

University of Prince Edward Island

Faculty of Veterinary Medicine
Summary of Dissertation

Submitted in Partial Fulfilment
of the Requirements for the

DEGREE OF MASTER OF SCIENCE

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**Development of a patient specific 3D-printed drill guide
for ventral slot surgery in dogs**

Complications associated with ventral slot decompression for cervical intervertebral disc extrusion have been reported in 9.9% of cases and include vertebral subluxation, hemorrhage, and neurologic deterioration. To minimize the risk of complications, slot dimensions should not exceed 33% of the length or width of the vertebral body.

Achieving these dimensions intraoperatively may be challenging, thus use of a surgical guide may result in more accurate outcomes. The objective of this study was to compare accuracy and precision of ventral slot dimensions created using a 3D-printed patient-specific surgical guide or the conventional freehand technique in canine cadavers. CT data was used to create patient-specific surgical guides from 8 large breed canine cadavers. Intervertebral sites were randomized to undergo either a guided (n=12) or freehand (n=12) ventral slot by a novice surgery resident.

Postoperative CT images were used to compare ventral slot dimensions, shape, and position. There was a significant difference between the intended and postoperative slot lengths of the freehand slots ($p < 0.01$). Dimensions of the guided ventral slots were not statistically different from the planned dimensions. Use of the guides resulted in improved precision for ventral slot positioning relative to midline, divergence from midline, and slot shape (difference in coefficient of variations, 32%, 4%, and 40% respectively). This study confirms that the use of a 3D-printed patient specific surgical guide improves accuracy of ventral slot creation in canine cadavers and improves surgical precision when used by a single novice surgical resident. Future studies investigating the benefit of these guides when used by experienced surgeons and in live patients are warranted.

Publications

1. O'Carroll C, Welch BT, Walker MA, Ogilvie AO, Lorrie Gaschen, Hoddinott KL. Decompressive craniectomy surgery in a dog with intracranial extradural hematoma following blunt force trauma. *Can Vet J*. 2024. 65(5):437-442.
2. Duguay MT, Walker MA, Ostrowska J, Hoddinott KL. Surgical treatment of a persistent right aortic arch with concurrent patent ductus arteriosus in a 4-month-old German shepherd dog. *Vet Med and Sci*. 2023. 9(4):1477-1482
3. Janse van Vuuren KM, Walker MA, Hoddinott KL. Medical management of gastric distension secondary to massive dry beet pulp ingestion in a dog. *Vet Rec*. 2022. 11:e505.
4. Walker MA, Hoddinott KL, Ogilvie AT. Treatment and outcomes of five dogs with intrathoracic migration of porcupine quills. *Vet Surg*. 2022
5. Dickson R, Scharf VF, Michael AE, Walker M, Thomson C, Grimes J, Singh A, Oblak M, Brisson B, Case JB. Surgical management and outcome of dogs with primary spontaneous pneumothorax: 110 cases (2009–2019). *JAVMA*. 2021. 258 (11):1229-35.
6. Walker MA, Singh A, Gibson TW, Rousseau J, Weese JS. Presence of *Qac* genes in clinical isolates of methicillin-resistant and methicillin-susceptible *Staphylococcus pseudintermedius* and their impact on chlorhexidine digluconate susceptibility. *Vet Surg*. 2020. 49: 971-967
7. Walker M, MacCormick M, Kilkenny J, zur Linden A, Singh A. Visuospatial skills are better predictors than dexterity for basic ultrasonographic and fluoroscopic skills in veterinary students. *Vet Radiol Ultrasound*. 2019. 60(1):81-92.
8. Gemignani F, Mayhew PD, Giuffrida MA, Robertson NA, Seguin B, Singh A, Walker M, Liptak JM, Romanelli G, Martano M, Boston SE, Lux CN, Busetto R, Culp WTN, Runge JJ. Association of surgical approach with complication rate, progression-free survival time, and disease-specific survival time in cats with mammary adenocarcinoma: 107 cases (1991–2014). *J Am Vet Med Assoc*. 2018 1;252(11):1393-402.
9. Walker MA. Struvite urolithiasis with eosinophilic polypoid cystitis in a shih tzu dog. *Can Vet J*. 2018, 9(2):181-3.
10. MacCormick M, Kilkenny J, Walker M, zur Linden A, Singh A. Investigating the impact of innate dexterity skills and visuospatial aptitude on the performance of baseline laparoscopic skills in veterinary students. *Vet Surg*. 2017. 46(8): 1175-1186.
11. Lopez D, Singh A, Wright TF, Gartley C, Walker M. Single incision laparoscopic-assisted ovariohysterectomy for an ovarian tumor in a dog. *Can Vet J*. 2017, 58(9), 975.
12. Walker M, Singh A, Weese JS. Bacterial Biofilms. *Clin Br*. 2017, 20(3):191-195.
13. Kilkenny J, Santarossa A, Mrotz V, Walker M, Monaghan D, Singh A. Investigating laparoscopic psychomotor skills in veterinarians and veterinary technicians. *Vet Surg*. 2017, 46(3), 433-440
14. Walker M, Singh A, Nazarali A, Gibson TW, Rousseau J, Weese JS. Evaluation of the impact of methicillin resistant *Staphylococcus pseudintermedius* biofilm formation on antimicrobial susceptibility. *Vet Surg*. 2016, 45(7), 968-971.
15. Morrison S, Singh A, Rousseau J, Walker M, Nazarali A, Crawford E, Brisson B, Sears W, Weese J.S. Impact of polymethylmethacrylate additives on methicillin-resistant *Staphylococcus pseudintermedius* biofilm formation in vitro. *Am Vet J R*. 2015, 76(5): 395-401
16. Walker M, Singh A, Rousseau J, Weese J.S. Bacterial contamination of surgical gloves in small animal surgery. *Can Vet J*. 2014, 55(12), 1160-1162.
17. Singh A, Walker M, Rousseau J, Weese J.S. Characterization of the biofilm forming ability of methicillin-resistant *Staphylococcus pseudintermedius*. *BMC Vet Res*. 2013, (9), 93.
18. Singh A, Walker M, Rousseau J, Monteith G, Weese JS. Methicillin-resistant *Staphylococcal* contamination of clothing worn by personnel in a veterinary teaching hospital. *Vet Surg*. 2013, 42(6): 643-648.
19. Weese JS, Walker M, Lowe T. In vitro miconazole susceptibility of methicillin-resistant *Staphylococcus pseudintermedius* and *Staphylococcus aureus*. *Vet Dermatol*. 2012, 23(5): 400-e74.
20. Weese JS, Lowe T, Walker M. Use of fluorescent tagging for assessment of environmental cleaning and disinfection in a veterinary hospital. *Vet Rec*. 2012, 171(9): 217-217.

Presentations

1. Walker M*, Hoddinott K, Ogilvie A. (2023). Development of a patient-specific 3D-printed drill guide for canine ventral slot. UPEI 3-minute Thesis. Prince Edward Island, Canada [Refereed] [Scope: Regional]
2. Walker M*, Hoddinott K, Ogilvie A. (2023). Development of a patient-specific 3D-printed drill guide for canine ventral slot. Canadian Emerging Veterinary Scholars Summit. October 2023. Calgary [Refereed] [Scope: National]
3. Walker M*, Hoddinott K, Ogilvie A. (2023). Development of a patient-specific 3D-printed drill guide for canine ventral slot. October 2023 American College of Veterinary Surgeons Symposium: Louisville, Kentucky. [Refereed] [Scope: International]
4. Walker M*, Singh A, Nazarali A, Rousseau J, Weese J.S. (2014-2015) Evaluating the impact of biofilm formation of *Staphylococcus pseudintermedius* on antimicrobial susceptibility in vitro. American College of Veterinary Surgeons Symposium: Nashville, Tennessee. [Refereed] [Scope: International]
5. Walker M*, Singh A, Rousseau J, Weese JS. (2013-2014). Biofilm forming ability of *Staphylococcus pseudintermedius*. American College of Veterinary Surgeons Annual Symposium, San Antonio, Texas. [Refereed] [Scope: International]

POSTER

1. Walker M*, Brisson B. (2023) Development of a low-cost, low-fidelity surgical simulator to teach feline castration. 5th International Veterinary Simulation in Teaching Conference, Grenada [Refereed] [Scope: International]
2. Walker M*, Singh A, Nazarali A, Rousseau J, Weese J.S. (2015) Evaluating the impact of biofilm formation of *Staphylococcus pseudintermedius* on antimicrobial susceptibility in vitro. 2016 Morris Animal Veterinary Student Scholars Symposium, Denver, Colorado. [Refereed] [Scope: International]
3. Walker M*, Singh A, Rousseau J, Weese J.S. (2015). Evaluating the impact of biofilm formation of *Staphylococcus pseudintermedius* on antimicrobial susceptibility in vitro. 2015 CPHAZ Symposium, Guelph, Canada-Ontario. [Refereed] [Scope: National]

Biographical Data

Born in Ajax, Ontario, Canada

Awards

2024 Zoetis Graduate Research Award
2024 George and Margaret Peake Scholarship
2023 Myra Scholarship for AVC Residency Students
2023 UPEI 3-Minute Thesis 2nd place in presentation
2022 John and Carol MacLeod Award for Research Communication Excellence
2022 Natasha Memorial Tuition Scholarship
2022 Alice Peak Bissett Residency in Companion Animals Scholarship
2021 UPEI Faculty Association Master's Medal
2021 Roderick Sterling MacDonald Scholarship
2021 University of Prince Edward Island Graduate Studies Research Conference 3rd place in presentation
2021 Alice Peak Bissett Residency in Companion Animals Scholarship
2021 The Class of 2006 Mentorship Award
2021 Dr. J. Regis Duffy Graduate Scholarships in Sciences
2020 The Class of 2006 Mentorship Award