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ISOKINETIC EXERCISE TRAINING ON IMPROVEMENT IN MUSCULAR STRENGTH IN KNEE OSTEOARTHRITIS- A META-ANALYTIC REVIEW

NARESH BHASKAR RAJ[1], Dr. SOUMENDRA SAHA[2*], PROF. Dr. AMRAN BIN SHOKRI[3], Dr. SRILEKHA SAHA[4], PROF. Dr. ABDUL NAWFAR SADAGATULLAH[5], PROF. Dr. HAIRUL ANWAR HASHIM[6], PROF. Dr. MOHAMED SAAT ISMAIL[7] AND CHOO MORLEY LIZA[8]

[1] Lecturer, School of Rehabilitation Science, Universiti Sultan ZainalAbidin,
[2&4] Senior Lecturers, Exercise and Sport Science Programme, School of Health Sciences,
[3&5] Associate Professor, Department of Orthopaedics, School of Medical sciences,
[6] Associate Professor,Exercise and Sport Science Programme, School of Health Sciences,
[7] Program Chairman, Exercise and Sport Science Programme, School of Health Sciences,
[8] Masters Student & Physiotherapist, Exercise and Sport Science Programme, School of Health Sciences,
Universiti Sains Malaysia.

ABSTRACT

Osteoarthritis is a disease with destruction of cartilage and damage of the subchondral bone. The prevalence of osteoarthritis has been on the rise due to increase in the elderly population. Isokinetic training has been used to improve the strength of muscles and to measure the peak torque of muscle in normal individuals and in patients with orthopaedic crises. Isokinetic exercises are frequently used in the management of osteoarthritis of knee; however the true effect remains unknown. Therefore the objective of the review was to determine the magnitude of the effect of isokinetic training on strength in patients with osteoarthritis of knee. An extensive literature search was done on Web of Science, ProQuest, PubMed, Ebscohost, and CINAHL between 1990 and 2014. Ten articles measuring the effect of isokinetic training on osteoarthritis of knee were included and methodologically assessed. Data from the trials were extracted based on the demographic characteristics, outcomes measured, isokinetic training protocol and the other interventions used. Standardized effect sizes with 95%confidence interval (CIs) were calculated from the pre-intervention and post intervention means of the isokinetic training group and other intervention group. About five articles were analysed for improvement in strength. Pooled analysis of the results from the articles included favoured isokinetic training as a modality for improving strength. Isokinetic training was found to be beneficial in improving the strength of muscle in patients with osteoarthritis. Yet there is no definitive evidence to confirm the beneficial effects of isokinetic training on osteoarthritis of knee.

KEYWORDS: **Osteoarthritis, Isokinetic training, Quadriceps strength, Meta-analysis.**

Dr. SOUMENDRA SAHA
Senior Lecturers, Exercise and Sport Science Programme, School of Health Sciences
Universiti Sains Malaysia.

***Corresponding author**

INTRODUCTION

Osteoarthritis is a degenerative disease of the cartilage with an increasing prevalence among the elderly population. The prevalence of osteoarthritis in Malaysians approximately 5.93%.osteoarthritis of knee is the commonest form of arthritis.[1] Recent researches have showed that osteoarthritis of knee commonly affects people in the age group of 60 years but incidences are not uncommon at younger age group.[1] Two thirds of populations with osteoarthritis of knee are constituted by females. Cartilage volume, genetic susceptibility, quadriceps strength and oestrogen receptors in the cartilage are the possible aetiologies for the preponderance of females among the elderly population.[1] Osteoarthritis manifests itself with cartilage erosion and changes in the bone with sudden inflammation of synovial membrane.[2] Loading of the osteoarthritis inflicted joints will lead to increased inflammatory response, joint pain and swelling.[3] Regular strengthening of muscles and cycling or walking are beneficial to patients with osteoarthritis of knee .They have been found not to worsen the inflammation of joint.[4,5] Exercises improve the intra-articular chondro-protective biomarkers in the knee of osteoarthritic patients.[6] Isokinetic dynamometers are very commonly used in the domain of rehabilitation and training of athletes [7, 8]due to its high reliability in quantification of muscle function at constant velocity through the range of motion.[9] Isokinetic strength training is more effective than isometric and isotonic strength training in reducing the disability and in improving the gait and muscular strength in patients with osteoarthritis of knee.[10] Isokinetic exercises are considered to be safer in aging population , and for those with cardiac disorders as the increase in heart rate and blood pressure is smaller compared to isometric exercises.[11] In isokinetic exercise, a combined concentric – eccentric mode has produced better results in improving the functional outcomes of the osteoarthritic patients.[12] Several authors have used isokinetic training for patients with osteoarthritis of knee but till date there is no review to determine the efficacy of isokinetic strength training in patients with osteoarthritis of knee. The main objective of the review is to find out the effectiveness of isokinetic training in improving the strength of the knee musculature of patients with osteoarthritis of knee.

METHODS

Experimental approach to the problem

A thorough online search using Web of Science, ProQuest, PubMed, Ebscohost, CINAHL was performed to obtain articles publishes between 1990 and 2014.The search strategy consisted of terms *isokinetic training* OR *isokinetic exercise* OR *isokinetic strength training* AND *osteoarthritis of knee* OR *osteoarthrosis of knee* OR *knee osteoarthritis* OR *knee osteoarthrosis*. Cross-referencing of articles was done to identify any articles not found with the initial search. The PRISMA flow diagram shows the selection of articles is shown in Figure.1.

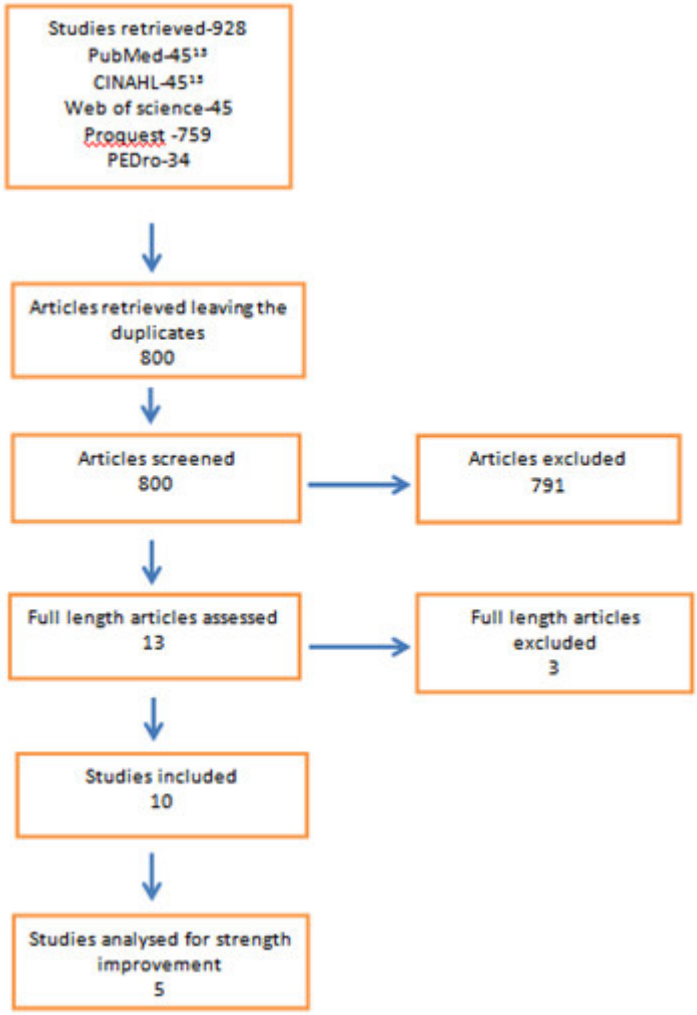


Figure 1
PRISMA flow diagram showing the selection of trials

Table 1
Methodological assessment of studies with Physiotherapy evidence Database (PEDro) scores

Study	1. Eligibility criteria?	2. Random allocation?	3. Concealed allocation?	4. BaselineSimilarity?	5. Blind participants?	6. Blinding therapists?	7. Blinding assessors?	8. Follow?	9. Intention to treat analysis?	10. Group comparison?	11. Point and variability?	Score
Akyol et al 2010[15]	Yes	Yes	Yes	Yes	No	No	No	Yes	Yes	Yes	Yes	8/11
Gur et al 2002[16]	Yes	Yes	No	Yes	No	No	No	Yes	Yes	Yes	Yes	7/11
Huang et al 2005[17]	Yes	Yes	Yes	Yes	No	No	Yes	Yes	Yes	Yes	Yes	9/11
Maurer et al 1999[18]	Yes	Yes	No	Yes	No	No	No	Yes	Yes	Yes	No	6/11
Rosa et al 2012[19]	Yes	No	No	Yes	No	No	No	Yes	Yes	Yes	Yes	6/11
Weng et al 2009[20]	Yes	Yes	Yes	Yes	No	No	Yes	Yes	Yes	Yes	Yes	9/11
Malas et al 2013[21]	Yes	Yes	No	Yes	No	No	No	Yes	Yes	Yes	Yes	7/11
Eyigor 2004[22]	Yes	Yes	No	Yes	No	No	No	Yes	Yes	Yes	Yes	7/11
Cetin et al 2008[23]	Yes	Yes	No	Yes	No	No	Yes	Yes	Yes	Yes	Yes	8/11
Huang et al 2003[24]	Yes	Yes	Yes	Yes	No	No	Yes	Yes	Yes	Yes	Yes	9/11
Score	10/10	9/10	4/10	10/10	0/10	0/10	4/10	10/10	10/10	10/10	9/10	6.9

Subjects

No subjects were used for this review. A complete description of the article included in the review is provided in Table.2

Table 2
Demographic characteristics and outcomes of included articles

Researcher	Diagnosis	Age	Population	Male/ female	Outcomes
Akyol et al 2010[15]	Knee osteoarthritis	56.60±8.13	40	0/20	VAS WOMAC 6 min walk dist. Muscle strength Quality of life, Depression
Gur et al 2002[16]	Knee osteoarthritis	55±12	23	NA	Functional capacity Knee pain Muscle strength –Peak torque
Huang et al 2005[17]	Knee osteoarthritis	62.0±8.4	120	25/95	Ambulation speed Lequesne index ROM, VAS, Peak Torque
Maurer et al 1999[18]	Knee osteoarthritis	66.4±8.8	113	66/47	VAS Strength Arthritis impact scale WOMACShort form 36
Rosa et al 2012[19]	Knee osteoarthritis	59	66	6/60	Pain, Strength Range of motion
Weng et al 2009[20]	Osteoarthritis	64±7.5	132	26/106	Range of motion Strength, Pain, Lequesne index
Malas et al 2013[21]	Knee osteoarthritis	58.8 ± 7.2	61	NA	50 foot walk test Peak torque Ultrasound evaluation WOMAC
Eyigor 2004[22]	Knee osteoarthritis	53.14±6.73	39	6/33	Disease severity, Pain 15 m walking WOMAC, Lequesne index Arthritis impact measurement scale - Short form 36 Muscle strength
Cetin et al 2008[23]	Knee osteoarthritis	59.82 ± 9.05 yrs	100	0/100	50 m walking test Pain Peak torque Index for severity of knee osteoarthritis(Lequesne)
Huang et al 2003[24]	Knee osteoarthritis	62 ± 4.5	132	39/93	Visual analog scale-Pain 50 m walking test Lequesne index Isokinetic Peak torque

NA-Not available
VAS-Visual analog scale
WOMAC-Western Ontario McMaster Universities Osteoarthritis Index
ROM-Range of motion

INCLUSION CRITERIA

The following were the criteria for the study to be included in the review :(a)Design: Trials in which isokinetic training were used on patients with osteoarthritis of knee were included irrespective of the study design.(b)Interventions: The isokinetic training and a comparative exercise only and or other interventions used to increase the strength and functional outcomes were included.(c) Study Populations: Participants with osteoarthritis of knee(d)Outcome Measure: The study included needed to investigate the changes in strength of quadriceps and pain parameters.(e) Language: The articles written in English were only included in the review.

METHODOLOGICAL QUALITY ASSESSMENT

All included articles were assessed using the Physiotherapy Evidence Database (PEDro) scale. Two of the assessors (S.S and A.S) evaluated the quality of the studies. PEDro scale is an extensively used critical appraisal tool consisting of 11 –point scale used to assess the methodological issues within articles.

STATISTICAL ANALYSES

The means and standard deviations of the subjects post intervention were collected for both the isokinetic groups and the other intervention groups. Standardised effect sizes and 95% confidence intervals were calculated. Few studies were not presented with the standard deviations thereby were not included for effect size calculation. Few studies presented the mean in the form of percentage or proportion thereby calculation of effect size was not possible for those studies. The standardised effect sizes allowed us to compare the results among different studies. The data were separated based on the outcomes of muscle strength. Effect sizes were classified as weak (d≤0.2), small (d=0.2-0.5) moderate (d=0.5-0.8) and strong (d≥0.8).[25]

RESULTS

Literature search

The database search conducted online yielded 928 original articles out of which 128 were duplicated of the original articles. The remaining 800 articles were searched based on the title and abstract. This led to the exclusion of 789 articles. 13 articles were retrieved and analysed based on the inclusion criteria. One article was excluded because of non-availability of the data.[10] One study was performed on patients with patellofemoral pain syndrome[26] and in one research the participants had anterior cruciate ligament

reconstruction.[27] A total of ten articles were included on this review (Table1).

Methodological quality

Each article was assessed based on the 11 points PEDro scale. The average score of the articles included were 6.9.The highest score obtained was 9 and the lowest score was 6.Most of the studies did not score on blinding of participants and therapists. Concealed allocation was one more criteria that were missing in most of the studies.

Demographic characteristics

The details from Table 2 reveals that the average age of the subjects included in the studies ranged from 55 to 64 years. There was heterogeneity in the number of people included in the research. The maximum number of people recruited was 132[20] and the minimum number of participants was 20.[15] There were lot of discrepancy in the ratio of male and female included. Most of the articles included had more female participants.[15, 17,19,20,22,23,24] Two articles did not provide the gender details.[16, 21] One study had more male population than female[18].When analysed for the outcomes used in the studies WOMAC was the commonest functional outcome measure used mostly in all the articles. Muscular peak torque was used to measure the changes in the strength by most of the researchers. One researcher measured the ambulation speed of the patients[17] while other investigator performed an ultrasound evaluation of the muscle.[21]

Isokinetic training

The isokinetic training group in the researches mentioned above used different isokinetic dynamometers.4 studies used Cybex isokinetic device for training and 3 researchers used Kin Com. One study did not mention the device used. Biodex 3 was used by one researcher. One researcher used stationary bicycle for imparting isokinetic training. The mode of isokinetic training imparted to the participants was only concentric[15,18,21,22,23] and combined concentric – eccentric.[16,17,20,24] Analyses of the velocity used in the isokinetic training reveals that a minimum of 2 velocity and a maximum of 6 velocities were used by the investigators. There was no data available from one article. The protocols of 3 studies were identical.[17, 20, and 24] The frequency of training was different in most of the studies. Some of the researchers performed isokinetic training for 3 times a week for 8 weeks. Table 3 shows the isokinetic training protocol used in the articles.

Table 3
Isokinetic training Protocol

Researcher	Device	Contraction	Velocity	Repetitions
Akyol et al 2010[15]	Cybex	Concentric and concentric- flexors and extensors	60,90,120,150,180	10 repetitions 10 sec rest between different modes and 10 min rest between right and left leg
Gur et al 2002[16]	Cybex 6000	Concentric –eccentric for knee flexors and extensors Concentric for knee flexors and extensors	30,60,90,120,150,180	12 reps 2 min rest between knee flexors and extensors and 5 minutes between legs
Huang et al 2005[17]	Kin-com 505	5 reps of Concentric-eccentric for knee extensors 5 reps Eccentric -concentric for knee flexors at 60% peak torque	30&120 at 60%peak torque	1-5 sets till 5th session 6 sets from 6th -24th session 3 times a week for 8 weeks. 5 sec rest-sets 10 sec rest-different modes 10 min-between legs
Maurer et al 1999[18]	NA	Concentric for knee extensors	90,120,150 deg/sec	3sets of 3 extensions at 3 velocity 3 times a week for 8 weeks. 1 minute rest after each set
Rosa et al 2012[19]	Stationary cycle	NA	-	40 min of cycling with 5 min rest after 10 min of cycling Resistance increased from 1kg to 3 kg 4 days per week for 8 weeks
Weng et al 2009[20]	Kin-com	5 reps of concentric and eccentric for knee extensors 5 reps of eccentric and concentric for knee flexors at 60% peak torque	30&120 deg /sec	1-5 sets for first 5 session 6 sets from 6th to 24th session 3 times a week for 8 weeks 5 sec rest-sets 10 sec rest-different modes 10 min-between legs
Malas et al 2013[21]	Biodex 3	Concentric –concentric 5 reps at 60 deg/sec 10 reps at 120 deg/sec 15 reps at 240 deg/sec	60,120,240	3 sets at each velocity 10 sec rest between different velocity and 30 seconds rest between different cycle,5 days /week for 3 weeks
Eyigor 2004[22]	Cybex	Concentric contraction 3 sets of 6 repetitions at 60,90,120 and 180 degree/sec	60,90,120,180	20 sec between sets 3 days a week for 6 weeks
Cetin et al 2008[23]	Cybex	5 repetitions of concentric contraction for knee extensors and knee flexors of concentric (1 set)	60,120,180	20 secs between sets and 60 secs between legs 3 times a week for 8 weeks 1-5 sets for first 5 session 5 sets from 6thto 24th session
Huang et al 2003[24]	Kin-com	5 reps of concentric and eccentric for knee extensors 5 reps of eccentric and concentric for knee flexors at 60% peak torque	30&120 deg /sec	1-5 sets for first 5 session 6 sets from 6th to 24th session 3 times a week for 8 weeks 5 sec rest-sets 10 sec rest-different modes 10 min-between legs

Other interventions

A variety of interventions were used by the researchers of the studies included in this review. Some of the authors used electrotherapy modalities either in combination with isokinetic training or just the modality alone.[15, 17] In two of the studies the groups were not imparted any intervention.[16, 20] One study done by Maurer et al., used educational intervention consists of lecture, video, nutritional guidelines and discussion.[18] There were studies with isometric exercise[19], isotonic exercise[21] and progressive resisted exercises[22] performed on patients with knee osteoarthritis. The details of the interventions are provided in Table 4.

Table 4
Other interventions

Researcher	Other interventions	Exercise description	Repetitions
Akyol et al 2010[15]	SWD +Isokinetic	Short wave diathermy for 20 mins + Isokinetic exercises	10 repetitions 10 sec rest between different modes and 10 min rest between right and left leg
Gur et al 2002[16]	No treatment	-	-
Huang et al 2005[17]	Continuous ultrasound Pulsed ultrasound No treatment	100%duty cycle 1MHz 1.5W/cm^{2}for 5 min 25% duty cycle 1MHz in 2.5W/cm^2	3 times a week for 8 weeks
Maurer et al 1999[18]	Educational intervention	Lecture Video Nutritional guidelines Discussion	4 sessions
Rosa et al 2012[19]	Isometric exercise	6 exercises	4 days/week for 8 weeks
Weng et al 2009[20]	Warm up cycling No treatment	-	-
Malas et al 2013[21]	Isotonic strengthening Exercises	Lifting 1.5 kg weight at 90 repetitions/day	5 days /week for 3 weeks
Eyigor 2004[22]	Progressive resisted exercise	3 sets of 10 repetitions 1st set 10 reps at 50%10 RM 2nd set at 75% 10RM 3rd set at 10RM	5 days a week for 6 weeks
Cetin et al 2008[23]	SWD+hotpacks+ isokinetic exercise TENS+ hotpacks+isokinetic exercise Ultrasound+ hotpacks+isokinetic exercise Hotpacks+isokinetic	SWD -15 mins TENS-60-100Hz,60 m secs pulse duration for 20 mins Ultrasound at1MHz,1.5W/cm^2 for 10 mins Hot packs.	3 times a week for 8 weeks
Huang et al 2003[24]	Isotonic strengthening Isometric strengthening	5 reps of concentric-eccentric at maximum velocity Isometric hold at various angle using Kin-com	3 times a week for 8 weeks

SWD-Short Wave Diathermy

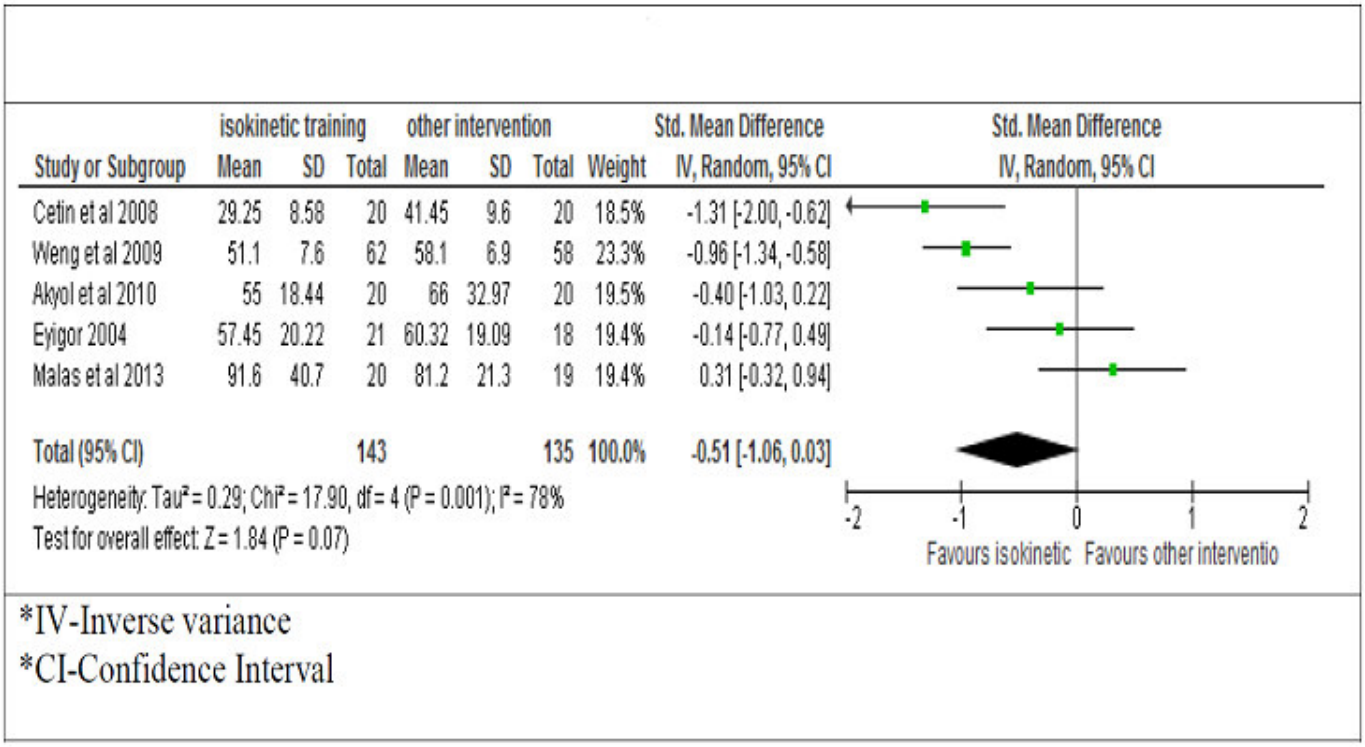
Effect of isokinetic training on strength

Analyses of the effect sizes for the outcome of strength revealed that the isokinetic intervention group showed a homogenous, negative effect that ranged from weak to strong (d=-0.1,-0.4,-0.9,-1.3) and one study with95%CI not crossing zero. One study had a small effect size with the 95% CI crossing zero. We could not calculate the effect sizes of 5 articles[16, 17,18,19,24] included in this review due to unavailability of the standard deviation values. The details of the effect size and 95%CI are shown in Table 6. Pooled analysis of the mean differences showed that the overall effect size for improvement in strength was about -0.51 with a 95%confidence interval (CI) of -1.06-0.03.The Chi^2 value of about 17.90 with df of 4.The I^2 value of 78% suggests substantial heterogeneity of the studies. Out of 5 studies analyzed four studies favored isokinetic training for improvement in strength and one study favored other interventions.

Table 5
Strength outcomes

Researcher	Isokinetic	Other interventions	Std.Mean Difference95%CI		
			IV	Lower	Upper
Akyol et al 2010[15]	55.00±18.44(20)	66±32.97(20)	-0.4118	-1.0381	0.2145
Gur et al 2002[16]	35%(8)	25%(9)	-	-	-
Huang et al 2005[17]	255.7(50)	284.5(54)	-	-	-
Maurer et al 1999[18]	28.35(49)	25.03(49)	-	-	-
Rosa et al 2012[19]	66.7(33)	81.8(33)	-	-	-
Weng et al 2009[20]	51.1±7.6(62)	58.1 ± 6.9(58)	-0.9628	-1.341	-0.5846
Malas et al 2013[21]	91.6±40.7(20)	81.2±21.3(19)	0.3177	-0.3141	0.9496
Eyigor 2004[22]	57.45±20.22(21)	60.32±19.09(18)	-0.1456	-0.776	0.4848
Cetin et al 2008[23]	29.25±8.58(20)	41.45 ± 9.60(20)	-1.3032	-1.848	-0.7583
Huang et al 2003[24]	228(56)	215(60)	-	-	-

Figure 2
Standardized mean differences for strength



*IV-Inverse variance
*CI-Confidence Interval

DISCUSSION

About 10 trials using isokinetic training for osteoarthritis of knee were included in the review. A total of 826 participants with osteoarthritis of knee were used in the trials. All the trials included in the review had different isokinetic training protocols involving different velocities and different repetitions. Akyol et al., (2010)[15] used concentric and concentric mode of isokinetic training for extensors and flexors at the velocities of 60, 90,120,150& 180 degree/second. The subjects performed 10 repetitions with 10 sec rest between different modes and 10 min rest between the legs. The other intervention group was imparted Short wave diathermy &Isokinetic training for 20 mins and isokinetic exercises for 10 repetitions with 10 sec rest between different modes and 10 min rest between right and left legs. The researcher reported improvement in quadriceps strength after isokinetic training. Weng et al., (2009)[20] performed the trial with 5 reps of concentric and eccentric for knee extensors, 5 reps of eccentric and concentric for knee flexors at 60% peak torque. The velocity used was 30&120 degree /second. The progression was 1-5 sets for first 5 session 6 sets from 6th to 24th session. The training continued for 3 times a week for 8 weeks with 5 second rest between sets and 10 sec rest between different modes and 10 min rest between legs. The researcher compared the isokinetic training with the control group that did not undertake any treatment other than warm up cycling. Malas et al.,(2013)[21] reported the isokinetic training regimen of concentric –concentric mode of 5 reps at 60 deg/sec ,10 reps at 120 deg/sec and 15 reps at 240 deg/sec with 3 sets at each velocity. A rest period of 10 sec rest between different velocity and 30 seconds between different cycles was given for 5 days /week for 3 weeks. The other intervention group consisted of isotonic strengthening exercises including lifting of 1.5 kg weight at 90 repetitions/day, 5 days /week for 3 weeks. Concentric contraction was the mode of isokinetic training imparted by Eyigor (2004).[22] 3 sets of 6 repetitions at 60, 90,120 and 180 degree/sec with 20 second rest between sets, 3 days a week for 6 weeks was the parameters fixed for the patients. Eyigor (2004)[22] used progressive resisted exercise for the other group at 3 sets of 10 repetitions with rate of progression at 1st set 10 reps at 50%10 RM (repetition maximum),2nd set at 75% 10RM and 3rd set at the 10 RM for 5 days a week for 6 weeks. The isokinetic training protocol of Cetin et al., (2008)[23] consisted of 5 repetitions of concentric contraction for knee extensors and knee flexors of concentric at 60,120,180 degree/ sec with 20 sec rest between sets and 60 seconds between legs, 3 times a week for 8 weeks. The progression of training was 1-5 sets for first 5 session and 5 sets from 6th to 24th session. The other group was given short wave diathermy, hot packs, transcutaneous electrical nerve stimulation and ultrasound therapy along with isokinetic exercises, 3 times a week for 8 weeks. Only three articles [17, 20, 24] were found to follow the same isokinetic training protocol. Most of the studies were performed for 3 times a week for 8 weeks lasting for 24 sessions. One study[19] used stationary bicycle for imparting isokinetic training thereby making it difficult to know the velocity and the repetitions performed. Out of 10 studies included in the review, 5 studies were included in the determination of effect size and 95% confidence interval for the improvement in strength. The trials were not taken up for analysis due to the unavailability of standard deviation values. Overall estimate of the mean differences showed that the overall effect size for improvement in strength was about -0.51 with a 95%confidence interval (CI) of -1.06-0.03.The Chi^2

value of about 17.90 (P=0.001) with df of 4.The I^2 value of 78% suggests substantial heterogeneity of the studies. The estimate of between study variance Tau^2 is about 0.29. Higgins et al., 2003 suggested that an I^2 value of 0% reveals no heterogeneity,25% low, 50% moderate and75% high heterogeneity.[28]The variation in the study outcomes may be due to patient related, intervention related, co-intervention related and outcome related causes.[29] In our review it was a combination of all these factors that resulted in considerable heterogeneity. The effects were the strongest for the isokinetic training in the improvement of strength. However definitive evidence that isokinetic training is beneficial in improving quadriceps strength associated with osteoarthritis cannot be concluded based on wide 95 %CI and the wide range of effect sizes. Effect sizes and 95%CI of all the interventions overlap revealing that definitive effects of increased strength between isokinetic training and other interventions may not exist. When considering the improvement in strength, two studies[20, 23] had very large effect size. Cetin et al., 2008 also used isokinetic strengthening exercises for all the groups including the control group. Only the physiotherapy modalities were different in various groups. The same trend was observed in the trial performed by Weng et al., 2009 comparing the effects of various stretching techniques on isokinetic exercises. This can be the reason for a large effect size due to the fact that the other group was also exposed to isokinetic training. All the groups were exposed to isokinetic exercises except the control group. Huang et al., (2003)[24] reported that isokinetic exercise had the lowest level of compliance among participants due to exercise induced pain associated with isokinetic training. Disability associated with osteoarthritis of knee has been found to decrease after isokinetic training. Thorstensson et al., (1976) reported strengthening of type II muscle fibers during isokinetic exercises thereby resulting in improvement of knee stability associated with osteoarthrosis of knee.[30] Gur et al.,(2002) explained the improvement on the strength of muscle due to increase in the cross sectional area of the muscle and muscular adaptation to strengthening. It could be postulated that, the improvement in strength associated with isokinetic training could be attributed to the increase in the number of motor neural units in the vastus medialis as well as in the vastus lateralis muscles got recruited and the resultant better synchronization of motor neuronal firing.[31,32] It could also be assumed that, the isokinetic training mediated hypertrophy of type II muscle fibres, which might also have contributed behind the increased strength of the muscles.[30,33] Thus from our review it can be noted that isokinetic training causes improvement in strength of knee musculature in patients with osteoarthritis of knee. But this finding may change with the inclusion of more related studies to the meta-analysis.

Limitations

Several limitations can be associated with this review. Only a limited number of studies were included in the review. The interventions, sample size, populations and duration varied significantly thereby it was difficult to compare these trials. Methodological biases such as lack of concealment, blinding of subjects and therapist were evident in most of the trials. Few trials reported improvement in strength as proportion of change and mean values thereby making it difficult to include them for pooled analysis. These limitations can be reduced as reporting of trials become more transparent and efficient.

Suggestions for future research

Research should be conducted to challenge the findings of this review. Isokinetic training is effective in improving the strength of the muscle around the knee in 4 of the 5 studies included but this number is very much insufficient for a strong conclusion. Researchers comparing the effect of isokinetic training over other strength training methods should be done to find out the real effect of isokinetic training. Authors should take measures to address the methodological bias in research by following proper guidelines.

CONCLUSION

This review has yielded preliminary trends on the efficacy of isokinetic training on improvement of knee muscle strength. Improvements in peak torque were demonstrated in patients with osteoarthritis of knee. Due to the limited number of studies included in the review, the findings of the review warrant further attention and examination.

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CONFLICT OF INTEREST

Conflict of interest declared none.

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