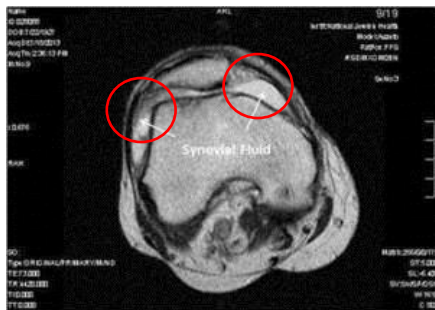


Arthroventions use insights from I-Corps to bring the KneeTap® to Clinical Marketplace

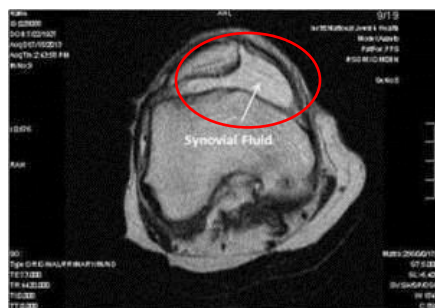
The Problem: Synovial fluid lubricates the knee joint for comfort, nutrition and range of movement. Removing synovial fluid or injecting the joint space may be done as part of the diagnosis and treatment of conditions such as arthritis. Synovial fluid may also be used in research to identify biomarkers for the development of effective treatments for degenerative conditions affecting joints. While knee aspirations are fairly common, about a third miss the joint space or do not collect sufficient fluid, resulting in repeated procedures and patient discomfort.



The Solution: KneeTap is a medical device that wraps around the knee, leaving an opening for needle aspiration or ultrasound. A provider inflates the bladder; the subtle pressure created concentrates synovial fluid in the joint space, making it easier to locate and aspirate. According to Dr. Richard Meehan, KneeTap inventor, "The biggest surprise – because I wanted to make this technically easier – was that patients, almost all of them say, 'That didn't hurt as much.'" The pressure caused by inflating the cuff overloads the sensory pathways for pain perception. "That was a plus – having patients say, 'I didn't feel that nearly as much as before.'"



Without KneeTap



With KneeTap

Arthroventions'
KneeTap Team



Richard Meehan,
MD
Rheumatologist,
National Jewish Health
Chief Medical Officer,
Arthroventions LLC.



Eric Hoffman,
CEO and Co-Founder,
Arthroventions LLC,
Biomedical Engineer,
Entrepreneur



Keegan Manion
Lead Engineer,
Arthroventions LLC.

Impact of I-Corps Program: The KneeTap team participated in the Spring 2017 I-Corps program. While they were excited about the possibilities that KneeTap presented for research, the Arthroventions team recognized that that path represented a long-term commitment and required significant grant funding. Initial funding was obtained from the Colorado Office of Economic Development and International Trade, Advanced Industries Accelerator Grant Program and Colorado Biologic Discovery Evaluation grants. As they developed their research program, the team wanted to cultivate revenue streams through the clinical marketplace.

To members of the KneeTap team, adopting the innovation seemed like a no-brainer – it made it easier for medical providers to perform knee aspirations accurately and reliably and helped reduce patient discomfort. The I-Corps customer discovery process surfaced, however, that different types of medical providers, working within diverse practice settings and reimbursement models, had unique needs and challenges. Resulting insights allowed the KneeTap team to segment their customer base and tailor their marketing approaches. According to Dr. Meehan:

... Every doctor's practice is unique and how much value this brings to them depends on their needs. The I-Corps program really forced us to look [at] really how many doctors find that that's a critical need for them. That was essential for us to look at from their perspective, so we interviewed multiple doctors in different practices.

Eric Hoffman, Arthroventions CEO, added, "We really had a broad scope at first [anticipating that] anybody who's doing these injections would like to use this device. Through this customer discovery [process], we realized [who] we need to target first to get our early adopters and start this domino effect."

One of the major pain points in medicine is time. This insight, and Dr. Meehan's own experience as an ER physician and medic in Iraq, led the team to package KneeTap together with the other equipment required for knee aspiration. Dr. Meehan shared, "The thought of asking a nurse for everything I needed to do a joint aspiration when the ER is crazy and chaotic ... Everybody likes the idea of something that is fast, everything is right there, it's sterile, and you can throw it away. Time is really important now in medicine." Currently, KneeTap is being marketed and distributed as a kit for integration in healthcare systems. "It has been very interesting moving into the next phase of the company and trying to do marketing and sales. I think I-Corps really helped us because it started with, 'You have to go talk to customers. You have to have a validated learning process.' In terms of finding that ideal customer segment or beachhead market, that was really important."

"We went from feature-focused to benefit-focused."

Keegan Manion, who began his tenure with Arthroventions as an intern while studying engineering at the University of Colorado Boulder, reflected on how I-Corps shaped his perspectives as a professional engineer. "I think [I-Corps] really broadened my horizons. Instead of thinking design, design, design, I take a step back and think, 'What are the pain points for people who are going to use these products?' I think I would have a completely different approach the next time around and really think more about the enduser and how they interact with the device rather than [just] how the device functions."

Future Directions: The KneeTap not only addresses pain points for medical providers, it also addresses the very real pain of knee aspirations for patients and collecting fluid for research and better diagnosis. As a result, the KneeTap is facilitating human subjects research in an area of great interest to Dr. Meehan, a rheumatologist. "People aren't going to be as keen to have repeated aspirations if it's uncomfortable. But, if it's precise, accurate and doesn't hurt as much, that opens up a whole new area of synovial fluid biomarker research." His research is specifically focused on examining the role of inflammation in cartilage degradation. "Just [being off the knee] for six weeks after an ankle injury results in damage to the knee joint. On MRI, you have less cartilage. We're trying to understand that mechanism [to] reduce cartilage loss ..." He and his team currently have two research grants that involve National Jewish Health and Craig Hospital, as well as the National Aeronautics and Space Administration (NASA) where

"Once you have the capability of getting more cells, more fluid, then you can answer more questions from a research standpoint that have practical implications ... That's how this has evolved [to address] another unmet need in orthopedics."

Dr. Meehan spent the early part of his career. “We’re going to be comparing the cytokine profile from patients at National Jewish to spinal cord-injured patients at Craig Hospital to NASA astronauts pre-flight, post-flight and, hopefully, in-flight. We’re going to look at [the synovial] fluid to see, for a given patient, what’s the earliest [sign] of irreversible cartilage damage.” The ultimate goal is to advance personalized medicine to promote and prolong joint health. “I think I could help more rheumatology patients by coming up with a panel of biomarkers that will identify what drug they are going to respond to, so they don’t have to spend three months on a toxic, expensive drug that they’re never going to respond to. I would not have thought about that ... without a device that made it easier to get the joint fluid. It has definitely changed my focus.”