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“Isokinetic Injury Rehabilitation Jumping Hurdles and Moving Forwards”

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Overview of Presentation

- Evolvement of evidence based research in clinical Isokinetics over the past decade.
- Evaluation of evidence based research on the role of Isokinetics in the clinical environment for the evaluation and treatment of injury.
- Identifying ongoing difficulties with the application of Isokinetics in rehabilitation of injury. Hurdles we have yet to overcome, identifying current gaps in our knowledge.
- Moving forwards to the future, evaluating the value of Isokinetic strength measurement in injury assessment and rehabilitation.
- Evaluating the validity of Isokinetic testing for functional performance.
- Is there a place for Isokinetic eccentric exercise in the evaluation and rehabilitation of tendinopathy?

There are four decades of evidence-based research on clinical Isokinetics. Medline have identified one thousand and fifty-nine scientific publications from 1974 ~ 2009.

1970s papers focused on the discussion on the definition of Isokinetic exercise and technology. Several papers on the mechanical and biomechanical considerations of Isokinetic together with implications of muscle testing.

1980s saw early studies on normative data. Some papers tended to overestimate diagnostic application of Isokinetic. There was much research on muscle testing relevant to conditions and rehabilitation with poor clinical application. We saw the early studies published by Dr. George Davis particularly in relation to Isokinetic trunk testing, much of his research data still holds today.

1990s Newton and Waddell (1993) reviewed a decade of literature on Isokinetic testing, one hundred and eight publications were identified, they concluded that there was inadequate scientific evidence to support the use of Isokinetics in pre-employment screening, routine clinical and in medical/legal screening.

2000s, the past decade has seen a more rigorous evidence based research showing a greater understanding of the characteristic strength and performance of muscle in different conditions. There was a considerable advancement in the evidence of Isokinetic

rehabilitation and the treatment of specific conditions with improved understanding of functional outcomes. Greater awareness of the role of Isokinetic in clinical context has been identified. “Application of Isokinetic in testing rehabilitation of the shoulder complex” by Dr. George Davis was one such paper, which further clarified and evaluated the role of Isokinetics in injury rehabilitation and in clinical application.

Discussion followed on the current difficulties with the application of Isokinetics in the rehabilitation in injury terms of the validity advances that have made and identifying the current gaps in our knowledge and ways in which we may move forward.

Normative data was discussed particularly in relation to normal subjects versus patient populations, the challenges we continue to face with respect to normative data due to a wide range of different protocols that have been used and measured on different models of dynamometers which are not comparable. While there’s general agreement that patients with injury show lower performance on Isokinetic measurement compared with normal symptomatic subjects we as yet need more convincing evidence to allow us to move forward with greater validity on the ability of Isokinetic measurement to discriminate among individuals (particularly between patients and normal subjects).

Safety issues of Isokinetic testing were discussed, reference was made to Davis contraindications spectrum (1992) reflecting on a broad spectrum of contraindications where essentially the clinician needs to ensure accurate clinical evaluation of the condition being tested and apply the contraindication spectrum accordingly. In terms of safety there is general agreement in all publications that dynamic Isokinetic testing is safe and there is no published report of significant complications or injury.

The validity of Isokinetic evaluation with respect to pain was also discussed, scientific studies have shown that pain during performance of Isokinetic testing has been found to be a possible strength releasing factor. In order to move forward we need further research to consider the relationship between pain and level of muscle performance in patients with pain.

Psychological factors were also discussed, we continue to have reduced performance of Isokinetic strength measurement, psychological factors where poor performance may not always be attributed to organic musculoskeletal abnormality alone. Psychological factors may be due to a failure to understand the degree of effort required, anxiety in relation to the test situation, fear avoidance, conscious symptoms limitation or limitations of the injury and of the condition. With a view to moving forward we need improved methods and guidelines for test interpretation.

Validity of Isokinetic testing with relation to performance was also discussed. It was widely agreed that for normal function of neuro-muscular skeletal requirements such as muscle performance, coordination and proprioception are the prerequisites for correct movement patterns. It is agreed that this complexity of measurement can seldom be performed in a completely functional setting. It is not possible to translate an isolated measure of strength performance of a group of muscles on an Isokinetic test

dynamometers into an estimate of overall function. Reference was made to both open kinetic chain Isokinetic assessment (angular testing) and closed kinetic chain assessment (linear testing). Reference was made to recent studies looking at the comparison of functional testing with angular and linear Isokinetic testing to determine their relationship to functional performance. Neither linear nor angular Isokinetic strength measurements correlated highly with functional testing. Our current understanding suggests that strength is a prerequisite of function, Isokinetic strength testing allows for specific measurement or persisting strength deficits following injury leading to a more accurate evaluation of factors which limit function.

Isokinetic in injury rehabilitation, it is firmly recognised that Isokinetic evaluation is a standard tool for muscular strength evaluation. The major advantage of Isokinetic evaluation is that it allows for early strength evaluation prior to the injured athlete being able to undertake functional testing. Isokinetic testing allows for identification and quantification of physical strength impairments that cause functional limitations.

Reference was made to a study carried out with Mr. James Colville of Cappagh Orthopaedic Hospital, Dublin and Dr. Marie-Elaine Grant evaluating shoulder muscle performance following capsulo-labral reconstruction for anterior instability. Studies involved assessing twenty-five dominant shoulders at 4 ~ 6 months after surgical stabilisation. It was concluded that Isokinetic Evaluation was of value in identifying and quantifying strength deficits which limit shoulder function resulting in a performance deficit. Test results showed that the greater persisting deficit at 4 ~ 6 months following surgical stabilisation were of the external rotators which showed a persisting 20% deficit followed by the abductors which showed an 18% strength deficit.

Future developments in the application of Isokinetics in injury rehabilitation is a constantly evolving medical science both of improved methods of treating many musculo-skeletal conditions. Eccentric exercises and the rehabilitation of tendinopathy has made very significant scientific milestones in terms of the validity of eccentric exercises tools to resolve tendonopathy. There are several recent studies over the past three years which have concluded positive effects of eccentric exercises in athletes suffering from tendonopathy. Athletes showed a 50 ~ 70% chance of improvement in function and pain and that athletes showed they could return to their pre-injury level of sporting activity. Other methods of recognised treatment such sclerosing therapy, injection therapy and surgical treatment showed no advantage compared to eccentric exercises. Tendons suitable for treatment with Isokinetic eccentric exercises were discussed and identified. The reactive tendon (the acutely contused tendon), which requires decrease load. Eccentric Isokinetic exercise is not recommended for these tendons. Tendon disrepair / failed healing tendon when they are in the chronic phase responded very positively to high tendon load; these tendons are highly suitable for Isokinetic eccentric exercises. Degenerative tendons can be rehabilitated with great caution. Areas of failed healing and degeneration within the tendon subject these tendons to the likelihood of rupture. These tendons should be treated with conservative Isokinetic eccentric exercise protocols.

Advantages of using Isokinetic eccentric exercises were identified:

Isokinetic eccentric exercise:

- Maintains a preset speed at a constant velocity.
- Permanent resisted adaptation provides an inherent safety mechanism with pre-set torque limits.
- During rehabilitation instantaneous torque measurement and screen feedback offers the patient the opportunity to adjust the pre-determined contraction intensity avoiding overload.
- Exercise bouts are performed through a constant range of motion.
- Passive motion can be used to return to the start position instead of the concentric loading phase.

Evidence based studies have been done on eccentric rehabilitation for tendonopathy. One study has been identified using Isokinetic eccentric exercises only in the treatment of thirty-four patients with tendonopathy. These patients were treated with 20 ~ 30 sessions of eccentric Isokinetic rehabilitation with progressive increase in load and speed. The results showed that 74% were completely relieved of their symptoms with return to full function. Peak torque symmetry was gained between the involved and non-involved side. US scan showed recovery of homogenous tendon structure.

Moving forwards new Isokinetic protocols should be considered, evidence based home program eccentric exercise regimes have concentrated on standard training three times daily using a slow eccentric exercises holding for 3 ~ 5 seconds. Isokinetic rehabilitation allows for a window of protocols which may ensure more rapid tendon recovery primarily by considering reduction of repetitions and increasing load and speed ensuring the safe high tendon load to facilitate recovery.

Isokinetic eccentric testing protocols were also discussed, the literature generally agrees that the patient/athlete should not receive feedback during testing, rather encouragement should be given. Bilateral Isokinetic eccentric measurements are not given prior to initiation of treatment. Estimation of the contraction intensity for eccentric exercises are evaluated on the contra-lateral healthy side. At the end of treatment both sides are assessed and bilateral asymmetries are calculated from peak torque and total work values.

Isokinetic eccentric rehabilitation protocols should be based on three parameters:

- Length – some athletes experience pain for maximal length of the muscle tendon reached, mechanical stops gradually allow the athlete to progress to full range of motion with less pain.
- Load – sub-maximal Isokinetic repetitions precede each session, start with a low loading (30% of max eccentric torque of the uninvolved side) and progressed as tolerated. After each eccentric contraction return to the articular start position passively.
- Speed – increased tension to load can be achieved by working at faster speeds.

Following Isokinetic eccentric exercise protocols expected response at 6 ~ 12 weeks for athletes/sportsmen with tendon disrepair are as follows:

- Improvement in the function, there is general consensus that return to modified sport is achieved by 12 weeks. Significant reduction in pain (visual analogue scale). Improvement in the Balinza Scale.
- Increased Isokinetic eccentric and concentric strength values together with symmetry between the involved and non-involved sides is usually identified.

Summary

The evidence based research shows that many hurdles have been overcome with respect to the use of clinical Isokinetic rehabilitation of injury. It is clearly established that injury rehabilitation using Isokinetic dynamometry is strongly supported by evidence based research.

It has been identified that we need to continue to move forward by further improving our knowledge in the application of Isokinetic evaluation and rehabilitation of injury supporting this by evidence based research.

There is a need to remain aware of new findings in medical science and apply these appropriately and creatively to our use of Isokinetic evaluation and rehabilitation following injury.

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