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SmartRehab: A Mobile Health App for Home-based Ankle Sprain Therapy

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KEYWORDS

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DECLARATIONS

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ABSTRACT

Recovering from an ankle fracture requires a team effort, and mobile health apps can enhance rehabilitation effectiveness. This will be a program where physiotherapists guide patients after surgery or immobilisation, with progress followed through an app. The ankle is a complex joint where bones, soft tissues, and neurovascular structures work together to support weight-bearing and movement. Considering its anatomy, biomechanics, and gender-related differences is crucial for evaluating and treating athletic injuries. The program reduced pain and swelling, improved muscle balance, stability, and walking, and improved quality of life. Affected individuals may experience difficulty walking, climbing stairs, and sensations like tingling, numbness, or pins and needles in the area. The findings support the effectiveness of Move 360 in improving functional outcomes and reducing pain in individuals with lateral ankle sprains. The main aim of the work was to design and validate an application for a mobile health system for home use of musculoskeletal therapy in patients with ankle sprain. The study results revealed that the mobile health app significantly increased recovery outcomes amongst the participants with ankle sprain. The study concluded that the mobile application is an effective solution for home-based rehabilitation in individuals with ankle sprains. It helped improve mobility, reduce pain, and support patient engagement in recovery. The app offered a convenient alternative to in-person therapy, especially for those with limited access to clinical care. Overall, the application contributed to better functional outcomes and user satisfaction.

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Recovering from an ankle fracture requires a team effort, and mobile health apps can enhance rehabilitation effectiveness. This will be a program where physiotherapists guide patients after surgery or immobilisation, with progress followed through an app. The program reduced pain and swelling, improved muscle balance, stability, and walking, and improved quality of life.^{1, 2} These injuries are frequent in sports involving a lot of jumping and running, making up 4–20% of musculoskeletal issues overall and 10–28% in jumping and running sports.^{3, 4}

The ankle is a complex joint where bones, soft tissues, and neurovascular structures work together to support weight-bearing and movement. Considering its anatomy, biomechanics, and gender-related differences is crucial for evaluating and treating athletic injuries. Lateral ankle sprain is the most common lower extremity injury, affecting people of all ages in sports and play.^{5, 6} Though often seen as a one-time injury, up to 74% of cases lead to chronic ankle instability with pain, swelling, and weakness. Ankle sprains usually affect the anterior talofibular ligament and calcaneofibular ligament, with severity varying based on injury mechanism, foot position, and rotational forces. Low-grade sprains (Grades I and II) involve ligament stretching or microscopic tears, while high-grade sprains (Grade III) can damage syndesmotic structures.^{7, 8}

Ankle sprains, especially on the outer (lateral) side, are very common in sports. They often happen when someone twists their ankle or lands awkwardly. These injuries can keep people from their usual activities for a while. About 1 in 3 people may sprain the same ankle again within a year or two. That's why proper and consistent rehab is so important.⁹ The mechanism may also lead to complete tendon disruptions and fractures of the ankle and foot in the highest energy scenarios. Symptoms of an ankle sprain include swelling, bruising, pain, mild heat, and redness, often accompanied by reduced movement and strength in the ankle and foot.^{7, 10}

Affected individuals may experience difficulty walking, climbing stairs, and sensations like tingling, numbness, or pins and needles in the area.¹¹ The findings support the effectiveness of Move 360 in improving functional outcomes and reducing pain in individuals with lateral ankle sprains. The main aim of the work was to design

and validate an application for a mobile health system for home use of musculoskeletal therapy in patients with ankle sprain. The study results revealed that the mobile health app significantly increased recovery outcomes amongst the participants with ankle sprain.

Kasnakova et al. compared to the present study, where the problem domain is narrowed to ankle sprains, this study shows the wider potential of mobile health interventions not only in sprains but also in more complicated fractures, proving that the tools can be used in various injury types.¹² Correia et al. focused on a home-based rehabilitation program for acute ankle sprains delivered via a mobile app, which participants used in an unsupervised manner. In comparison, however, current showed greater improvement of functional ability and pain reduction, which is probably because of the increased supervision and remote therapist support.¹³

Karaoba in 2024 examined the role of telerehabilitation in athletes recovering from orthopaedic injuries, particularly ankle sprains. However, recent research encompassed not only rehabilitation but also pain management and usability metrics, proving that telerehabilitation not only works with athletes but can become useful in society, as well.¹⁴ Crowell et al. (2024) investigated the effectiveness of the SWAY app, which was designed to track and improve balance in patients recovering from ankle sprains. The existing research, however, was more general as it included the use of strengthening exercises, flexibility, and pain reduction to give a more holistic picture of recovery, and Crowell was more focused on the tracking of balance deficits.¹⁵

The study concluded that the mobile application is an effective solution for home-based rehabilitation in individuals with ankle sprains. It helped improve mobility, reduce pain, and support patient engagement in recovery. The app offered a convenient alternative to in-person therapy, especially for those with limited access to clinical care. Overall, the application contributed to better functional outcomes and user satisfaction.

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