Objectives: Simulation is the new foundation for surgical training in the UK and will have a role in training, selection and assessment of surgeons. Procedural training exposure in patients will require successful completion of core competencies in the simulated environment. Simulation training will assess core knowledge, decision making, communication and technical skills. There are many proposed methods for surgical simulation including cadaveric models, virtual reality environments, computer modelling, decision tree analysis and cognitive simulation.

Cognitive simulation provides a readily accessible and low cost alternative to traditional methods of procedural skill acquisition that can supplement traditional experiential learning. The technique may combine knowledge assessment, visualisation, mental rehearsal, multisensory feedback, kinaesthetics, problem solving and decision analysis, supporting the development of psychomotor and decision making skills. The technique requires mentor-assessor contextualisation and facilitation with exploration of knowledge around a core narrative defined through expert and peer consensus. There is no requirement for complex equipment or cadaveric tissue and the technique translates well into the traditional mentoring environment and enhances the experience of procedural-based assessments (PBAs) currently in use within the surgical specialties in the UK.

OrthOracle is an on-line training resource that provides a structured learning platform for complex surgical procedures in orthopaedics and trauma surgery. The platform allows greater procedural detail than in traditional print textbooks and the segmentation of the narrative allows a trainee to dictate their own rate of learning. Knowledge is assessed through CPD multiple choice questions. Future developments of OrthOracle will provide for wider knowledge acquisition through interactive guided learning and enhanced assessments using decision-tree analysis and expert panel defined core datasets for structuring cognitive simulation. The aim of this study is to explore the use of OrthOracle as a model for wider development of cognitive simulation training in hand surgery.

Methods: A series of complex surgical procedures were deconstructed to key component steps and a value assigned to each representing its importance. Carpal tunnel surgery was selected for validation in the hand surgery sub-group by OrthOracle editors as a common and typical benchmarking procedure for trainee evaluation. Consensus on the grading scale was reached by a committee of fellowship trained hand surgeons, all actively involved in Plastic Surgery and Orthopaedic Surgery trainee assessments through the UK Intercollegiate Surgical Curriculum Programme (ISCP) and also in the training and assessment of higher trainees in hand surgery through the UK Hand Diploma Programme. Trainees in hand, orthopaedic and plastic surgery were also consulted in development of the final assessment tool. The cognitive simulation assessment tool was piloted with a group of 5 trainees from CT2, ST3, ST4, ST5 and post-CCST Fellow grades. Trainees were recruited to undergo cognitive simulation training and assessment using standardised techniques. Baseline information regarding previous training and operative experience was recorded prior to simulation and trainees were asked to score themselves in key areas based on their experience. 50% were provided with free access to the OrthOracle training platform as a prelude to assessment. All cognitive simulation assessments were undertaken by consultant hand surgeons and scores assigned using the approved grading scale.

Results: A cognitive simulation tool (CoST) was developed for carpal tunnel surgery through expert and trainee consensus. The tool was piloted with trainees at different stages of their surgical training. A group of trainees were provided with access to the OrthOracle platform as a prelude to cognitive simulation assessment for carpal tunnel decompression and a control group underwent assessment using standard techniques including mental rehearsal. Trainees performed better in the cognitive simulation tasks when they had higher levels of experiential learning. Trainees with OrthOracle priming performed better than their counterparts. Trainee feedback on the experience was positive compared to prior training and assessment experience.

Conclusion: Service pressures, shortened training hours and greater numbers of trainees have limited the effectiveness of the traditional cognitive apprenticeship model of surgical training where a trainer would scaffold the trainee allowing progressive autonomy and skill acquisition in a controlled and supervised environment. Each procedure is layered into defined steps that can be mastered independently. Learning is structured into three discreet phases although trainees may advance to higher levels of competence in different parts of a given procedure at rates determined by their experience and progress. The scaffolding of training in this way allows both the trainer and trainee to see progress and to focus training into areas beneficial to overall development.

A cognitive simulation approach is relatively inexpensive and can be introduced with little methodological training. The framework is developed from existing procedural assessments and will be familiar to trainers and trainees. Alternative training methods include cadaveric training, computer simulations and virtual reality but are limited by cost and availability. Cognitive simulation is a cheap and effective alternative training tool. The high quality images and supplementary procedural training material on the OrthOracle platform can be developed for the purpose of cognitive simulation in hand and orthopaedic surgery.

The Carpal Tunnel Cognitive Simulation Tool (CoST) is an intuitive, simple, structured guide for cognitive simulation delivery and assessment that has proven beneficial in a pilot study. It is acceptable to trainers, assessors and trainees. Used in conjunction with the digital learning OrthOracle platform it can enhance the trainee experience and allow the trainer to scaffold the development of surgical expertise, rapidly highlighting areas for development to both trainer and trainee. Further validation demonstrating improvement in task performance will require a large scale prospective study.