Transformation of Digital Health: Advancing Telerehabilitation with Smartwatch Technology

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Abstract

The emergence of innovative electronic devices has revolutionized the role of medicine, specifically telemedicine and telerehabilitation. A smartwatch is similar in shape to a traditional wristwatch with a built-in, networked computer with an array of sensors. The use of smartwatches has provided healthcare workers with new opportunities for monitoring and managing health. Monitoring of vitals like heart rate, blood pressure, and oxygen saturation, has been made possible by the help of smartwatches. These features provide the wearer with a real-time picture of their health. Monitoring of vital health parameters over time can help detect irregularities in health status and can also be used for remote patient monitoring. This enables healthcare professionals to monitor their patient's health from anywhere. Smartwatches are being used in physical rehabilitation nowadays for monitoring vitals during physical therapy and tracking the progress of the wearer. This mini-review discusses insights into the benefits of using smartwatches in healthcare, and focuses on the evolving role of smartwatches in telerehabilitation.

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Introduction

Wearable technology has altered our way of life. With the development of advanced electronic devices with sensors and connectivity like smartphones, smart watches, smart glasses, and other devices monitoring vital signs, wearable technology has made significant changes in delivery modes of remote treatments and has gained popularity in the general population.[1]

Smartphone technology has transformed the world by introducing applications such as internet connectivity, artificial intelligence, and Global Positioning Systems (GPS). A smartwatch is an electronic device that resembles a traditional wristwatch but has additional features and capabilities. Like smartphones, it can run multiple applications, connect to the internet, and allow individuals to access a variety of health-related information. Smartwatches are becoming more advanced as technology develops, with new features and functions being added frequently.

The popularity and usage of the smartwatch are on the rise, and with new models and brands of smartwatches being launched every year, the percentage of the population using these devices has increased significantly as well. Other features found in smartphones and smartwatches enable patients the ability to share relevant vital health information swiftly and effortlessly with their family members and healthcare professionals. Smartphones and smart watches are the tools that may bring promising changes in the future of healthcare.[2]

The features that smartphones and smartwatches provide have the potential to revolutionize the healthcare sector. Information regarding health of the patients can be synchronized with smartphones applications and provide consumers with positive recommendations regarding their lifestyles and habits.

Physical therapy is an important part of treatment and rehabilitation of people with injuries, chronic illness or any other physical disabilities. Traditional physical therapy treatment programmes rely on frequent in-person visits of the patient to a hospital or rehabilitation clinical setting. The treatment sessions are given by or under the supervision of a physical therapist. Smart watches have transformed physical therapy treatment by allowing patients and healthcare providers to track physical activity, monitor progress of the treatment, set personal goals, and improve communication between the physical therapists and patients.[3]

An increasing amount of evidence supports the use of smart watches in physical therapy. Recent technical advancements in smart watches have resulted in the development of physical activity trackers that are capable of monitoring activity levels and other health indicators in real-time and provide continuous monitoring and feedback.[4]

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Smart watch in Healthcare and Rehabilitation
Some ways in which smart watches have improved treatment are as follows:

Vital signs monitoring: Smart watches are equipped with built-in sensors that can monitor vital signs such as heart rate, body temperature, blood pressure, ECG and blood oxygenation. The information received from smart watches can help health care providers assess and facilitate a patient's progress during and post treatment.[5]

Remote Monitoring of Health: Sometimes patients are unable to visit clinics in person due to multiple reasons. A smart watch can connect such patients with their healthcare providers. Progress of such patients can be monitored remotely through various applications installed on their smart watches. Remote monitoring can also help patients follow doctors' instructions and allow doctors to intervene if any problems arise.[6]

Remote monitoring for Patient care is an application of smart watches which has shown great potential in future of healthcare. These devices can record and share vital health information in real time, allowing health care providers to monitor patients remotely and provide interventions when needed. For example, a smart watch with sensors can capture vital signs such as heart rate, blood pressure and sleep patterns, thereby providing doctors information of the patient's health. This information is particularly useful for patients with chronic diseases that require regular monitoring and early detection of changes or abnormalities.[7]

Reminders for exercise and medicine: Smart watches can also assist patients by reminding them for exercises or time for any medicine administration. Reminders on watches can help patients adhere to their exercise and medication schedules and reduce the likelihood of missing out treatment. Smart watches utilizing their in-built sensors can provide an accurate, non-invasive way to monitor people's behaviour and activities, gestures and movements required to exercise or take medication and allow caregivers and doctors to monitor patient's treatment regime.[8]

Physical activity and sedentary behaviour monitoring: The smart watch can track the daily activity levels of the patient. This information can be utilized by healthcare providers to evaluate patients activity status and sedentary behaviour. Patients can also benefit from professional supervision to motivate themselves and measure their progress.[9]

Gait pattern analysis: Smart watches with accelerometer and gyroscope can analyze three kinds of gait parameters, step length, swing time and stance time.[10] Monitoring gait patterns is an important part of rehabilitation. The current methods for gait analysis require a visual analysis of the patient in the clinical setting and using equipment to analyze gait. By analyzing gait patterns using spatio-temporal gait parameters, physical therapists can identify complex problems and design treatments. This information can further be used to evaluate a patient's walking balance, and posture as well.[11]

Biofeedback: Smartwatches are also useful in providing real time biofeedback to patient during or after treatment or exercise. These feedbacks can facilitate and motivate the patients to maintain physical activity and healthy exercise habits. Quick instructions provided by activity monitoring can also increase the effectiveness of treatment protocol.[12]

Fall monitoring: Fall is a serious incident that can cause medical emergency. Smart watch is a cost effective tool that can monitor and detect incidence of fall among its users and share it immediately with healthcare providers. Apart from this some models of smartwatches can also be used in screening of fall risk.[13] The integration of smartwatches as screening tools can further facilitate patients, their families and healthcare providers and improve responses to emergency situations. Smart watches can also act as medical bracelets that can provide immediate vital health related information to doctors.[14,15]

The integration of smartwatches in the treatment of patients has proven valuable for healthcare workers. Due to their smart features such as providing quick access to medical records, medical advice, and drug information, these devices have not only facilitated patients but healthcare workers as well.[16]

Challenges and limitations of smart watches
While there are various advantages of using smartwatches in healthcare, they are certain limitations as well. The accuracy and reliability of health parameter provided by smartwatches is still being researched upon. The parameters provided may not always be as accurate as medical devices.[7,17] Additionally, privacy and security concerns must be addressed to ensure the protection of health information accessed and stored by these devices. Smart watches are transforming healthcare by providing a device that deliver real-time information, providing health assessment features and increase patient engagement. However, it should be emphasized to the patients that smart watches do not replace the expertise of a trained healthcare professional and they should be used to support treatment programmes for better outcomes.

Local Pakistani Perspective
Despite the increasing use of smart watches by the general population, there is a ack of integration of effective use of

smart watches in our clinical settings. This lack can be associated with limited data present on smart watch usage, high cost of some brands of smart watches and limited knowledge of general population and healthcare workers regarding health features present in smart watches.

Smart watch enables patient to follow treatment plans while staying connected to their healthcare provider. Smartwatch empowers the patient and increases the efficiency and effectiveness of a treatment plan. Overall, smart watches allow for more accessible telerehabilitation for different patients who might not be able to attend in-person therapies. By helping overcome the limitations, these electronic devices allow for more inclusive therapy programmes and improve overall quality of life.

Conclusion

In conclusion, smart watches have been recognized as useful tools that show promising changes in healthcare and telerehabilitation. They have gained popularity in the healthcare field with many applications that can help patients and healthcare professionals by allowing them to access information that can provide remote health monitoring, improve treatment compliance and provide health feedback. While there are many advantages in using smart watches, its integration in rehabilitation sciences is still limited. They can help in improvement of quality of life and reduce financial burden of healthcare.

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