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Title

Randomized prospective study comparing the effectiveness of spaced learning to mass learning in microsurgical procedures.

Purpose

Spacing phenomenon occurs when learning outcomes are greater with the teaching process spread out over time (spaced learning), as opposed to having the same total duration of teaching carried out over a single session (mass learning). Spaced learning has been shown to improve explicit memory tasks including free recall, recognition, cued –recall and frequency estimation. It has been used in various medical specialties with promising results and has been shown to be at least as good as mass training in learning clinical skills such as cardio-pulmonary resuscitation and laparoscopy skills.

We aim to test the concept of spaced learning in learning delicate and complex skilled procedures like microsurgery. Our hypothesis is that spaced learning is better than mass learning in acquiring microsurgical suturing skills.

Methods

Medical students with no prior exposure to microsurgical training were randomized into control (mass-learning) and treatment (spaced learning) groups. The students were all taught to handle microsurgical instruments and to suture a prefabricated 4mm wide elastic strip under the microscope using Digital Surgicals MicroTrainer. The control group was taught continuously over 8hrs while the treatment group was taught in 2-hour sessions held each week over a span of 4 weeks. The learning outcomes that were measured included duration taken as well as the placement of the sutures in relation to each other, with the latter being objectively assessed with the use of a computer program from Digital Surgicals. In addition to being assessed at the beginning of the sessions, all participants completed another test 1 month after the completion of the sessions.

Results

42 medical students (mean age= 22.5 years old) participated in the study, with 24 (n=57.1%) being randomized to the mass-learning group and 18 (n= 42.9%) in the spaced group. 3 students in the spaced group were later excluded from the study as they were unable to complete all 4 sessions. Both groups had comparable baseline suturing skills and improved after microsurgical training, although the groups differed in ways of improvement. The mass-learning group took a shorter duration (54.63min vs 45.71min, $p=0.025$) while the spaced learning group improved on total score (25.13 vs 31.60, $p=0.008$), which took into account spacing and deviation of knots. Satisfaction with the teaching sessions in both groups was statistically similar (8.00 vs 8.47, $p=0.229$).

Conclusion

Microsurgical courses are currently conducted in a mass learning method where participants undergo up to 5 days of continuous training. As practicing clinicians with hectic work schedules, it is often logistically challenging to arrange for prolonged leave to attend such courses. Spaced learning offers a flexible alternative of learning that allows the weaving of learning sessions into the busy schedule of daily work. The results of the study can help pave the way to efficient restructuring of training programs without compromising on learning outcomes. However, it is imperative to take into account the higher likelihood of reduced attendance rate with an increased number of sessions, as reflected by the higher dropout rate for the spaced learning group in this study.