RRI Case Study

THE DEVELOPMENT OF NEW REHABILITATION DEVICES FOR USE IN THE COMMUNITY SETTING- THE REHAB ANGEL

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RESPONSIBLE INNOVATION COMPASS

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 710543

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The main output for this case study is a video, which is supplemented by a short case description.

Please click here for the case videos:

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Executive Summary

This case study is about a collaboration between a university partner and an SME. The output of the collaboration is the Rehab Angel, a commercially available angle device used mostly for knee rehabilitation purposes.

The key driver for the university research was to provide clinicians with robust tools that they can use to evaluate, treat and therefore improve the clinical outcome in their patients. The research has assisted the development of the evidence base of many clinical treatments and assessment tools. This has led to the design and development of new rehabilitation products and medical devices in partnership with both large companies and small to medium sized enterprises.

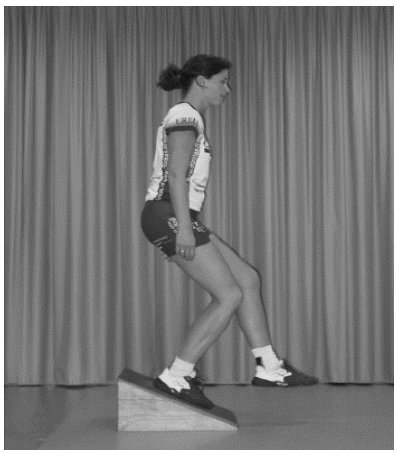

Figure 1: Previous fixed angle device used clinically (Zwerver et al, 2007)

The example used in this case study came from research on the exploration of the biomechanics of squatting tasks and the implications for lower limb rehabilitation. Single-limb squats on a decline angle have been suggested as a rehabilitative intervention to target the knee extensors, however very little empirical research existed documenting the optimum angle of decline, with most clinicians using a single angle of 25 degrees, Figure 1. Extensive research showed that different flexible angles were more beneficial for the patients, which led to the development and commercialisation of the Rehab Angel.

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Research and the Product

Work undertaken at the Allied Health Research unit, University of Central Lancashire UK, identified a lack of evidence of the exact nature and "dosage angle" of interventions used by clinicians. The research group then explored the use of squatting using decline boards and aimed to determine the optimum angle and the most effective regimen. A paper, published in the *Journal of Athletic Training* (Richards et al, 2008), was the first to determine the biomechanics of such exercises, and suggested the optimum angles for different rehabilitation purposes.

The university was subsequently involved with prototype development and providing further proof of concept testing for the final commercially available product. This has led to the publication of "The effect of different decline angles on the biomechanics of double limb squats and the implications to clinical and training practice" (Richards et al, 2016), Figure 2.

Figure 2: New rehabilitation device, the "Rehab Angel"

The aim of this study was to determine the loads around and on the ankle and knee joints and muscle activity while performing a "squat" (a common physiotherapy task) to highlight the benefits and implications to rehabilitation. Eighteen healthy subjects performed double limb squats at six angles of declination: 0, 5, 10, 15, 20 and 25 degrees. The range of motion of the knee and ankle joints, joint loads and muscle activity of the gastrocnemius (calf muscle), tibialis anterior (front of the lower leg), rectus femoris (quadriceps) and biceps femoris (hamstring) were evaluated. As the decline angle increased up to 20 degrees, the range of motion possible at the ankle and knee increased. The joint loads showed a decrease at the ankle up to a 15 degrees decline and an increase at the knee up to 25 degrees decline, indicating a progressive reduction in loading around the ankle with a corresponding increase of the load in the patellar tendon and patellofemoral joint. These trends were supported by a decrease in tibialis anterior activity and an increase in the rectus femoris activity up to 15 degrees decline. However, gastrocnemius and biceps femoris activity increased as the decline angle increased above 15 degrees. These findings suggested that there is little benefit in using a decline angle greater than 15-20 degrees unless the purpose is to offer an additional stability challenge to the knee joint and that the use of graduated exercise maybe better than a fixed angle.

This work led to the development of a new rehabilitation device, the "Rehab Angel", which allows the decline angle to be adjusted based on our findings (Richards et al, 2008), in cooperation with Medical Devices Technology International Limited (MDTi).

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Stakeholder collaboration

The Rehab Angel was the product of collaboration between a range of stakeholders, in particular UK National Health Service, academia and industry. The three groups formed a team with the purpose of developing a new device that could provide a graduated rehabilitation. These partners brought in their collective expertise in order to allow knowledge exchange and rapid development of a new rehabilitation device. This collaboration removed many of the latent issues around the innovation pathway, since key knowledge holders and product production systems were brought into the delivery of the project from the outset. The purpose of this innovation was to provide a low cost, readily accessible evidence base for the rehabilitation device, which could improve care and outcomes through patient physical rehabilitation in the community setting.

Industry Benefits

The Rehab Angel aims to assist patients to better assess and undertake exercise regimens before and after appointments with healthcare professionals, therefore improving clinical utility and productivity.

This aforementioned collaboration aimed to address a clinical need and with an industry focus to create a new product that could be supported by evidence to allow more effective marketing and a greater understanding of a rehabilitation exercise.

This case study shows that an SME led technology innovation, when linking with a university, can gain important independent testing. The SME involvement allowed a real world output, in the shape of a new rehabilitation device that linked theoretical research and enhanced clinical understanding. This collaborative R&D project supported the SME in:

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a) proof of market, through an understanding of current clinical practice;
b) proof of concept testing, through testing of the effect of adapting the rehabilitation exercises (Richards et al, 2008);
c) the development and testing of the final prototype (Richards et al, 2016); and
d) provided independent reports and peer review papers to allow “evidence based” marketing and purchasing.

This project, funded through National Health Service (NHS) innovation and European Regional Development Fund (ERDF) innovation helped the SME access knowledge, testing and development services, which increased the ability of the SME to innovate and commercialise the new rehabilitation device. Thereby greater levels of innovation in all sectors of the economy were encouraged, with the longer term goal of driving economic growth and creating jobs, whilst improvement rehabilitation within the clinical environment.

The Rehab Angel is now commercially available and is being used in many rehabilitation centres and professional sports clubs in a variety of knee and other lower limb pathologies. The core impact of this work has been positive developments in patient care and quality of life by improving the efficacy and effectiveness in these areas, with a particular focus on the advancement of conservative management and lower limb rehabilitation.

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Why does this case fall under RRI?

Using the key action points of RRI developed by the Science with and for Society unit:[1]

- engage society more broadly in its research and innovation activities,
- increase access to scientific results,
- ensure gender equality, in both the research process and research content,
- take into account the ethical dimension, and
- promote formal and informal science education.

This project high-lights the benefits of stakeholder collaboration (societal engagement) and more importantly the benefits of informal science education to the economy, given the considerable knowledge transfer from the university to the SME, which commercialized the Rehab Angel.

[1] https://ec.europa.eu/programmes/horizon2020/en/h2020-section/science-and-society

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