FUTURISTIC ROLE OF ISOKINETIC IN DIFFERENT ASPECTS OF REHABILITATION IN DIABETIC PATIENT: - A HOLISTIC APPROACH.

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I. ABSTRACT

There is sufficient evidence that people with diabetes have significantly reduced maximal muscle power in their lower limbs compared to healthy controls. The muscular strength of the knee flexor and extensor was reported to have decreased by 17% and 14%, respectively, by the authors. A decrease in walking activity has also been associated with neuropathy and weaker muscles, which can also result in balance impairment and inadequate gait control. People with DM are more likely to fall because of deteriorating sensory capacity and the significance of Sensory inputs from the periphery in modulating the stability of gait. Because of the aforementioned, it is essential to assess a patient's strength to ascertain how effectively they are controlling their diabetes.

II. INTRODUCTION

The neuromuscular system in humans is responsible for controlling movement. The neuromuscular system transmits neural impulses to muscle fibers through motor unit activation, which causes muscle contraction and force production [1]. It is good knowledge that the condition known as the development of Diabetes Mellitus (DM) is a chronic illness that can develop at various times throughout a person's life [2]. Diabetes is now recognized as a multifaceted and heterogeneous disease that can affect people at various stages of life [3]. People with DM may also have impaired lower extremity muscle power and experience frequent fatigue, which impairs their propensity to move and may cause coordination deficits. According to recent studies, skeletal muscle damage is common in elderly diabetic individuals, resulting in decreased Physical efficiency and Muscle power. The main biological reasons hypothesized to contribute to muscular weakness in diabetics include resistance to insulin, high blood sugar levels, skeletal adipose intrusion, and neuropathies of the peripheral nervous system [4,5]. Muscular strength can deteriorate as a result of some biological DM-related factors, including resistance to insulin, high blood sugar levels, muscular fat intrusion, and cellular oxidative stress. Diabetes, a common metabolic disorder, is a major contributor to functional impairment, a loss of independence, and reduced mobility in individuals. Functional impairment and Disability have a complex and multifaceted etiology. Cardiovascular illness, radicular neuropathy, obesity, osteoarthritis, visual deficits, and cognitive dysfunction are a few possible pathways that may be involved; all of these conditions are more prevalent in people with diabetes [6,7].

Muscle injuries and other conditions that limit movement and physical activity can be treated using isokinetic therapy. Utilizing isokinetic devices, which enable consistent speeds and torque to be applied to musculature is how this method works [7,8]. By allowing patients to exercise safely and at a controlled intensity, it has been shown to be helpful in the rehabilitation of injuries by stimulating the recovery of muscle strength and endurance. This strategy can also assist those who are physically challenged or have inactive lifestyles to prevent muscular atrophy and muscle loss [8].

Physical therapists routinely utilize isokinetic exercise to strengthen particular muscles in patients recuperating from injuries. Its benefits include regulated resistance, quickness to lower the danger of harm, and experiencing barriers across a joint's whole range of motion [9]. Others, such as physiotherapists, can carefully track the development of an individual. Previous studies have shown that isokinetic workouts have a greater impact on exercising than static and neutral workouts for enhancing functional performance [8, 9]. In sports, exercise, and medical situations, an Isokinetic (Biodex)dynamometer is used to measure the torque, power, and strength of muscles. The apparatus adapts to different velocity and ranges of movement and allows for the exact

examination of different joints and muscle groups. A thorough analysis that contrasts the right and wrong answers is made possible by isolating the joint of interest [8,11].

III. RECENT EVIDENCE: -

a. *Effects of isokinetic exercise on chronic low back pain in terms of radiography and inflammation*.

The requirements for participation in the study, the department's sports therapist analyses those involved. Before isokinetic training, the IKT group's participants were instructed to warm up for five minutes and then slowly stretch their back extensors and flexors. The individual is instructed to stand vertically in the isokinetic dynamometer (Biodex Corporation, New York). Participants in the CST group underwent the use of the Swiss ball for balance training of their core muscles from Fitness World in Italy. The Togo rules were used to determine the ball's size [12].

b. Adolescents with Cerebral Palsy Receiving Intensive Rehabilitation Alongside a Non-functional Isokinetic Strengthening Program

The review evaluated the impacts of a thorough recovery program combined with an isokinetic moderate fortifying project on walk measurements, strong strength, spasticity, and joint position sense. The same intensive therapy was provided to both groups, since knee flexors and extensors were said to be reliable markers of the strength of all lower limb muscles, it was determined to measure and strengthen them. Strength training programs were developed and evaluated on kids with spastic diplegia. Aye et al. discovered gains in muscle strength, gait characteristics, and Gross motor function measure (GMFM) following a strength training program for the hip and knee. The findings of this study assisted in determining if an isokinetic knee flexor and extensor strength training program was beneficial in improving gait traits, muscle strength, spasticity, and joint position perception in adolescents with spastic diplegia. This clinical experiment was predicted to have favorable findings. If so, isokinetic strength training programs should have been considered as an additional treatment for CP patients [13].

c. *Contrasting treatment with the isokinetic program and Resistant-Band strengthening exercises in individuals with impairment of the ankle.*

Participants who have unilateral impaired ankle stability were included based on the inclusion and exclusion criteria, they all complied with the International Ankle Consortium's diagnostic criteria for persistent Instability of the ankle. Prior to training, each subject received assessments of dynamic balance and isokinetic muscular strength with a CAIT score. Both the IST and TBT groups engaged in muscle-strengthening activities in three sessions each week over a six-weeks.
Isokinetic muscular strengthening for six weeks gave favorable results as compared to Resistant-Band with a gradual resistance program to improve impairment in FAI patients. [14].

d. Impact of a six-week strength-training protocol on diabetes type 2 diabetes mellitus patients' neuromuscular performance.

This study included 13 patients with T2DM individuals between the ages of 40 and 60. An endocrinologist had identified T2DM in each subject 4–10 years earlier. For diabetic management, all patients took oral medicines. All subjects had fasting blood sugars between 100 and 150 milligrams per decilitre (milligram/deciliter), A test for oral glucose tolerance (OGTT) score of greater than 200 milligrams per decilitre and hemoglobin that has been glycated levels between 7 and 9 percent. On the Michigan questionnaire, each participant received a score between 4 and 7. There was no prior history of smoking, drinking, or drug use. Participants who quit the exercise and testing or stopped the training regimen were not included in the study those who used medication. All individuals completed a strength-training regimen incorporating the calf, hip abductors, and adductors over the course of six weeks on three different days. Before and after each training session, blood pressure and blood glucose levels were recorded and heart rate was measured while exercising [15].

IV. TESTING AND TRAINING WITH ISOKINETIC: -

Isokinetic accurately measures the muscular forces in rehabilitation to provide optimal loading of the muscles. Isokinetic testing and training are essential components of the thorough assessment and care of diverse joints. This type of exercise provides objective, solitary joint assessment and training. The thorough assessment and rehabilitation of the patient with diabetes mellitus include isokinetic training and testing as key components.

A. **Factors that influence measurement**: -

When using isokinetic for testing and training, as well as when creating programs to improve performance, the following elements should be taken into consideration:

- **Subject-related factors: -** Due to the individuality of each person, testing and training will each produce a different set of results. The following research findings and subject-related considerations should be kept in mind by the examiner**.**

- **Age: -** The most important influence is a decrease in the activity level, torque, work, or power decreases with increasing age.
- **Gender: -** When individuals are matched for age and activity level, male subjects produce forces that are often greater than those produced by female ones.
- **Limb dominance: -** Consider the dominant limb and sports activity where the unilateral limb is dominant which affect testing and interpretation.
- **Joint angle: -** The ability of isokinetic to accommodate resistance, which allows for maximum dynamic loading across the range of motion, is one of its distinctive features.
- **Muscle Action: -** In contrast to concentric muscle activities, where only the contractile unit can contribute to force formation**,** eccentric muscle actions result in greater force production since both contractile and non-contractile tissue (elastic components) are involved**.**

B. **Components of testing protocols:**

Basic mechanics should be developed and followed when testing. Examples of some are described below.

- **Test Speed: -**The examiner decides which speeds will yield the most important information before choosing a test speed, or angular velocity. At slower speeds, individuals will be quite strong, but at faster speeds, they will not be able to produce the force quickly. Following these results, one might customize a strength and conditioning program based on the test results.
- **Test Repetition: -**Depending on the test's objectives, the number of repetitions will vary. If one is analysing peak torque, researchers advise that a person execute at least five repetitions and that test data not be taken from the first repetition. Fewer repetitions (10) are used to assess muscular power, whereas higher repetitions (i.e., >20) are utilized to assess a muscle group's capacity for muscular endurance.
- **Rest Intervals During Testing**: -Optimum rest interval should be 90 seconds if the power profile testing is performed the interval recommended is 3 minutes.
- **Consistent Evaluation: -** Giving subject feedback in any form—verbal, visual, etc.—has been shown to improve performance. Therefore, when administering the test, the examiner should be consistent about whether or not to provide feedback. This is especially crucial when follow-up testing will be done rather than a single screening.
- **Test Situation: -**The subject's position has an impact on how well muscles work. If at all possible, the subject should be placed as close to the postures used for sporting performance. We must be aware that changing the subject's position affects things like the relationship between muscle length and tension and the kinaesthetic input to the joint.
- **Joint-Specific Instructions: -**The movement's direction and functional testing, such as examining eccentric/concentric ratios.
- **Testing the Uninvolved Side First: -**First, test the uninvolved side. First, evaluating the side that isn't involved is crucial for two reasons. First, it lessens any fear by enabling the patient to comprehend and carry out the required movement. It also offers information for bilateral comparison, unilateral ratios, and similar calculations.
- **Limits on the minimum and maximum force or torque**: -Based on the specific subjects tested, the examiner sets these restrictions. In general, the maximum limits of the isokinetic dynamometer threshold would likely be required and desired for human performance assessment.
- **Knowledge and Experience of the Tester: -**Because there are so many variables that might affect a test's outcome, such as proper positioning and stability, different computer settings, and subject response, its testers must perform the exam**.**

C. **Procedure: -**

The Biodex isokinetic dynamometer was used to measure the hip joint's muscle strength.

a) **Hip** - Abduction/Adduction:

Standardized position:

- In order to optimize participants' stability and reduce compensating processes during the Hip adduction-abduction, we designed a novel setting. (Figure 1).
- To ensure full extension of the knee during testing and to avoid pelvic rotation, a brace was employed to secure the tested leg. It was secured to the dynamometer pad at the joint level of the femur.
- To reduce spine and lumbar rotation while being examined, place participants on a backrest in a side-lying posture and allow them to grab the grip in front of them.
- During isokinetic testing, the hip joint's initial positions were 0° of flexion and complete adduction.
- The non-testing knee and hip secured to the dynamometer chair while flexed to 45 degrees and 60 degrees, respectively, for comfort and stability.
- The tested leg is strap-adjustable and situated at 75% of the femur's length, close to the knee joint.
- To adapt to the protocol, individuals were directed to perform 3 submaximal repetitions at the linear pace.
- Between both velocity conditions, interval should be one minute.

- Five Isokinetic concentric/concentric repetitions at a fast rate (120°/s), three repetitions at a slow rate (60°/s) are then performed.
- An appropriate rest interval (up to 5 minutes) was also provided to participants in between each different muscle group assessed.

b) **Hip-**Flexion/Extension: -

Standardized position:

- Position: sitting in the lying down position, flat on the chair back. (Figure 2).
- The tested hip had a flexion inclination of 0° with the knee bent to 90 degrees.
- The rectus femoris or Tensor Fascia Lata muscle lengths during hip flexion were standardized using the brace.
- At the femur level, the thigh tested was anchored to the dynamometer pads.
- The shank was not fixed, and the non-examined leg was fastened to the dynamometer chair without any pelvic movement. The straps held the lower body and trunk to the dynamometer chair.
- The tested leg is strap-adjustable and situated at 75% of the femur's length, close to the knee joint.
- Participants were told to finish three submaximal sessions at the same pace in order to adjust to the test protocol.
- Perform three isokinetic concentric/concentric repetitions at a low velocity (60 degree per second), followed by five repetitions at a high speed (120 degree per second).
- Between subsequent velocity conditions, interval should be one minute.
- An appropriate rest interval (up to 5 minutes) was also provided to participants in between each different muscle group assessed.

FIGURE: -1

FIGURE: - 2

c) **KNEE: -Flexion-Extension**

<u>Positioned on the isokinetic dynamometer –</u>

- The motor axis is appropriately stabilized at the trunk, pelvic waist, and thigh levels, and it is visually aligned with the knee joint axis. (De Paula Lima et al., 2019).
- 3 cm above the tibial malleolus was where the lever arm was positioned for the lower limb test. (De Mendonca et al., 2017).
- The control of the isokinetic device, which aims to correct the peak torque values in the knee flexion and extension movements brought on by gravity, also served to determine the weight of the limb being tested. (Hannon et al., 2019).

Concentric Isokinetic Strength Assessments

Assessment	Setup	Positioning
Knee flexion – extension 	Dynamometer Orientation: 90° Dynamometer Tilt: 0° Seat Orientation: 90° Seatback Tilt: 85° Axis of Rotation: through the lateral femoral condyle on a sagittal plane. Knee attachment proximal to medial malleoli. Range of motion is set. Ready Position: Full Flexion	Comfortable sitting position. Good alignment upper body, pelvis and lower legs. Tested leg fixated above the knee. Straps around the chest and arms crossed to avoid compensatory movements.
Hip flexion – extension 	Dynamometer Orientation: 0° Dynamometer Tilt: 0° Seat Orientation: 0° Seatback Tilt: Fully Reclined Axis of Rotation: superior and anterior to greater trochanter when limb is in neutral position. Range of motion is set. Ready Positon: Neutral Extension	Comfortable position. Good alignment upper body, pelvis and lower legs. Non-tested leg fixated on chair. Straps around the chest and arms crossed to avoid compensatory movements.
Hip abduction – adduction 	Dynamometer Orientation: 0° Dynamometer Tilt: 0° Seat Orientation: 0° Seatback Tilt: Fully Reclined Axis of Rotation: superior and medial to greater trochanter. Hip attachment proximal to the knee. Range of motion is set. Ready Position: Full Adduction	Comfortable position. Good alignment upper body, pelvis and lower legs using a backrest. Non-tested leg fixated on chair. Arms crossed to avoid compensatory movements.

FIGURE: - 3

D. **Data analysis: -**

Isokinetic data can be analysed and interpreted in a variety of ways, and then used as the foundation for creating or making changes to an exercise program for conditioning or performance improvement [16].

TABLE: - 1

Measure	Denotation
Maximal torque	The maximum torque is defined as the number of repetitions.
Mean Maximal torque	The average of the maximal torque calculated.
Angle-fixed torque	The torque during a particular range in the spectrum of movement.
The time rate at which torque develops (TRTD) to its maximum torque	The lapse between the torque production and it's maximal.
The speed at which torque develops over time until a set time	Torque developed at a specific period can be measured quantitatively by the maximum torque at the moment (typically 0.2 sec) or qualitatively by the inclination of the torque curve.
The speed at which a given ROM develops torque	Time to achieve a fixed mark in particular ROM.
TAE-Torque Acceleration Energy	Work completed in the initial 0.125 second.
RIT-Reciprocal Innervation Time	Agonistic torque production quits and is replaced with oppositional tension release.
Torque perish rate	The torque curve's downslope; that is, its downward trajectory remains straight or convex., but concavity indicates difficulties generating torque toward the ROM's conclusion.
Total work	The area under the torque-angular position curve.
Work fatigue	Work produced in the 1st 3rd of a set is divided by work produced in the last 3rd of a set; at least 15 to 40 repetitions should be accomplished.
CV, or coefficient of variation	ROM divides the average torque value for the set by the number of repetitions in the set to determine the mean difference in torque. It serves as evidence of consistent effort across a set of repeats. Experimentally, 10% is advised.
Qualitative scrutiny	The evaluation of the torque curve by a physician/physiotherapist shows specific impairments.

E. **Advantages: -**

- Provides reliable, unbiased proof of the functionality of dynamic muscles
- A dynamically tense muscle should be loaded as efficiently as possible at all locations along its entire range of movement.
- A muscle can be worked to its full potential across its whole spectrum of motion with the ideal friction.
- Muscle groups can be separated for research and treatment.
- Free from discomfort and fatigue
- Compatibility with other functional tests
- Following intensive isokinetic training, after a workout delayed-onset pain in the muscle is minimal.
- Practice moving over a velocity spectrum at various angular velocities.
- Due to the specificity of training, exercising at higher intensities and quicker angular velocities can engage
- Fast-twitch muscle fibers, which are essential for carrying out functional activities, can be activated by faster angular velocities. Athletic performance and fitness level are improved via increased functioning of the muscles, force management rate, torque management time, torque boosting energy, and force development rate.
- According to Bernoulli's principle, when an outer layer (articulating cartilage) moves across fluid (articular fluid) at a lesser angular velocity, there are fewer compressive stresses on the surface. A hemodynamic overflow to lesser orbital velocities occurs with isokinetic aversion at a rate of 30 degrees/second.
- Range of motion exercises with short arcs have a 30° to 40° overflow
- To keep the patient engaged during exercise, real-time feedback is given.
- Computerized feedback enhances the accuracy of torque control.

F. **Limitations: -**

- Testing and training are specific for muscle groups.
- Ineffective movement patterns.
- Insufficient speeds to accurately imitate the speeds of athletic performance.
- At slower speeds, higher joint compressive forces
- Using the entire range of movement during testing or recovery may result in enhanced translation.

G. **Contraindications: -**

- Absolute contraindications: -
- Bruised muscles and tendons
- Acute sprains of the ligament or capsule
- Damage to soft tissues
- Acute pain
- Small ROM
- Extreme effusion
- Unstable joints
- Relative contraindications: -
- Mild muscular sprains
- Subacute sprains of the ligaments or the capsule
- ROM restriction in some areas and joint laxity
- Pain

V. APPLICATION OF ISOKINETIC IN REHABILITATION

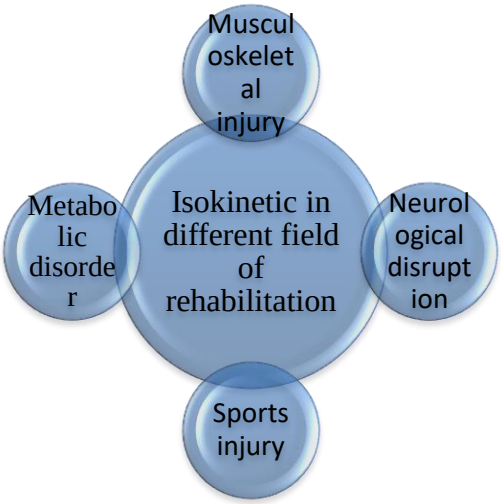

FIGURE: - 4

Isokinetic Rehabilitation Protocol [17]: -

EXERCISE	INTERPRETATION
• Multiple range isometrics: sub-maximal intensity	The condition of the patient determines the appropriate angles. In order to prevent extra pressure, angles between 90° and 30° are initially employed. The angles are determined by symptoms if the patient has patellofemoral issues. During the first stages of therapy, this typically represents between 30% and 60% of MVC.
• Short-arc (ROM) isokinetic: submaximal intensity	When the full range of motion is unsafe and starting dynamic activities is not unsafe, short-arc exercises are employed to improve dynamic muscles. begin between 90° and 30°. Reduce the magnitude of free limb acceleration by using medium angular velocities (60°–180°/s). Avoid rotational velocities below 60°/s to prevent pain, excessively sluggish motor patterns, and higher joint compressive stresses. Angular velocities measured in increments of 30 degrees per second conduct employed due to the physical overload and impact of strengthening.
• Complete Range of Motion isokinetic: suboptimal strength	With no contraindications to consider (for example, factors that hinder the healing of soft tissues with an Anterior Cruciate Ligament -R), Full Range of Motion dynamic isokinetic exercises can be performed. In order to produce physiologic overflow at slower rates, incremental velocities of 30° per second may be utilized. The majority of velocity-specific increases in isokinetic strength (110).
• Plyometrics	Plyometric exercises help athletes build the explosive power needed for most sports. Start with simple hopping and jumping activities, then proceed to box jump drills, and then final drills that mimic the movement patterns of particular sports.

• Functional specificity exercises	Most multiplanar, high-speed reactionary drills are difficult to replicate in a clinical setting. The return to sports practice circumstances at this phase of the recovery program must be controlled and gradual. Increase your movement patterns' specificity, responsiveness, and intensity to prepare for a complete return to athletics.

VI. CORRELATION BETWEEN ISOKINETIC TRAINING AND FUNCTIONAL PERFORMANCE

The ability to conduct daily activities without delay or suffering is referred to as FUNCTIONAL PERFORMANCE.

- Experimenters have explored the outcomes of isokinetic exercise among individuals with hemiplegia following cerebral vascular infarct, ACL injury, and numerous other neurological and musculoskeletal conditions over the once many decades. The maturity of studies set up that isokinetic exercise improves muscle strength, function, walking capability, and quality of life (18).
- This current study by I. Poulis et al. 2023, provides an association between operational effort and isokinetic muscular strength, one year after TKR surgery, to assess the correlation between maximum isokinetic strength of the knee and functional exertion 12 months post-surgery. The study included 15 cases who had been treated for first-line unilaterally TKA and were examined at least one year later (19). An electromechanical dynamometer, the Biodex System 3 pro (Biodex Systems, Inc, Corporation, Shirley, NY), was used to measure the isokinetic necklace of the quadriceps and hamstring muscles in the active and inactive legs in gyration speed 60 ° per sec and 180 °per sec Maximum extensor strength had a strong correlation with functional performance at both isokinetic rapidity. Measuring knee extensor strength is an important tool for assessing and establishing mileposts in TKA recuperation (19).
- This 2023 case report by Karen Obara et al., The purpose of an Isokinetic exercise regimen to improve endurance and muscle performance among a person with a partially meniscus tear is to characterize the impact of isokinetic and sensorimotor training regimens on musculoskeletal strength and fitness . A 40-year-old person hurt his right knee during a football game, and an MRI demonstrated significant meniscal injury(20). He was trained with an isokinetic program along with proprioception exercises (11 weeks, 22 sessions) to amend strength and performance, tested pre and post treatment, as well as a half month follow-up. The Biodex- 4 system in concentric mode was used to estimate muscle functioning of the knee flexors and extensors at an angular velocity of 60, 120, and 300 °/s. post-intervention, bettered knee flexor, and extensor muscle exertion, which was achieved (or continued to ameliorate) at six months of follow-up. (20).
- The study by Dallas et al. 2021, benefits of 10-week involving isokinetic exercises on muscular strength and fitness in juvenile gymnasts aimed to determine isokinetic benefits on muscle strength and fitness, combined with conventional training among preadolescent gymnasts (21). The maximum strength of the knee joint at extension was measured with a Cybex II isokinetic dynamometer at velocities of 60°/ s and 300°/s. Subjects were divided into two groups and trained for ten weeks for a duration of two hours per week distributed over three non-consecutive days each week. The experimental group was given technical training (specialized training and muscular strength through Cybex II), while a control group was administered a muscle strengthening program only. The result was favourable towards the experimental group with bettered knee, and jumping factors (21).
- A randomized controlled study by Kerim et al. 2021, Efficacy of isokinetic programme of the upper extremities in post-stroke hemiplegia. The research focused to probe the efficacy of isokinetic activity on hemiplegia cases post-stroke. All the cases were aimlessly assigned. The experimental group entered isokinetic training as well as wrist and triceps muscle strengthening exercises for four weeks (3 days/week, total of 12 sessions) via an isokinetic dynamometer (HUMAC 2009), while control group was given individual using fitness bands to add strength (22). The findings stated that: -
  I) Post-intervention, the isokinetic program redounded in a lesser enhancement of maximum Extn torque (at 60°/ sec) and loftiest extensor isometric force than the strengthening program at resident and ii) lesser enhancement in upper extremity disability in the isokinetic exercise group at the end of eight weeks (22).
- Gopal Nambi et al. In 2020, conducted a randomized controlled trial, back exercise using isokinetics was more beneficial than introductory stability programme in terms of discomfort level and athletic performance in football players with prolonged LBP The impact of IKT and CST on athletic performance in council football players with chronic LBP (23).. On a Biodex Corporation, NY isometric dynamometer with high peak torque, isokinetic training was performed at different angular velocities similar to 60, 90, and 120 degrees/s. training using elevated peak torque at various velocity angles improves core strength and flexion/ extension rate in athletes. According to the results, strength training with the IKT protocol bettered pain and athletic performance compared to CST or other traditional training for council football players. In patients with LBP, an IKT program in recuperation should be included to get a salutary effect on pain intensity and performance (23).
- The 2018 study by Shelley et al, the isokinetic program versus conventional program in cases with chronic stroke, delved into whether isokinetic training could ameliorate muscle strength, Hemiplegic knee, functional mobility, and

physical exertion, and its effect on long-term spasticity stroke survivors (24). The results demonstrated that a short-term isokinetic program for stroke survivors could lead to increased strength and walking speed without associated changes in muscle tone. Physical exertion has great cerebral benefits (24,25).

VII. CONCLUSION

This study has some detailed shreds of evidence regarding isokinetic training, exercises, and their utilities in various musculoskeletal and neuromuscular conditions. Isokinetic training is a good alternative to traditional techniques for all musculoskeletal conditions. If incorporated into a rehabilitation muscle conditioning program, use a staged approach, starting with lower-intensity isokinetic exercises followed by progressive difficulty isokinetic training [26,27].

VIII. SUMMARIZATION

This chapter explores the future significance of Isokinetic assessment and in numerous aspects of rehabilitation in the physiotherapy vision. It highlights the significance of complete testing and training to enhance muscular strength and function, which is essential for diabetics to aid in physical function. Muscle strengthening can improve insulin sensitivity and glucose metabolism. When coupled with other activities, isokinetic training enhances balance and coordination. Isokinetic exercise improves muscle strength by rendering the muscles more contractile. Thus, the variables that increase muscular strength are neuronal and hypertrophic factors, which build muscular strength during the early phases of the Isokinetic resistance training program and gradually dominate neurons to attain strength.

IX. REFERENCES

[1] Moritani T Muscle strength, power, and motor task acquisition are accompanied by neuromuscular adaptations. J Biomech.1993;26(Sup 1):95–107

[2] The Lancet. Diabetes: A dynamic disease. Lancet 2017, 389, 2163.

[3] Andersen, H. Diabetic motor dysfunction. Diabetes Meta-Research Reviews, 2012, 28 (Suppl. S1), 89–92.

[4] Individuals with diabetes who have type 2 diabetes may lose muscle strength as a result of aging, physical exercise, and diabetic complications.. Nomura, T.; Kawai, T.; Kataoka, H.; Ikeda, Y. Phys. Ther. Res. 2018, 21, 33–38.

[5] Park, S.W.; Goodpaster, B.H.; Stormier, E.S.; Kuller, L.H.; Boudreau, R.; Kammerer, C.; de Reenie, N.; Harris, T.B.; Schwartz.; Talansky, F.A.; et al. The health, age, and body composition study: Increased loss of skeletal muscle strength in older people with diabetes of the type 2 variety. Diabetes Management 2007, 30, 1507–1512.

[6] Bianchi, L.; Volpato, S. Musculoskeletal degeneration in type 2 diabetes poses a serious danger to the patient's mobility and autonomy.Acta Diabolo. 2016, 53, 879–889.

[7] Tsutsui, H.; Kinugawa, S.; Matsushima, S.; Yokota, T. Diabetes-related cardiac and skeletal muscle deterioration is associated with oxidative stress.. J. Clin. Beachem. Nutra. 2011, 48, 68–71.

[8] Peñaloza-González JA, González-Mejía S, García-Melo JI. Development of an Isokinetic Device Control Approach for Physical Training. Sensors. 2023 Jun 22;23(13):5827.

[9] Tovar-Cuevas, J.R.; Mutes, J.D.; Mora, G.Q.; Romero, A.P.; García-Melo, J.I. the development of an information system for online care services for physical rehabilitation. The pilot case consists of patients with minor knee injuries who live in vulnerable areas.Dyna 2018, 85, 284–293.

[10] Ovalle, O.R.; Melo, J.I.G.; Chaux, J.F.C. Synchronized telerehabilitation care in rural zones supported by teleoperated technological aids: Application to a Colombian case. *Investing. Innovation Ing.* **2022**, *10*, 162–177.

[11] Parrington, L.; Ball, K. Biomechanical Considerations of Laterality in Sport. In *Laterality in Sports*; Elsevier: Amsterdam, The Netherlands, 2016; pp. 279–308.

[12] Nambi G, Abdelbaset WK, Albay SF, Mowat SA, Verma A, Saleh AK, Atalla NN. Isokinetic training–its radiographic and inflammatory effects on chronic low back pain: A randomized controlled trial. Medicine. 2020 Dec 12;99(51).

[13] Kwon HY, Kim BJ. The effects of task-specific movement patterns during resistance training on cardiopulmonary functions and abdominal muscular thickness in children with cerebral palsy: a crossover, placebo-controlled double-blind clinical experiment. Physical Therapy Science is a peer-reviewed journal. 2018;30(8):1073-80.

[14] Wang B, Zhang X, Zhu F, Zhu W, Wang X, Jia F, Chen W, Zhang M. A randomized controlled trial comparing rehabilitation with isokinetic exercises and Thera-Band strength training in patients with functional ankle instability. Plops one. 2022 Dec 1;17(12): e0278284.

[15] Shahrjerdi S, Barleymeal F, Svedberg HH, Mohajeri-Tehrani MR. Effect of a 6-week strength-training program on neuromuscular efficiency in type 2 diabetes mellitus patients. Diabetology international. 2020 Oct; 11:376-82.

[16] Davies GJ (1984) A collection of isokinetics in therapeutic use, 1st end. S & S Publishers, Lacrosse, WI

[17] Bolz S, Davies GJ (1984) Differences in leg length and their relationship to overall leg strength. Journal of Orthopedic Sports Physical Therapy 6(2):123–129

[18] Park JH, Shin JH, Lee H, Rho J, Park HS. Isokinetic exercise after an ischemic attacks: changes in intermuscular coordination and their implications for neurorehabilitation. Neuro Engineering and Rehabilitation Journal. 2021 Dec; 18:1-7.

[19] Poulis I, Vases K, Kareli E, Chado's T, Chado's S, Kanellopoulos A. The relationship between isokinetic strength and functional performance 12 months after total knee arthroplasty. Archives of Hellenic Medicine/Area Elle Nikes IA trikes. 2017 May 1;34(3).

[20] Obara K, Silva P, Silva M, Mendes F, Santiago G, Oliveira I, Cardoso J. Isokinetic Training Program to Improve the Physical Function and Muscular Performance of an Individual with Partial Injury of the Medial Meniscus: A Case Report. International Journal of Sports Physical Therapy. 2023 Jun 2;18(3):758-68.

[21] Dallas GC, Dallas C, Mariachi M. The Effect Of 10-Week Isokinetic Training on Muscle Strength and Gymnastic Performance in Preadolescent Female Gymnast. Science of Gymnastics Journal. 2021 Oct 1;13(3):399-409.

[22] Kerimov K, Benday IC, Ozdemir C, Guasti O. The effects of upper extremity isokinetic strengthening in post-stroke hemiplegia: a randomized controlled trial. Journal of Stroke and Cerebrovascular Diseases. 2021 Jun 1;30(6):105729.

[23] Nambi G, Abdelbaset WK, Alqahtani BA, Agrawal SM, Anodonta AM, Saleh AK. A randomized controlled research found that isokinetic back training is more helpful than core stability training for pain intensity and sports performance in football players with chronic low back pain. Medicine. 2020 May 5;99(21).

[24] Corian F, Jourdan C, Bakhti K, Player C, Assent A, Picot MC, Mottet D, Julia M, Bonnin HY, Laffont I. A randomized controlled trial of upper-body isokinetic strengthening versus passive mobilization in individuals with chronic stroke. Physical Medicine and Rehabilitation Archives. 2018 Feb 1;99(2):321-8.

[25] Baramulla M, Akman MN, Klink S, Çetin N, Yavuz N, Esker R. Isokinetic assessment of trunk muscular strength in women suffering from persistent low-back pain. The American publication of Physical Medicine and Rehabilitation is a peer-reviewed medical publication.2001 Sep 1;80(9):650-5.

[26] Asada F, Nomura T, Tagami M, Kubota M, Ohashi M, Nomura M. Lower-limb muscle strength in relation to bodyweight and muscle mass in middle-aged type 2 diabetes patients without diabetic neuropathy. Physical Therapy Science Journal. 2017;29(7):1181-5.

[27] Nambi G, Abdelbaset WK, Agrawal SM, Albay SF, Anodonta AM, Saleh AK. A randomized controlled trial of virtual reality or isokinetic instruction regarding pain, necrophobia, and serum stress hormones in persistent low back pain. Health Care and Technology. 2021 Jan 1;29(1):155-66.