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CHAPTER 14 | ADDENDUM

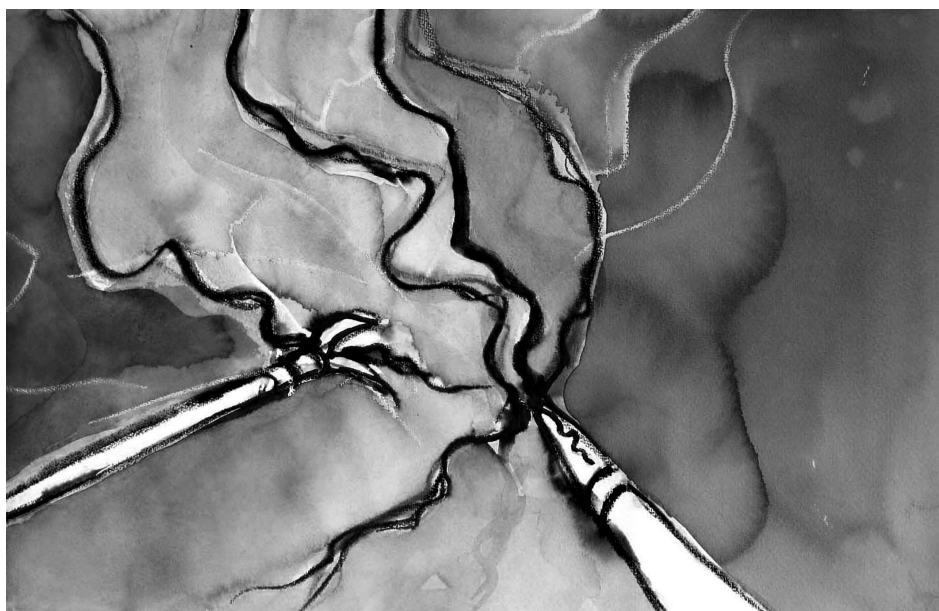
LITERATURE

AUTHOR AFFILIATIONS

ABOUT THE AUTHOR

PUBLICATIONS

DANKWOORD



LITERATURE

- Aggarwal, R., Grantcharov, T., Moorthy, K., Milland, T., & Darzi, A. (2008). Toward feasible, valid, and reliable video-based assessments of technical surgical skills in the operating room. *Ann.Surg.*, 247, 372-379.
- Aggarwal, R., Hance, J., Undre, S., Ratnasothy, J., Moorthy, K., Chang, A. et al. (2006). Training junior operative residents in laparoscopic suturing skills is feasible and efficacious. *Surgery*, 139, 729-734.
- Aggarwal, R., Moorthy, K., & Darzi, A. (2004). Laparoscopic skills training and assessment. *Br.J.Surg.*, 91, 1549-1558.
- Altgassen, C., Michels, W., & Schneider, A. (2004). Learning laparoscopic-assisted hysterectomy. *Obstet.Gynecol.*, 104, 308-313.
- Ames, C., Frisella, A. J., Yan, Y., Shulam, P., & Landman, J. (2006). Evaluation of laparoscopic performance with alteration in angle of vision. *J.Endourol.*, 20, 281-283.
- Anastakis, D. J., Regehr, G., Reznick, R. K., Cusimano, M., Murnaghan, J., Brown, M. et al. (1999). Assessment of technical skills transfer from the bench training model to the human model. *Am.J.Surg.*, 177, 167-170.
- Arthur W Jr, B. W. J. S. P. M. T. (1998). (1998) Factors that Influence Skill Decay and Retention: A Quantitative Review and Analysis. Human Performance 11:57-101. Human Performance 11, 57-101.
- Basdogan, C., De, S., Kim, J., Muniyandi, M., Kim, H., & Srinivasan, M. A. (2004). Haptics in minimally invasive surgical simulation and training. *IEEE Comput.Graph.Appl.*, 24, 56-64.
- Basdogan, C., Sedef, M., Harders, M., & Wesarg, S. (2007). VR-based simulators for training in minimally invasive surgery. *IEEE Comput.Graph. Appl.*, 27, 54-66.
- Bashankaev, B., Baido, S., & Wexner, S. D. (2011). Review of available methods of simulation training to facilitate surgical education. *Surg. Endosc.*, 25, 28-35.
- Beard, J. D. (2007). Assessment of surgical competence. *Br.J.Surg.*, 94, 1315-1316.
- Bennett, A., Birch, D. W., Menzes, C., Vizhul, A., & Karmali, S. (2011). Assessment of medical student laparoscopic camera skills and the impact of formal camera training. *Am.J.Surg.*, 201, 650-654.
- Bholat, O. S., Haluck, R. S., Murray, W. B., Gorman, P. J., & Krummel, T. M. (1999). Tactile feedback is present during minimally invasive surgery. *J.Am.Coll.Surg.*, 189, 349-355.
- Bijen, C. B., Briet, J. M., de Bock, G. H., Arts, H. J., Bergsma-Kadijk, J. A., & Mourits, M. J. (2009). Total laparoscopic hysterectomy versus abdominal hysterectomy in the treatment of patients with early stage endometrial cancer: a randomized multi center study. *BMC.Cancer*, 9, 23.
- Blanchard, M. H., Amini, S. B., & Frank, T. M. (2004). Impact of work hour restrictions on resident case experience in an obstetrics and gynecology residency program. *Am.J.Obstet. Gynecol.*, 191, 1746-1751.
- Bodle, J. F., Kaufmann, S. J., Bisson, D., Nathanson, B., & Binney, D. M. (2008). Value and face validity of objective structured assessment of technical skills (OSATS) for work based assessment of surgical skills in obstetrics and gynaecology. *Med.Teach.*, 30, 212-216.
- Botden, S. M., Torab, F., Buzink, S. N., & Jakimowicz, J. J. (2008). The importance of haptic feedback in laparoscopic suturing training and the additive value of virtual reality simulation. *Surg.Endosc.*, 22, 1214-1222.
- Brolmann, H. A., Vervest, H. A., & Heineman, M. J. (2001). Declining trend in major gynaecological surgery in The Netherlands during 1991-1998. Is there an impact on surgical skills and innovative ability? *BJOG.*, 108, 743-748.
- Cadeddu, J. A., Wolfe, J. S., Jr., Nakada, S., Chen, R., Shalhav, A., Bishoff, J. T. et al. (2001). Complications of laparoscopic procedures after concentrated training in urological laparoscopy. *J.Urol.*, 166, 2109-2111.
- Chang, L., Petros, J., Hess, D. T., Rotondi, C., & Babineau, T. J. (2007). Integrating simulation into a surgical residency program: is voluntary participation effective? *Surg.Endosc.*, 21, 418-421.
- Chen, C. C., Korn, A., Klingele, C., Barber, M. D., Paraiso, M. F., Walters, M. D. et al. (2010). Objective assessment of vaginal surgical skills. *Am.J.Obstet.Gynecol.*
- Chmarra, M. K., Bakker, N. H., Grimbergen, C. A., & Dankelman, J. (2006). TrEndo, a device for tracking minimally invasive surgical instruments in training setups. *Sensors and Actuators A-Physical*, 126, 328-334.
- Chmarra, M. K., Dankelman, J., van den Dobbelsteen, J. J., & Jansen, F. W. (2008). Force feedback and basic laparoscopic skills. *Surg. Endosc.*, 22, 2140-2148.
- Chmarra, M. K., Grimbergen, C. A., & Dankelman, J. (2007). Systems for tracking minimally invasive surgical instruments. *Minim.Invasive.Ther.Allied Technol.*, 16, 328-340.

- Clasen, K., Camus, M., Tournaye, H., & Devroey, P. (1997). Ectopic pregnancy: let's cut! Strict laparoscopic approach to 194 consecutive cases and review of literature on alternatives. *Hum. Reprod.*, 12, 596-601.
- Conrad, J., Shah, A. H., Divino, C. M., Schluender, S., Gurland, B., Shlasko, E. et al. (2006). The role of mental rotation and memory scanning on the performance of laparoscopic skills: a study on the effect of camera rotational angle. *Surg. Endosc.*, 20, 504-510.
- Cotin, S., Stylopoulos, N., Ottensmeyer, M., Neumann, P., Rattner, D., & Dawson, S. (2002). Metrics for laparoscopic Skills Trainers: The weakest link! In *Lecture Notes in Computer Science* (pp. 35-43).
- Cuschieri, A., Francis, N., Crosby, J., & Hanna, G. B. (2001). What do master surgeons think of surgical competence and revalidation? *Am.J.Surg.*, 182, 110-116.
- Dagash, H., Chowdhury, M., & Pierro, A. (2003). When can I be proficient in laparoscopic surgery? A systematic review of the evidence. *J.Pediatr. Surg.*, 38, 720-724.
- Darzi, A. & Mackay, S. (2002). Recent advances in minimal access surgery. *BMJ*, 324, 31-34.
- Darzi, A., Smith, S., & Taffinder, N. (1999). Assessing operative skill. Needs to become more objective. *BMJ*, 318, 887-888.
- Davis, D. A., Mazmanian, P. E., Fordis, M., Van Harrison, R., Thorpe, K. E., & Perrier, L. (2006). Accuracy of physician self-assessment compared with observed measures of competence: a systematic review. *JAMA*, 296, 1094-1102.
- Derossis, A. M., Bothwell, J., Sigman, H. H., & Fried, G. M. (1998). The effect of practice on performance in a laparoscopic simulator. *Surg. Endosc.*, 12, 1117-1120.
- Dunkin, B., Adrales, G. L., Apelgren, K., & Mellinger, J. D. (2007). Surgical simulation: a current review. *Surg.Endosc.*, 21, 357-366.
- Elwyn, G., O'Connor, A., Stacey, D., Volk, R., Edwards, A., Coulter, A. et al. (2006). Developing a quality criteria framework for patient decision aids: online international Delphi consensus process. *BMJ*, 333, 417.
- Emam, T. A., Hanna, G., & Cuschieri, A. (2002). Comparison of orthodox versus off-optical axis endoscopic manipulations. *Surg.Endosc.*, 16, 401-405.
- ESGE 2009: <http://www.esge.org>
- Eva, K. W. & Regehr, G. (2005). Self-assessment in the health professions: a reformulation and research agenda. *Acad.Med.*, 80, S46-S54.
- Feldman, L. S., Hagarty, S. E., Ghitulescu, G., Stanbridge, D., & Fried, G. M. (2004a). Relationship between objective assessment of technical skills and subjective in-training evaluations in surgical residents. *J.Am.Coll.Surg.*, 198, 105-110.
- Feldman, L. S., Sherman, V., & Fried, G. M. (2004b). Using simulators to assess laparoscopic competence: ready for widespread use? *Surgery*, 135, 28-42.
- Forde, K. A. (1993). Endosurgical training methods: is it surgical training that is out of control? *Surg.Endosc.*, 7, 71-72.
- Frank, J. R. & Danoff, D. (2007). The CanMEDS initiative: implementing an outcomes-based framework of physician competencies. *Med. Teach.*, 29, 642-647.
- Fried, G. M., Derossis, A. M., Bothwell, J., & Sigman, H. H. (1999). Comparison of laparoscopic performance in vivo with performance measured in a laparoscopic simulator. *Surg. Endosc.*, 13, 1077-1081.
- Fried, G. M., Feldman, L. S., Vassiliou, M. C., Fraser, S. A., Stanbridge, D., Ghitulescu, G. et al. (2004). Proving the value of simulation in laparoscopic surgery. *Ann.Surg.*, 240, 518-525.
- Gallagher, A. G., McClure, N., McGuigan, J., Ritchie, K., & Sheehy, N. P. (1998). An ergonomic analysis of the fulcrum effect in the acquisition of endoscopic skills. *Endoscopy*, 30, 617-620.
- Gallagher, A. G., Ritter, E. M., Champion, H., Higgins, G., Fried, M. P., Moses, G. et al. (2005). Virtual reality simulation for the operating room: proficiency-based training as a paradigm shift in surgical skills training. *Ann.Surg.*, 241, 364-372.
- Ginsburg, S., Regehr, G., Hatala, R., McNaughton, N., Frohna, A., Hodges, B. et al. (2000). Context, conflict, and resolution: a new conceptual framework for evaluating professionalism. *Acad.Med.*, 75, S6-S11.
- Goff, B., Mandel, L., Lentz, G., Vanblaricom, A., Oelschlager, A. M., Lee, D. et al. (2005). Assessment of resident surgical skills: is testing feasible? *Am.J.Obstet.Gynecol.*, 192, 1331-1338.
- Goff, B. A., Lentz, G. M., Lee, D., Houmar, B., & Mandel, L. S. (2000). Development of an objective structured assessment of technical skills for obstetric and gynecology residents. *Obstet.Gynecol.*, 96, 146-150.
- Goff, B. A., Nielsen, P. E., Lentz, G. M., Chow, G. E., Chalmers, R. W., Fenner, D. et al. (2002). Surgical skills assessment: a blinded examination of obstetrics and gynecology residents. *Am.J.Obstet.Gynecol.*, 186, 613-617.
- Gordon, M. J. (1992). Self-assessment programs and their implications for health professions training. *Acad.Med.*, 67, 672-679.
- Gould, J. C. (2006). Building a laparoscopic surgical skills training laboratory: resources and support. *JSLs*, 10, 293-296.

- Grantcharov, T. P., Kristiansen, V. B., Bendix, J., Bardram, L., Rosenberg, J., & Funch-Jensen, P. (2004). Randomized clinical trial of virtual reality simulation for laparoscopic skills training. *Br.J.Surg.*, 91, 146-150.
- Grober, E. D., Hamstra, S. J., Wanzel, K. R., Reznick, R. K., Matsumoto, E. D., Sidhu, R. S. et al. (2004a). Laboratory based training in urological microsurgery with bench model simulators: a randomized controlled trial evaluating the durability of technical skill. *J.Urol.*, 172, 378-381.
- Grober, E. D., Hamstra, S. J., Wanzel, K. R., Reznick, R. K., Matsumoto, E. D., Sidhu, R. S. et al. (2004b). The educational impact of bench model fidelity on the acquisition of technical skill: the use of clinically relevant outcome measures. *Ann.Surg.*, 240, 374-381.
- Haluck, R. S. & Krummel, T. M. (2000). Computers and virtual reality for surgical education in the 21st century. *Arch.Surg.*, 135, 786-792.
- Hamilton, E. C., Scott, D. J., Fleming, J. B., Rege, R. V., Laycock, R., Bergen, P. C. et al. (2002). Comparison of video trainer and virtual reality training systems on acquisition of laparoscopic skills. *Surg.Endosc.*, 16, 406-411.
- Hammond, I. & Karthigasu, K. (2006). Training, assessment and competency in gynaecologic surgery. *Best.Pract.Res.Clin.Obstet.Gynaecol.*, 20, 173-187.
- Hammoud, M. M., Nuthalapaty, F. S., Goepfert, A. R., Casey, P. M., Emmons, S., Espey, E. L. et al. (2008). To the point: medical education review of the role of simulators in surgical training. *Am.J.Obstet.Gynecol.*, 199, 338-343.
- Hanna, G. B., Shimi, S. M., & Cuschieri, A. (1998). Task performance in endoscopic surgery is influenced by location of the image display. *Ann.Surg.*, 227, 481-484.
- Haveran, L. A., Novitsky, Y. W., Czerniach, D. R., Kaban, G. K., Taylor, M., Gallagher-Dorval, K. et al. (2007). Optimizing laparoscopic task efficiency: the role of camera and monitor positions. *Surg.Endosc.*, 21, 980-984.
- Heemskerk, J., Zandbergen, R., Maessen, J. G., Greve, J. W., & Bouvy, N. D. (2006). Advantages of advanced laparoscopic systems. *Surg.Endosc.*, 20, 730-733.
- Hiemstra, E., Kolkman, W., & Jansen, F. W. (2008). Skills training in minimally invasive surgery in Dutch obstetrics and gynecology residency curriculum. *Gynecol.Surg.*, 5, 321-325.
- Hiemstra E, Jansen F.W. (2010). OSATS Guideline. *Dutch.J for.Med.Educ.*, 29; 5: 135-141
- Hiemstra, E., Kolkman, W., Wolterbeek, R., Trimbos, B., & Jansen, F. W. (2011). Value of an objective assessment tool in the operating room. *Can.J.Surg.*, 54, 116-122.
- Hodges, B., Regehr, G., & Martin, D. (2001). Difficulties in recognizing one's own incompetence: novice physicians who are unskilled and unaware of it. *Acad.Med.*, 76, S87-S89.
- Horeman, T., Rodrigues, S. P., Jansen, F. W., Dankelman, J., & van den Dobbelaars, J. J. (2010). Force measurement platform for training and assessment of laparoscopic skills. *Surg.Endosc.*, 24, 3102-3108.
- Hyltander, A., Liljegren, E., Rhodin, P. H., & Lonroth, H. (2002). The transfer of basic skills learned in a laparoscopic simulator to the operating room. *Surg.Endosc.*, 16, 1324-1328.
- IGZ 2007: <http://www.igz.nl>
- Jansen F.W. & Trimbos-Kemper G.C.M (2008). *Hysteroscopic surgery, the basis.*
- Jansen, F. W. & Trimbos-Kemper G.C.M (2006). *Laparoscopy, the basis.*
- Jordan, J. A., Gallagher, A. G., McGuigan, J., McGlade, K., & McClure, N. (2000). A comparison between randomly alternating imaging, normal laparoscopic imaging, and virtual reality training in laparoscopic psychomotor skill acquisition. *Am.J.Surg.*, 180, 208-211.
- Kingston, A., Abbott, J., Lenart, M., & Vancaillie, T. (2004). Hysteroscopic training: the butternut pumpkin model. *J.Am.Assoc.Gynecol.Laparosc.*, 11, 256-261.
- Kolkman, W., Engels, L. E., Smeets, M. J., & Jansen, F. W. (2007a). Teach the teachers: an observational study on mentor traineeship in gynecological laparoscopic surgery. *Gynecol. Obstet.Invest.*, 64, 1-7.
- Kolkman, W., van de Put, M. A., Van den Hout, W. B., Trimbos, J. B., & Jansen, F. W. (2007b). Implementation of the laparoscopic simulator in a gynecological residency curriculum. *Surg.Endosc.*, 21, 1363-1368.
- Kolkman, W., Wolterbeek, R., & Jansen, F. W. (2005). Gynecological laparoscopy in residency training program: Dutch perspectives. *Surg.Endosc.*, 19, 1498-1502.
- Kolkman, W., Wolterbeek, R., & Jansen, F. W. (2006). Implementation of advanced laparoscopy into daily gynecologic practice: difficulties and solutions. *J.Minim.Invasive.Gynecol.*, 13, 4-9.
- Kolkman, W., van de Put, M. A. J., & Jansen, F. W. (2008). Laparoscopic simulator: construct validity and establishing performance standards for residency training. *Gyn Surg*; 5:109-114. *Gynecological Surgery*.
- Korndorffer, J. R., Jr., Dunne, J. B., Sierra, R., Stefanidis, D., Touchard, C. L., & Scott, D. J. (2005a). Simulator training for laparoscopic suturing using performance goals translates to the operating room. *J.Am.Coll.Surg.*, 201, 23-29.



- Korndorffer, J. R., Jr., Hayes, D. J., Dunne, J. B., Sierra, R., Touchard, C. L., Markert, R. J. et al. (2005b). Development and transferability of a cost-effective laparoscopic camera navigation simulator. *Surg.Endosc.*, 19, 161-167.
- Korndorffer, J. R., Jr., Scott, D. J., Sierra, R., Brunner, W. C., Dunne, J. B., Slakey, D. P. et al. (2005c). Developing and testing competency levels for laparoscopic skills training. *Arch.Surg.*, 140, 80-84.
- Korndorffer, J. R., Jr., Stefanidis, D., & Scott, D. J. (2006). Laparoscopic skills laboratories: current assessment and a call for resident training standards. *Am.J.Surg.*, 191, 17-22.
- Kothari, S. N., Kaplan, B. J., DeMaria, E. J., Broderick, T. J., & Merrell, R. C. (2002). Training in laparoscopic suturing skills using a new computer-based virtual reality simulator (MIST-VR) provides results comparable to those with an established pelvic trainer system. *J.Laparoendosc. Adv.Surg.Tech.A*, 12, 167-173.
- Kruger, J., Gordon, C. L., & Kuban, J. (2006). Intentions in teasing: when "just kidding" just isn't good enough. *J.Pers.Soc.Psychol.*, 90, 412-425.
- Landis, J. R. & Koch, G. G. (1977). The Measurement of Observer Agreement for Categorical Data. In *Biometrics* (pp. 159-174).
- Larsen, C. R., Grantcharov, T., Aggarwal, R., Tully, A., Sorensen, J. L., Dalsgaard, T. et al. (2006). Objective assessment of gynecologic laparoscopic skills using the LapSimGyn virtual reality simulator. *Surg.Endosc.*, 20, 1460-1466.
- Larsen, C. R., Soerensen, J. L., Grantcharov, T. P., Dalsgaard, T., Schouenborg, L., Ottosen, C. et al. (2009). Effect of virtual reality training on laparoscopic surgery: randomised controlled trial. *BMJ*, 338, b1802.
- Lentz, G. M., Mandel, L. S., Lee, D., Gardella, C., Melville, J., & Goff, B. A. (2001). Testing surgical skills of obstetric and gynecologic residents in a bench laboratory setting: validity and reliability. *Am.J.Obstet.Gynecol.*, 184, 1462-1468.
- Loh, F. H., Hameed, N., & Ng, S. C. (2002). The impact of minimal access surgery on gynaecological surgery in a university gynaecological unit over a 10-year period from 1991 to 2000. *Singapore Med.J.*, 43, 177-181.
- Lynn, D. J., Holzer, C., & O'Neill, P. (2006). Relationships between self-assessment skills, test performance, and demographic variables in psychiatry residents. *Adv.Health Sci.Educ.Theory. Pract.*, 11, 51-60.
- Maagaard, M., Sorensen, J. L., Oestergaard, J., Dalsgaard, T., Grantcharov, T. P., Ottosen, B. S. et al. (2011). Retention of laparoscopic procedural skills acquired on a virtual-reality surgical trainer. *Surg.Endosc.*, 25, 722-727.
- MacRae, H. M., Satterthwaite, L., & Reznick, R. K. (2008). Setting up a surgical skills center. *World J.Surg.*, 32, 189-195.
- Madan, A. K. & Frantzides, C. T. (2007). Prospective randomized controlled trial of laparoscopic trainers for basic laparoscopic skills acquisition. *Surg.Endosc.*, 21, 209-213.
- Mahmood, T. & Darzi, A. (2004). The learning curve for a colonoscopy simulator in the absence of any feedback: no feedback, no learning. *Surg. Endosc.*, 18, 1224-1230.
- Mandel, L. P., Lentz, G. M., & Goff, B. A. (2000). Teaching and evaluating surgical skills. *Obstet. Gynecol.*, 95, 783-785.
- Mandel, L. S., Goff, B. A., & Lentz, G. M. (2005). Self-assessment of resident surgical skills: is it feasible? *Am.J.Obstet.Gynecol.*, 193, 1817-1822.
- Martin, J. A., Regehr, G., Reznick, R., MacRae, H., Murnaghan, J., Hutchison, C. et al. (1997). Objective structured assessment of technical skill (OSATS) for surgical residents. *Br.J.Surg.*, 84, 273-278.
- Martin, M., Vashisht, B., Frezza, E., Ferone, T., Lopez, B., Pahuja, M. et al. (1998). Competency-based instruction in critical invasive skills improves both resident performance and patient safety. *Surgery*, 124, 313-317.
- Matern, U., Faist, M., Kehl, K., Giebmeyer, C., & Buess, G. (2005). Monitor position in laparoscopic surgery. *Surg.Endosc.*, 19, 436-440.
- McClusky, D. A., III & Smith, C. D. (2008). Design and development of a surgical skills simulation curriculum. *World J.Surg.*, 32, 171-181.
- Medeiros, L. R., Stein, A. T., Fachel, J., Garry, R., & Furness, S. (2008). Laparoscopy versus laparotomy for benign ovarian tumor: a systematic review and meta-analysis. *Int.J.Gynecol. Cancer*, 18, 387-399.
- Moore, M. J. & Bennett, C. L. (1995). The learning curve for laparoscopic cholecystectomy. The Southern Surgeons Club. *Am.J.Surg.*, 170, 55-59.
- Moorthy, K., Munz, Y., Sarker, S. K., & Darzi, A. (2003). Objective assessment of technical skills in surgery. *BMJ*, 327, 1032-1037.
- Moschos, E. & Coleman, R. L. (2004). Acquiring laparoscopic skill proficiency: does orientation matter? *Am.J.Obstet.Gynecol.*, 191, 1782-1787.
- Moulton, C. A., Dubrowski, A., MacRae, H., Graham, B., Grober, E., & Reznick, R. (2006). Teaching surgical skills: what kind of practice makes perfect?: a randomized, controlled trial. *Ann.Surg.*, 244, 400-409.
- Munz, Y., Almoudaris, A. M., Moorthy, K., Dosis, A., Liddle, A. D., & Darzi, A. W. (2007). Curriculum-based solo virtual reality training for laparoscopic intracorporeal knot tying: objective

- assessment of the transfer of skill from virtual reality to reality. *Am.J.Surg.*, 193, 774-783.
- Munz, Y., Kumar, B. D., Moorthy, K., Bann, S., & Darzi, A. (2004). Laparoscopic virtual reality and box trainers: is one superior to the other? *Surg. Endosc.*, 18, 485-494.
- Najmaldin, A. (2007). Karl Storz Lecture. Skills training in pediatric minimal access surgery. *J.Pediatr.Surg.*, 42, 284-289.
- Navez, B. & Penninckx, F. (1999). Laparoscopic training: results of a Belgian survey in trainees. Belgian Group for Endoscopic Surgery (BGES). *Acta Chir Belg.*, 99, 53-58.
- Newmark, J., Dandolu, V., Milner, R., Grewal, H., Harbison, S., & Hernandez, E. (2007). Correlating virtual reality and box trainer tasks in the assessment of laparoscopic surgical skills. *Am.J.Obstet.Gynecol.*, 197, 546-4.
- Nussbaum, M. S. (2002). Surgical endoscopy training is integral to general surgery residency and should be integrated into residency and fellowships abandoned. *Semin.Laparosc.Surg.*, 9, 212-215.
- NVOG-HOOG 2005: http://www.medischevervolgopleidingen.nl//content/documenten/specialisme/gynaecologie/nvog_hoog.pdf
- Omar, A. M., Wade, N. J., Brown, S. I., & Cuschieri, A. (2005). Assessing the benefits of "gaze-down" display location in complex tasks. *Surg.Endosc.*, 19, 105-108.
- Palter, V. N., Orzech, N., Aggarwal, R., Okrainec, A., & Grantcharov, T. P. (2010). Resident perceptions of advanced laparoscopic skills training. *Surg.Endosc.*.
- Pandey, V. A., Wolfe, J. H., Liapis, C. D., & Bergqvist, D. (2006). The examination assessment of technical competence in vascular surgery. *Br.J.Surg.*, 93, 1132-1138.
- Park, A., Witzke, D., & Donnelly, M. (2002a). Ongoing deficits in resident training for minimally invasive surgery. *J.Gastrointest.Surg.*, 6, 501-507.
- Park, A. & Witzke, D. B. (2002b). Training and educational approaches to minimally invasive surgery: state of the art. *Semin.Laparosc.Surg.*, 9, 198-205.
- Pearson, A. M., Gallagher, A. G., Rosser, J. C., & Satava, R. M. (2002). Evaluation of structured and quantitative training methods for teaching intracorporeal knot tying. *Surg.Endosc.*, 16, 130-137.
- Perkins, N., Starkes, J. L., Lee, T. D., & Hutchison, C. (2002). Learning to use minimal access surgical instruments and 2-dimensional remote visual feedback: how difficult is the task for novices? *Adv.Health Sci.Educ.Theory.Pract.*, 7, 117-131.
- Porte, M. C., Xeroulis, G., Reznick, R. K., & Dubrowski, A. (2007). Verbal feedback from an expert is more effective than self-accessed feedback about motion efficiency in learning new surgical skills. *Am.J.Surg.*, 193, 105-110.
- Purkayastha, S., Aziz, O., Athanasiou, T., Paraskevas, P., & Darzi, A. (2004). Does laparoscopic surgery offer adequate clearance in rectal cancer?--A discussion. *Int.J.Surg.*, 2, 103-106.
- Rattner, D. W., Apelgren, K. N., & Eubanks, W. S. (2001). The need for training opportunities in advanced laparoscopic surgery. *Surg.Endosc.*, 15, 1066-1070.
- RCOG 2009: <http://www.rcog.org.uk/files/rcog-corp/uploaded-files/Ed-Core-OSATS.pdf>
- Reznick, R., Regehr, G., MacRae, H., Martin, J., & McCulloch, W. (1997). Testing technical skill via an innovative "bench station" examination. *Am.J.Surg.*, 173, 226-230.
- Reznick, R. K. & MacRae, H. (2006). Teaching surgical skills--changes in the wind. *N.Engl.J.Med.*, 355, 2664-2669.
- Rosser, J. C., Jr., Lynch, P. J., Cuddihy, L., Gentile, D. A., Klonsky, J., & Merrell, R. (2007). The impact of video games on training surgeons in the 21st century. *Arch.Surg.*, 142, 181-186.
- Rosser, J. C., Rosser, L. E., & Savalgi, R. S. (1997). Skill acquisition and assessment for laparoscopic surgery. *Arch.Surg.*, 132, 200-204.
- Schijven, M. & Jakimowicz, J. (2003). Virtual reality surgical laparoscopic simulators. *Surg. Endosc.*, 17, 1943-1950.
- Schijven, M. P. & Bemelman, W. A. (2011). Problems and pitfalls in modern competency-based laparoscopic training. *Surg.Endosc.*, 25, 2159-2163.
- Schijven, M. P., Berlage, J. T., & Jakimowicz, J. J. (2004). Minimal-access surgery training in the Netherlands: a survey among residents-in-training for general surgery. *Surg.Endosc.*, 18, 1805-1814.
- Schijven, M. P., Jakimowicz, J. J., Broeders, I. A., & Tseng, L. N. (2005). The Eindhoven laparoscopic cholecystectomy training course--improving operating room performance using virtual reality training: results from the first E.A.E.S. accredited virtual reality trainings curriculum. *Surg.Endosc.*, 19, 1220-1226.
- Schijven, M. P., Schout, B. M., Dolmans, V. E., Hendriks, A. J., Broeders, I. A., & Borel Rinkes, I. H. (2008). Perceptions of surgical specialists in general surgery, orthopaedic surgery, urology and gynaecology on teaching endoscopic surgery in The Netherlands. *Surg.Endosc.*, 22, 472-482.
- Schreuder, H.W., van den Berg, C.B., Hazebroek, E.J., Verheijen, R.H., Schijven, M.P. (2011).

- Laparoscopic skills training using inexpensive box trainers: which exercises to choose when constructing a validated training course. *BJOG*, 118, 1576-1584.
- Scott, D. J., Bergen, P. C., Rege, R. V., Laycock, R., Tesfay, S. T., Valentine, R. J. et al. (2000). Laparoscopic training on bench models: better and more cost effective than operating room experience? *J.Am.Coll.Surg.*, 191, 272-283.
- Scott, D. J., Young, W. N., Tesfay, S. T., Frawley, W. H., Rege, R. V., & Jones, D. B. (2001). Laparoscopic skills training. *Am.J.Surg.*, 182, 137-142.
- Seymour, N. E., Gallagher, A. G., Roman, S. A., O'Brien, M. K., Bansal, V. K., Andersen, D. K. et al. (2002). Virtual reality training improves operating room performance: results of a randomized, double-blinded study. *Ann.Surg.*, 236, 458-463.
- Sharma, D., Shaban, A., Riddell, A., Kalsi, V., Arya, M., & Grange, P. (2009). Video-games station or minimally invasive skills training station? *BJU.Int.*, 104, 159-160.
- Shay, B. F., Thomas, R., & Monga, M. (2002). Urology practice patterns after residency training in laparoscopy. *J.Endourol.*, 16, 251-256.
- Sinha, P., Hogle, N. J., & Fowler, D. L. (2008). Do the laparoscopic skills of trainees deteriorate over time? *Surg.Endosc.*, 22, 2018-2025.
- Smith, S. G., Torkington, J., Brown, T. J., Taffinder, N. J., & Darzi, A. (2002). Motion analysis. *Surg.Endosc.*, 16, 640-645.
- Smith, W. D., Berguer, R., & Nguyen, N. T. (2005). Monitor height affects surgeons' stress level and performance on minimally invasive surgery tasks. *Stud.Health Technol.Inform.*, 111, 498-501.
- Southern Surgeons Club (1991). A prospective analysis of 1518 laparoscopic cholecystectomies. The Southern Surgeons Club. *N.Engl.J.Med.*, 324, 1073-1078.
- Stassen, L. P., Bemelman, W. A., & Meijerink, J. (2010). Risks of minimally invasive surgery underestimated: a report of the Dutch Health Care Inspectorate. *Surg.Endosc.*, 24, 495-498.
- Stefanidis, D., Acker, C. E., Swiderski, D., Heniford, B. T., & Greene, F. L. (2008). Challenges during the implementation of a laparoscopic skills curriculum in a busy general surgery residency program. *J.Surg.Educ.*, 65, 4-7.
- Stefanidis, D. & Heniford, B. T. (2009a). The formula for a successful laparoscopic skills curriculum. *Arch.Surg.*, 144, 77-82.
- Stefanidis, D., Hope, W. W., Korndorffer, J. R., Jr., Markley, S., & Scott, D. J. (2010). Initial laparoscopic basic skills training shortens the learning curve of laparoscopic suturing and is cost-effective. *J.Am.Coll.Surg.*, 210, 436-440.
- Stefanidis, D., Korndorffer, J. R., Jr., Black, F. W., Dunne, J. B., Sierra, R., Touchard, C. L. et al. (2006a). Psychomotor testing predicts rate of skill acquisition for proficiency-based laparoscopic skills training. *Surgery*, 140, 252-262.
- Stefanidis, D., Korndorffer, J. R., Jr., Markley, S., Sierra, R., & Scott, D. J. (2006b). Proficiency maintenance: impact of ongoing simulator training on laparoscopic skill retention. *J.Am.Coll.Surg.*, 202, 599-603.
- Stefanidis, D., Korndorffer, J. R., Jr., Sierra, R., Touchard, C., Dunne, J. B., & Scott, D. J. (2005). Skill retention following proficiency-based laparoscopic simulator training. *Surgery*, 138, 165-170.
- Stefanidis, D., Scott, D. J., & Korndorffer, J. R., Jr. (2009b). Do metrics matter? Time versus motion tracking for performance assessment of proficiency-based laparoscopic skills training. *Simul.Healthc.*, 4, 104-108.
- Strom, P., Hedman, L., Sarna, L., Kjellin, A., Wredmark, T., & Fellander-Tsai, L. (2006). Early exposure to haptic feedback enhances performance in surgical simulator training: a prospective randomized crossover study in surgical residents. *Surg.Endosc.*, 20, 1383-1388.
- Sweet, R. M., Hananel, D., & Lawrenz, F. (2010). A unified approach to validation, reliability, and education study design for surgical technical skills training. *Arch.Surg.*, 145, 197-201.
- Swift, S. E. & Carter, J. F. (2006). Institution and validation of an observed structured assessment of technical skills (OSATS) for obstetrics and gynecology residents and faculty. *Am.J.Obstet. Gynecol.*, 195, 617-621.
- Torkington, J., Smith, S. G., Rees, B., & Darzi, A. (2001a). The role of the basic surgical skills course in the acquisition and retention of laparoscopic skill. *Surg.Endosc.*, 15, 1071-1075.
- Torkington, J., Smith, S. G., Rees, B. I., & Darzi, A. (2001b). Skill transfer from virtual reality to a real laparoscopic task. *Surg.Endosc.*, 15, 1076-1079.
- Trimbos J.B. (2007). *Basics of Surgery, tools, techniques, attitude and expertise*.
- van der Meijden, O. A. & Schijven, M. P. (2009). The value of haptic feedback in conventional and robot-assisted minimal invasive surgery and virtual reality training: a current review. *Surg.Endosc.*, 23, 1180-1190.
- van Dongen, K. W., van der Wal, W. A., Rinkes, I. H., Schijven, M. P., & Broeders, I. A. (2008). Virtual reality training for endoscopic surgery: voluntary or obligatory? *Surg.Endosc.*, 22, 664-667.
- van Hove, P. D., Tuijthof, G. J., Verdaasdonk, E. G., Stassen, L. P., & Dankelman, J. (2010).

- Objective assessment of technical surgical skills. *Br.J.Surg.*, 97, 972-987.
- Van Sickle, K. R., McClusky, D. A., III, Gallagher, A. G., & Smith, C. D. (2005). Construct validation of the ProMIS simulator using a novel laparoscopic suturing task. *Surg.Endosc.*, 19, 1227-1231.
- Van Herzeele, I., O'Donoghue, K. G., Aggarwal, R., Vermassen, F., Darzi, A., & Cheshire, N. J. (2010). Visuospatial and psychomotor aptitude predicts endovascular performance of inexperienced individuals on a virtual reality simulator. *J.Vasc.Surg.*, 51, 1035-1042.
- Vassiliou, M. C., Feldman, L. S., Andrew, C. G., Bergman, S., Leffondre, K., Stanbridge, D. et al. (2005). A global assessment tool for evaluation of intraoperative laparoscopic skills. *Am.J.Surg.*, 190, 107-113.
- Verdaasdonk, E. G., Stassen, L. P., Schijven, M. P., & Dankelman, J. (2007a). Construct validity and assessment of the learning curve for the SIMENDO endoscopic simulator. *Surg.Endosc.*, 21, 1406-1412.
- Verdaasdonk, E. G., Stassen, L. P., van Wijk, R. P., & Dankelman, J. (2007b). The influence of different training schedules on the learning of psychomotor skills for endoscopic surgery. *Surg.Endosc.*, 21, 214-219.
- Vossen, C., Van Ballaer, P., Shaw, R. W., & Koninckx, P. R. (1997). Effect of training on endoscopic intracorporeal knot tying. *Hum.Reprod.*, 12, 2658-2663.
- Westebring-van der Putten EP, Goossens, R. H., Jakimowicz, J. J., & Dankelman, J. (2008). Haptics in minimally invasive surgery--a review. *Minim.Invasive.Ther.Allied Technol.*, 17, 3-16.
- Zehetner, J., Kaltenbacher, A., Wayand, W., & Shamiyeh, A. (2006). Screen height as an ergonomic factor in laparoscopic surgery. *Surg.Endosc.*, 20, 139-141.

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Ellen Hiemstra was born on September 23rd 1979 in Zwolle. She attended the Gymnasium Ceeleum in Zwolle, which she finished Cum Laude in 1997. She moved to Delft to study Civil Engineering at the Delft University of Technology. After obtaining her Propadeuse and meeting her future partner Rienk Krol, she was admitted to study Medicine at the University of Utrecht which she finished in 2004. She started to work as a resident at the department of Gynaecology of the Leiden University Medical Center (LUMC) and at the department of Obstetrics and Gynaecology of the Haga Hospital in the Hague. In 2005 she was selected for the official residency training program in Obstetrics and Gynaecology. After one year of training at the Haga Hospital (Dr. E.J. van Rijssel), she decided to combine her passion for medicine with her previous passion for technology. She attended a PhD program (2007-2009) at the department of Minimally invasive surgery in gynaecology at the LUMC (Prof. Dr. F.W. Jansen) in collaboration with the Delft University of Technology (Prof. J. Dankelman), resulting in this thesis. In January 2010 she continued her residency training at the Haga Hospital (Dr. B.W. Hellebrekers) and currently at the LUMC (Prof. Dr. J.M. van Lith). In the continuum of the circle of life, Malou (the daughter of Rienk and Ellen) starts exploring the realm of technology at home with plugs and electrical sockets.

PUBLICATIONS

Related to this thesis

Hiemstra E, Kolkman W, Jansen FW. Skills training in minimally invasive surgery in Dutch obstetrics and gynecology residency curriculum. *Gyn Surg* 2008; 5: 321-5

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Hiemstra E, Kolkman W, Wolterbeek R, Trimbos JBMZ, Jansen FW. The Value of an Objective Assessment Tool in the Operating Room. *Can J Surg*, 2011; 54: 116-22

Hiemstra E, Kolkman W, le Cessie S, Jansen FW. Are Minimally Invasive Procedures harder to acquire than Conventional Surgical Procedures? *Gyn Obstet Invest*. 2011; 71: 268-73.

Hiemstra E, Terveer EM, Chmarra MK, Dankelman J, Jansen FW. Virtual Reality in Laparoscopic Skills Training: Is Haptic Feedback replaceable? *Minimally Invasive Therapy & Allied Techniques*, 2011; 20: 79-84

Hiemstra E, Jansen FW. Richtlijn OSATS. *Tijdschrift voor Medisch Onderwijs*. 2010. 29; 5: 135-41.

Hiemstra E, Chmarra MK, Dankelman J, Jansen FW. Intracorporeal suturing: economy of movements in a box trainer model. *JMIG*, 2011; 18: 494-9

Jansen FW, **Hiemstra E**. Comment on *Laparoscopic skills training using inexpensive box trainers: which exercises to choose when constructing a validated training course*. *BJOG*, 2011; accepted

Hiemstra E, Hossein pour Khaledian N, Trimbos JBMZ, Jansen FW. Intraoperative assessment of resident's surgical skills: benefits and pitfalls. *Submitted*

Hiemstra E, Schreuder HWR, Stiggelbout AM, Jansen FW. Grading surgical skills curricula and training facilities for minimally invasive surgery. *Submitted*

Hiemstra E, Hossein pour Khaledian N, Dobbels JJ, Dankman J, Jansen FW. Optimizing laparoscopic skills training: Does a fixed Camera Compromise Depth Perception? *Submitted*

Other publications

Hiemstra E, Weijenborg PT, Jansen FW. Management of chronic pelvic pain additional to tubal sterilization. *J Psychosom Obstet Gynaecol*. 2008 :29 (3) 153 -6

Schaafsma BE, **Hiemstra E**, Dankelman J, Jansen FW. Feedback in laparoscopic skills acquisition: an observational study during a basic skills training course. *Gynecol Surg*. 2009; 6: 339–43

Kroon de CD, **Hiemstra E**, Trimbos JBMZ, Jansen FW. Power Doppler area in the diagnosis of endometrial cancer. *Int J Cancer*. 2010; 20: 1160-5

Okken LM, Chmarra MK, **Hiemstra E**, Dankelman J, Jansen FW. Assessment of joystick and wrist control in hand-held articulated laparoscopic prototypes. *Submitted*

Hiemstra E, Schoot D. Hoofdstuk 10 Skills oefeningen. Hysteroscopisc Chirurgie: de basis. Jansen FW, Trimbos-Kemper T. Editor Laurier, Noordwijk, 2008. ISBN: 9789081289719

Hiemstra E, Terveer EM, Dankelman J, Jansen FW. Comment on Systematic review of randomized controlled trials on the effectiveness of virtual reality training for laparoscopic surgery. Website Br J Surg 2008.

Rodrigues SP, de Burlet KJ, **Hiemstra E**, Twijnstra ARH, van Zwet EW, Trimbos-Kemper TCM, Jansen FW, Dynamics of b-hCG in ectopic pregnancy, submitted

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