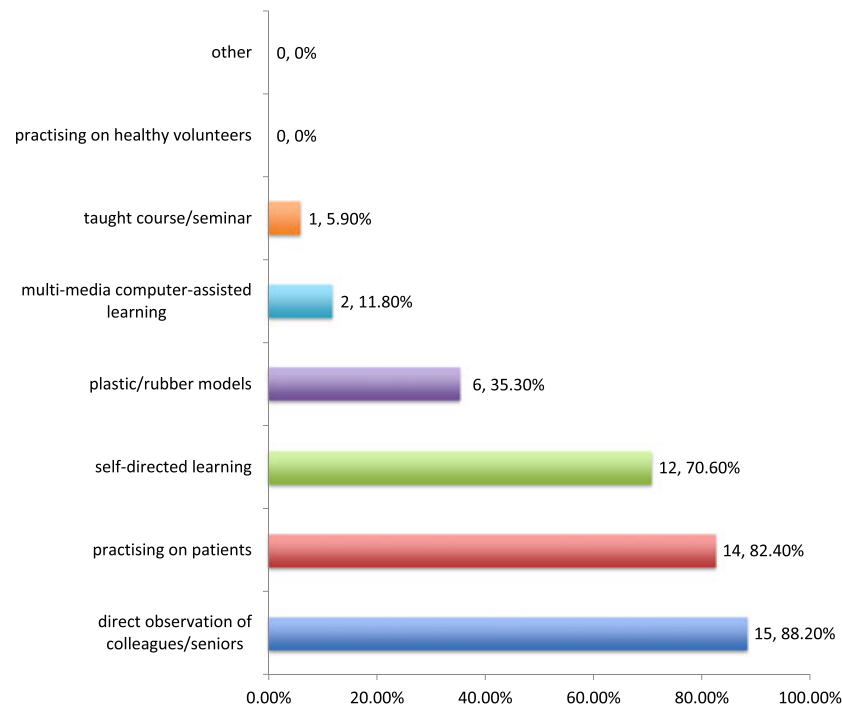


FIGURE 2 Former modes of joint injection training (multiple selections allowed). [Colour figure can be viewed at wileyonlinelibrary.com]

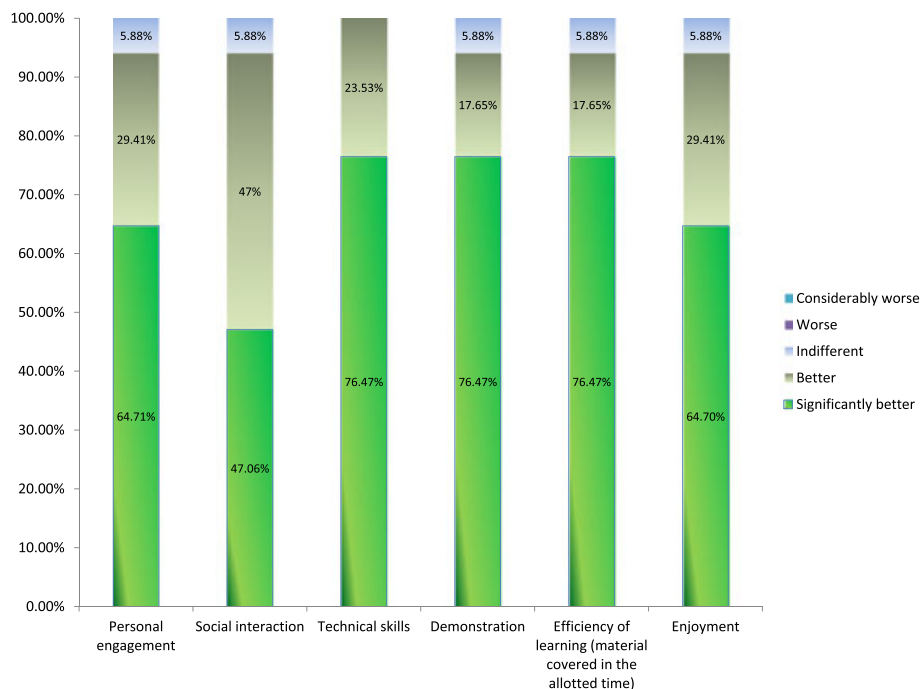


FIGURE 3 How the cadaveric style learning event compared to any previous experiences of joint injection training. [Colour figure can be viewed at wileyonlinelibrary.com]

valued the opportunity for enhancement of cadaver-based learning from expert anatomists and physiotherapist colleagues:

'Learning from faculty and delegates was really useful. I realised I could have been doing it better for years!'

Delegates reported excellent facilities and provision of learning material for injections but suggested that somehow models could be injected with coloured material or examined post-injection with ultrasound to confirm accuracy of injection technique. In terms of content, there was a call to make the first anatomy briefing more

clinically applicable so that learners were not lost in the depth of detail.

4 | DISCUSSION

This study aimed to tackle the current deficiency in postgraduate learning of anatomy in the field of rheumatology, and report on an evaluation of a purpose-made cadaveric style anatomy course for rheumatologists in the UK.

TABLE 3 Confidence levels

Group	Confidence in anatomy ^a		Confidence in injections ^b		Confidence in examination of upper limb ^c		Confidence in examination of lower limb ^d	
	Before	After	Before	After	Before	After	Before	After
Mean	52.35	83.53	57.65	81.18	60.59	76.47	58.24	77.65
SD	18.55	12.22	21.66	14.53	13.91	11.15	13.80	11.47
SEM	4.50	2.96	5.25	3.52	3.37	2.70	3.35	2.78
N	17	17	17	17	17	17	17	17

^a**Confidence in anatomy.** *P*-value and statistical significance using a paired *t*-test: <0.0001. The mean of Before and After group: 31.18 (95% confidence interval of this difference: from -37.44 to -24.91). Intermediate values used in calculations: *t* = 10.5474, d.f. = 16, standard error of difference = 2.956.

^b**Confidence in injections.** *P*-value and statistical significance using a paired *t*-test: <0.0001. The mean of Before and After group: 23.53 (95% confidence interval of this difference: from -30.79 to -16.27). Intermediate values used in calculations: *t* = 6.8726, d.f. = 16, standard error of difference = 3.424.

^c**Confidence in examination of upper limb.** *P*-value and statistical significance using a paired *t*-test: <0.0001. The mean of Before and After group: 15.88 (95% confidence interval of this difference: from -18.49 to -13.27). Intermediate values used in calculations: *t* = 12.9085, d.f. = 16, standard error of difference = 1.230.

^d**Confidence in examination of lower limb.** *P*-value and statistical significance using a paired *t*-test: <0.0001. The mean of Before and After group: 19.41 (95% confidence interval of this difference: from -23.66 to -15.16). Intermediate values used in calculations: *t* = 9.6787, d.f. = 16, standard error of difference = 2.006.

As expected, the majority of course attendees were trainees in the field of rheumatology and MSK medicine. Of note, respondents selected more traditional methods of learning when considering their previous experiences with joint injection training, namely direct observation of others and practising on real patients. This is likely to reflect familiarity with conventional and possibly more tried and trusted techniques, but also the accessibility and cost-effectiveness of utilizing observation and live patients. Only two participants reported using computer-based learning, which is perhaps surprising given the rise in available online materials.

In terms of overall experience of the course, 100% of attendees stated that they found the educational event to be worthwhile and an effective use of their time with respect to learning about MSK anatomy, examination and injection techniques. The confidence levels of course attendees revealed statistically significant improvements in terms of anatomy learning, injections, and examination of the upper and lower limb. These confidences persisted at the three-month follow-up mark, indicating that the benefits were retained in the 29.4% who participated in the follow-on study.

Learners showed a preference for MSK anatomy to be taught in an interactive manner, something that would appear to have been previously neglected from their training. Secondly, attendees found the group and peer learning to be a particularly rewarding and exciting educational experience that enriched their knowledge and application of MSK anatomy. This corroborates the findings of a major systematic review of teaching strategies and methods in MSK education (O'Dunn-Orto, Hartling, Campbell, & Oswald, 2012), in which five of six studies favoured interactive small group learning, two of four studies favoured computer-assisted learning and two of two studies favoured peer learning. Clinicians specializing in rheumatology also reported a positive experience in receiving training from allied health professionals, namely Extended Scope Practitioners and consultant physiotherapists. This reminds one of the importance of multidisciplinary training in promoting transfer of knowledge and skills, especially when clinicians are expected to veer 'out of their comfort zones'.

Survey respondents made a call for cadaveric/prosection training to become a regular part of the rheumatology programme, to reflect the national curriculum requirements. Cadaveric anatomy could be

taught alongside clinical anatomy, examination, injection and ultrasound as part of the existing rheumatology training programmes. This would also ensure that trainees had the necessary knowledge and skills to fulfil curriculum competencies, and lead to accreditation in their portfolios.

Despite the widespread availability of online learning programmes that can support anatomy teaching, these findings demonstrate a continuing need for face-to-face and hands-on anatomy training. The specialty of rheumatology has perhaps tended to be more of a clinical one with less reliance on modern technologies. This contrasts with other specialties such as orthopaedics where use of multi-media and computer-assisted learning has become fairly standard in educational practice (Blake, 2014). It would seem refreshing that in this era of advanced technologies, including computerized digital images, hands-on techniques such as dissection still have a strong relevance.

4.1 | Strengths

The innovative and interactive anatomy course proved to be successful with overall satisfaction and improvement in confidence scores among attendees. This is the first time that this course had been run in this capacity in the UK. It would appear that this is a well-received way of teaching about MSK anatomy in postgraduate medicine. Nowadays, with financial and time constraints, cutbacks in study leave budgets, support for self-directed learning and so much emphasis on return for investment of NHS funds, this type of course could become a cost-effective and low-maintenance means to teaching sophisticated concepts and techniques in anatomy. Future initiatives should aim to further develop and enhance the content and delivery of the training programme, and build on feedback from course delegates, particularly the suggestions to make the anatomy learning more goal-directed and clinically relevant, and possibly the introduction of ultrasound to complement the cadaveric materials. Clearly, such developments should involve the introduction of standards for MSK anatomy competency through knowledge and skills testing using criterion-referenced methods.

4.2 | Limitations

The survey represented a snapshot of a single educational event with a relatively small number of attendees. This may be due to several

reasons, such as the current restriction and disparity in study leave allocation for trainees, the lack of awareness of the fundamental importance of MSK anatomy and the absence of any accreditation. To draw more extensive conclusions about the course, it would be important to refine the programme and tailor it to a wider community that may include more allied health professionals, general practitioners and consultants. It is also important to reiterate that confidence of trainees does not always reflect competence and performance; therefore a set of standards and an assessment tool for future courses should be created to add to its validity. This could take the form of a simple pre- and post-course multiple-choice question examination, a practical examination or, in the case of 'criterion sampling', a set of behaviours that must be observed to perform as a rheumatologist in an effective manner.

One could surmise that training in MSK anatomy is likely to benefit one's continuing professional development when assessing patients presenting with MSK problems but, thus far, there are little data to prove the value in contemporary training and practice, particularly with regards to demonstrating improved clinician performance, satisfaction, or even safer and less costly care. These challenges should ideally be addressed to determine the relevance and implications of studying MSK anatomy in rheumatology training in the 21st century.

5 | CONCLUSIONS

In the UK, MSK anatomy is a relatively neglected component of postgraduate learning in rheumatology training and practice. There is currently a lack of uniformity in the way that MSK anatomy is taught and applied in postgraduate medicine, which differs from surgical specialties, and can only add to confusion and frustration of trainees.

As a result, this novel national MSK anatomy course has demonstrated positive outcomes in learner satisfaction and confidence, with respect to knowledge of surface anatomy, performance of intra-articular injections and extended clinical examination. It has restored the continuing need for face-to-face and hands-on anatomy teaching in a world of advanced technologies.

In the future, it is hoped that newer evidence-based strategies for teaching in this area will become embedded in curricula and foster local programmes of learning. To demonstrate overall effectiveness of learning, these initiatives should also be seen to improve patient outcomes and return for investment, and therefore further aspects of evaluation and assessment should be pursued.

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