

Modern Robotic
Dynamometry

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to meet today's growing challenges



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Introduction

Over the course of modern rehabilitation history, concept of treatment and the devices that assist in these processes have ebbed and flowed like the tides. One thing that always remains an integral part of rehabilitation is the use of robotic dynamometry. Today, the dynamometer is enjoying a new resurgence as the need for objective data and the markets for which it serves expand.

Today's dynamometers are not "your father's" dynamometers, although the perception may be that the technology has not evolved in 30 years. This is not the case. Technology has the capability to address the needs of not only professional athletes, but runs the entire rehabilitative spectrum from athlete to pediatric cerebral palsy and neurologically impaired patients.

Today's Technology

Today's technology gives the clinician easy access to tools that can help facilitate muscular control, strength, endurance, acceleration and deceleration; all components that are basic requirements for non-compensatory functional movements.

Features such as biofeedback, accommodating resistance, clinically controlled submaximal contractions, active assistive motion, dynamic co-contractions, EMG activity and kinesthetic awareness are all facilitated by the technology's ability to deliver concentric and eccentric contraction types in isotonic, isometric, passive, reactive eccentric, and of course, isokinetic modes. All of the contraction types can be monitored and measured in real time with the data reported or delivered in raw form for statistical analysis. These new devices also have protocols that can deliver active and passive position sense activities and testing.

This is a long way from the cardboard measuring tools used by our rehabilitation ancestors. A renewed interest in quantification and outcomes is driving this need. There have been over 2,000 professional publications penned over the years in support of this concept.

Open- and Closed-Kinetic Chain Exercise

Having witnessed changes in philosophy and changes in reimbursement structures over the last 30 years, open-chain kinetic activities and dynamometry have fallen in popularity since their prominence in the 1980's and 90's. There was a dramatic swing from the aforementioned to closed-chain activities and more affordable ways to deliver therapeutic exercise. However, over the last couple of years, clinicians have begun to realize that when the pendulum swings one way, it has a tendency to swing back and like the tides, we are currently reaching the happy medium where we realize that a combination of both philosophies give us availability to the largest arsenal of rehabilitative tools and delivers a means to objectively measure progress.

In the case of lower extremity function, there have been countless documented cases of high-level athletes completing their rehabilitation and passing their functional performance evaluation only to return to the field and reinjure themselves. We have also witnessed above-knee amputees perform functional activities, such as the squat. In both cases, both subjects had insufficient quadriceps strength.

In the case of the AK, there is no quad function. Our bodies are tremendous compensators and the musculature that supports the links above and below the deficiency have the ability to accept and modify loads associated with that specific movement. Not addressing this isolated deficiency leaves that weak link in the chain unprotected and susceptible to the external forces it will be subjected to in activities of daily living or sport activities. It is important to build proper muscular function all along the chain before solely relying on functional activities to complete the rehabilitative process. The use of robotic dynamometry allows the clinician to address these issues and also allows for the documentation of progress, providing the evidence necessary to determine continued treatment or completion of a particular phase of rehabilitation.

Expansion in the Use of Dynamometry

Certainly in past years sports medicine has seen significant use of the dynamometer. Today, the dynamometer is used in over 70 countries worldwide with recent installations in Estonia, India and Jordan. One of the most significant adoptions of this technology in sports has been seen in the English Premier League of Football, where 16 professional teams have adopted the technology, including but not limited to Manchester United, Chelsea, Manchester City, Aston villa and Blackburn Rovers. England's National Rugby team have their own dynamometer and five of Brazil's professional soccer teams use the technology as well. But the expansion is not limited to sports.

U.S. Special Forces including Naval Special Warfare Groups 1 and 2 (SEALS) as well as six other special groups have begun using Biodex technology. NASA has units specifically for the use of testing Astronauts. Not to

be outdone, the Russian Cosmonaut Program in Star City outside of Moscow uses the device for subject performance testing. Biodex's System 4 was also in use at the international physiotherapy tent at the London Olympics. The list is lengthy, with new installations throughout professional and collegiate sports, not only in the US, but worldwide.

Normative data for pediatric subjects has grown as our utilization for children with Cerebral Palsy has increased. The use of the dynamometer for patients with stroke and other neurodegenerative diseases is expanding rapidly and Biodex has development projects in the works to address this particular group with new attachments and new robotic capabilities. Biodex is entering a phase of renewed R&D on our dynamometer and is actively positioning itself to address these developing markets over the next ten years.

Summary

The role of robotic dynamometry in the world is expanding. We have solidified our standing in the sports medicine community and have seen significant growth there. Our international position in the sporting community is in a growth phase as well. Biodex is committed to support the general orthopedic community as well as with programs like Fall Risk which include the use of the dynamometer. We are in development of new programs and utilizations as the role of the dynamometer expands in the world of neurorehabilitation. Biodex is excited about its position in the market and we are looking forward to the challenges ahead. At 200-strong employees, with clinical, technical and sales support, Biodex is ready to embrace the future of dynamometry. We hope you will come along with us.



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