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# Editor's Spotlight/Take 5

# Editor's Spotlight/Take 5: To Cast, to Saw, and Not to Injure: Can Safety Strips Decrease Cast Saw Injuries?

**Seth S. Leopold MD**

Even our simplest interventions expose patients to risk. Acetaminophen, even in moderate doses, can cause liver damage [2]. One population study suggested that nearly half of all cases of septic arthritis—a potentially life-threatening surgical emergency—are iatrogenic, related to joint injections and arthroscopic surgery [4]. Even generally well-tolerated treatments can result in serious harm and healthcare expenditures across a population when they are not used thoughtfully [9].

Although casting fractures usually is safer than, and for some injuries can be as good or better than, surgery, even well-applied casts can cause problems. Tight casts and dressings remain in the front of surgeons' minds, but cast removal, usually delegated to the junior-most team member or a technician, is anxiety-provoking [7], sometimes painful, and occasionally injurious to the patient [1]. Cuts and burns from cast saws can result in disfiguring wounds, and in one study [8], cast-related complications were the leading cause of litigation against a large pediatric multispecialty care group.

Although less-experienced handlers of the cast saw have been implicated as the problem in some studies [13], training and education alone seem insufficient to eliminate the risks [10]. Soaking casts off may work for plaster [12], but it is tedious, messy, and ineffective for fiberglass casts. Although soft-roll cast padding can help [14], excessive amounts of cotton roll cannot be the solution; too much padding results in ineffective casting and loss of reduction when the cast needs to be molded to maintain the position of a fracture [3, 6]. There are no high-tech approaches on the horizon; million-dollar medicine is no help here. Solving this problem will take … a few bucks worth of synthetic ribbon?

Apparently so. Matthew A. Halanski MD and his team at the University of Wisconsin have spent the last several years developing a realistic model to determine whether a cast saw would have risked cutting or burning a child's arm in the course of cast removal—without subjecting any child to risk or harm. They then tested a barrier method using what the manufacturer describes cryptically if accurately as "proprietary blue material" placed beneath the cast, and found that it dramatically reduced the risk of laceration or thermal injury in

*Note from the Editor-In-Chief: In* "Editor's Spotlight," *one of our editors provides brief commentary on a paper we believe is especially important and worthy of general interest. Following the explanation of our choice, we present* "Take Five," *in which the editor goes behind the discovery with a one-on-one interview with an author of the article featured in* "Editor's Spotlight."

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this real-world-accurate simulation. Excitingly, the benefit seemed substantial in the hands of experienced surgeons and novices alike.

Whether or not you are a pediatric orthopaedic surgeon—indeed whether or not you even apply and remove casts—you will be inspired by how Dr. Halanski solved a resistant problem with a simple intervention in this issue of *Clinical Orthopaedics and Related Research®*. You will also enjoy his perspective on larger questions related to patient safety in the Take-5 interview that follows.

**Take Five Interview with Matthew A. Halanski MD, senior author of "To Cast, to Saw, and Not to Injure: Can Safety Strips Decrease Cast Saw Injuries?"**

**Seth S. Leopold MD:** *Congratulations on your lovely study, which tested a clever and economical solution to a vexing problem. I thoroughly enjoyed reading your work. How did you create this safety innovation?*

**Matthew A. Halanski MD:** Many people have studied the anatomy of cast saw injuries, identified the risk factors (both for thermal and abrasive injuries), and have tried to minimize the risks involved such as cast material and thickness, cast padding, saw type, blade sharpness, and user experience, among others. Despite all of this information, the injuries continue to occur. I believe it is difficult to control all of the variables, especially if the person removing the cast has little experience. It appeared to me that the common variable, regardless of thermal or abrasive injury, was the blade touching the skin. If we could prevent the blade from touching the skin, we could prevent the injuries. Another example of "KISS"—Keep It Simple, Stupid.

**Dr. Leopold:** *How did you become interested in testing it?*

**Dr. Halanski:** After residency, I published a paper on thermal risk factors of casting [5]. As I entered into practice, there appeared to be a growing interest in preventing cast saw injuries. I think much of this was brought to the national stage by Peter Waters MD, past president of the Pediatric Orthopaedic Society of North America. As I had research experience with modeling and casting, and had recently returned to the University of Wisconsin where I had done the majority of my previous work, I set out to determine whether we could study this problem. Around that time, one of our pediatric orthopaedic nurse practitioners needed a research project for her doctorate and we started using a similar model to see how many times residents and more experienced healthcare providers touched the blade to the model's "skin." We then looked at how effective a teaching module was at improving technique. We demonstrated that something beyond simply "more education" was needed to eliminate these injuries.

**Dr. Leopold:** *Safety problems can be addressed with systems-level safety innovations, education-based approaches, and, like the project here on cast strips, what I would characterize as simple (though thoughtful) mechanical solutions. Your research programs have explored all three areas. How do you decide which safety problems are most amenable to each kind of approach?*

**Dr. Halanski:** Firsthand knowledge about the problem is key. The first question to ask is "who is having the problem?" Sufficient familiarity with the system is also important in order to evaluate the feasibility of the potential solutions and innovations that one might bring to bear. In terms of problems pertaining to patient safety (or, more broadly, morbidity of treatments), treating surgeons who have multiple options for intervention are often the most amenable to systems-level approaches. For example, my research program has evaluated topics such as reducing radiation in hip imaging, decreasing the usage of surgery in patients with clubfoot, and exploring ways to minimize patient morbidity during spine surgery. All of those projects resulted in systems-

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level recommendations. In all these studies, the interventions were being performed by multiple practicing physicians and the relative efficacy of the various possible interventions was unknown. Once we provided the data, a system-wide approach to change then could occur.

When it comes to education-based approaches, we should consider how a subject is being taught and who is going to be educated. Perhaps the most promising venue for education-oriented initiatives are those areas with trainees (medical students or residents) in which no current education is being used. By contrast, simply adding a module to an existing program or trying to educate attending surgeons and then trying to measure a change may be more difficult. Also, I think education, from a safety-improvement standpoint, works best the simpler the subject matter. For example, when we studied the effects of an educational program on resident's ability to measure compartment pressures, little formal education, at our center, was being performed on the subject. Generally, the procedure is quite simple, so perhaps that is why the intervention was productive [11].

Finally, I think simple solutions are always the best. These simple solutions are especially rewarding when, as in this study, much is known about the problem, yet the problem continues to happen. Trying to identify a single point in the process to avert the problem and exploit it, especially if it is simple and low cost, seems to be the ideal solution.

**Dr. Leopold:** *Sometimes things bite back; we set out to solve one problem, but create others. Please tackle this question both in the specific and the general case: Are there any pitfalls or risks to watch out for with respect to the cast strips you used here, and, more generally, when you are trying to*

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*make a system safer, how do you ensure that your well-intentioned interventions do not lead to unintended consequences?*

**Dr. Halanski:** There is no foolproof way. Blade sharpness is a good example in the cast-saw area. The sharper the blade, the lower the blade temperature the lower the risk of thermal injury; however, the sharper the blade, the higher the risk of abrasive injury. This is also the case with cast padding. The more padding, the less risk of cast-saw injury, but this may lead to more lost reductions, which is the reason the cast is on in the first place. I think it is best to try to test multiple scenarios. An example in the current study was that at one point we had placed the strips directly under the fiberglass. These strips were slightly less effective than when placed with an intervening layer of cotton under-cast padding; we believe the reason for this was that the strips would get "stuck" to the fiberglass, and so were easier to cut through. As clinicians, we always need to be mindful that moving forward of such unintended variables and consequences. Use of these strips, in practice, may have the unintended consequence of users becoming more aggressive and less attentive during the cast-removal process, owing to a false sense of security provided by the strips.

**Dr. Leopold:** *You have, in a relatively short time, made a number of important contributions to several areas of pediatric orthopaedic research. To what do you attribute your success? What suggestions do you have for the young academician starting out in practice?*

**Dr. Halanski:** I have been blessed. I have had great partners, great mentors and trainees to mentor, and I have been at institutions where I have had time to pursue lines of inquiry with access to great lab personnel and collaborators. Also, I believe I am doing what I was created to do; when you do that, I think success follows. I have learned over my career that everyone has a gift. I believe my gift is not being the smartest individual. Rather, it is being able to (1) identify clinically relevant questions or problems, (2) connect those problems with solutions I have heard about, read about, or thought about, and (3) possess the people skills required to engage others who have the expertise I lack to help me answer these questions. Being at an institution with a ridiculous number of talented and really smart experts does not hurt, either.

My chief recommendation to young(er) academicians is to find good mentors. Ken Noonan MD, Haemish Crawford FRACS, and Paul Anderson MD are three mentors who have helped me tremendously. Early on, Ken told me to focus on one area of research, so that over my career it would be easier to measure the long-term contribution that I was making to science and the field of orthopedics. I have not quite done that (I am not always the best listener); however I have tried to keep my research focused along a limited number of lines of inquiry, and I think that has helped. Next, I would suggest that young academicians should strive to work at institutions that have the resources or the populations they wish to study. For example, my research on spinal muscular atrophy is made possible because the University of Wisconsin cares for a high volume of children with this disorder. Trying to study this population at my previous position would not have been possible.

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## References

1. Ansari MZ, Swarup S, Ghani R, Tovey P. Oscillating saw injuries during removal of plaster. *Eur J Emerg Med.* 1998;5:37–39.
2. Arundel C, Lewis JH. Drug-induced liver disease in 2006. *Curr Opin Gastroenterol.* 2007;23:244–254.
3. Bhatia M, Housden P L. Redisplacement of paediatric forearm fractures:

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Role of plaster moulding and padding. *Injury.* 2006; 37:259–268.
4. Geirsson AJ, Statkevicius S, Vikingsson A. Septic arthritis in Iceland 1990–2002: Increasing incidence due to iatrogenic infections. *Ann Rheum Dis.* 2008;67:638–643.
5. Halanski MA, Halanski AD, Oza A, Vanderby R, Munoz A, Noonan KJ. Thermal injury with contemporary cast-application techniques and methods to circumvent morbidity. *J Bone Joint Surg Am.* 2007;89:2369–2377.
6. Hang JR, Hutchinson AF, Hau RC. Risk factors associated with loss of position after closed reduction of distal radial fractures in children. *J Pediatr Orthop.* 2011;31:501–506.
7. Katz K, Fogelman R, Attias J, Baron E, Soudry M. Anxiety reaction in children during removal of their plaster cast with a saw. *J Bone Joint Surg Br.* 2001;83:388–390.
8. Killian J, White S, Lenning L. Cast-saw burns: Comparison of technique versus material versus saws. *J Pediatr Orthop.* 1999;19:683–687.
9. Kilo CM, Larson EB. Exploring the harmful effects of health care. *JAMA.* 2009;302:89–91.
10. Monroe KC, Sund SA, Nemeth BA, Noonan KJ, Halanski MA. Cast-saw injuries: Assessing blade-to-skin contact during cast removal. Does experience or education matter? *Phys Sportsmed.* 2014;42:36–44.
11. Morris MR, Harper BL, Hetzel S, Shaheen M, Davis A, Nemeth B, Halanski MA. The effect of focused instruction on orthopaedic surgery residents' ability to objectively measure intracompartmental pressures in a compartment syndrome model. *J Bone Joint Surg Am.* 2014; 96:e171.
12. Sadruddin N, Chinoy MA, Javed MI. Soak the cast off. *J Coll Physicians Surg Pak.* 2007;17:380–381.
13. Shore BJ, Hutchinson S, Harris M, Bae DS, Kalish LA, Maxwell W 3rd, Waters P. Epidemiology and prevention of cast saw injuries: Results of a quality-improvement program at a single institution. *J Bone Joint Surg Am.* 2014;96:e31.
14. Shuler FD, Grisafi FN. Cast-saw burns: Evaluation of skin, cast, and blade temperatures generated during cast removal. *J Bone Joint Surg Am.* 2008;90:2626–2630.