

FLEX CEUs



Hamstring Stretches - Frequency
Required to Maintain Knee
Extension Range of Motion



results of this study are consistent with the current study that to maintain an initial improvement in ROM three times a week of on-going stretching is required. Finally, in comparison to the current study, Rancour et al (2009) and Wallin et al (1985) did not have a true control group.

From a clinical and practical perspective, an on-going stretching programme with reduced frequency allows maintenance of the benefits of stretching exercises with minimal effort and potentially improves participants' compliance with on-going stretching exercises. Although stretching is commonly prescribed in clinical practice, research has shown that once a client is discharged from therapy, compliance rate with the home exercise programmes are low and too many exercises can reduce compliance (Haynes 1979, Henry et al 1999, Schneiders et al 1998, Sluijs et al 1993). In the current study, both stretching groups maintained a high level of compliance, averaging 93%, throughout the study. Possible reasons for this high compliance may include the reduced frequency of stretching required, clear written and verbal instruction, and continuous reminders and regular follow-up by the research team (Eakin et al 2007, Jacobs et al 2004, Schneiders et al 1998).

A number of limitations were associated with this study. Recruitment of participants for this study was primarily carried out within a university setting and only healthy and university-aged individuals were included in the study. The findings, therefore, may not be directly applicable to injured or older populations. Despite regular reminders and follow-up, nine of the 63 participants withdrew from the study. An intention-to-treat analysis was used to compensate for this. Finally, other variables such as force or muscle stiffness (Gajdosik 1991, Magnusson 1998, Reid and McNair 2004) associated with stretching interventions were not measured this study.

Future research examining structural changes associated with static stretching and whether these changes are maintained through on-going stretching is required. Future studies may also need to look at that whether different types of stretching (e.g. PNF versus static stretching) or stretching of different muscle groups have different effects on maintenance. Finally, as the results of this study are limited to a healthy university-age population, the effect of on-going stretching protocol of this study needs to be confirmed in different clinical populations such as elderly and females, and those with diseases that affect joint ROM such as osteoarthritis, and muscle injury.

CONCLUSION

The results of the current study demonstrated that on-going hamstring stretching programmes of three times a week was required to maintain the increased ROM following an initial six week stretching intervention. Reducing the number and frequency of stretching exercises required from five to three times a week may enhance compliance, particularly, in populations where maintaining an appropriate range of motion is helpful to enhance performance and reduce the risk of injury and re-injury.

KEY POINTS

- Stretching exercises are commonly prescribed to improve muscle extensibility and joint ROM, but on-going stretching exercises may be required to maintain any initial improvements in ROM.
- An initial stretching regime of 3x30 seconds, once per day, five days a week for six weeks to the hamstring muscles, significantly increases knee extension ROM.
- A frequency of three times a week is required with an on-going stretching programme for a further six weeks to maintain the initial improvement in knee extension ROM.

REFERENCES

- Bandy WD, Irion JM (1994) The effect of time on static stretch on the flexibility of the hamstring muscles. *Physical Therapy* 74: 845-850.
- Bandy WD, Irion JM, Briggler M (1997) The effect of time and frequency of static stretching on flexibility of the hamstring muscles. *Physical Therapy* 77: 1090-1096.
- Bassett SF (2003) The assessment of patient adherence to physiotherapy rehabilitation. *New Zealand Journal Physiotherapy* 31: 60-66.
- Chan SP, Hong Y, Robinson PD (2001) Flexibility and passive resistance of the hamstrings of young adults using two different static stretching protocols. *Scandinavian Journal of Medicine and Science in Sports* 11: 81-86.
- Cohen J. (1988) *Statistical Power Analysis for the Behavioural Sciences*. Hillsdale, NJ: Lawrence Erlbaum Associates.
- Cornbleet SL, Woolsey NB (1996) Assessment of hamstring muscle length in school-aged children using the sit-and-reach test and the inclinometer measure of hip joint angle. *Physical Therapy* 76: 850-855.
- Davis DS, Ashby PE, McCale KL, McQuain JA, Wine JM (2005) The effectiveness of 3 stretching techniques on hamstring flexibility using consistent stretching parameters. *Journal of Strength and Conditioning Research* 19: 27-32.
- Decoster LC, Cleland J, Altieri C, Russell P (2005) The effects of hamstring stretching on range of motion: a systematic literature review. *Journal of Orthopaedic and Sports Physical Therapy* 35: 377-387.
- Depino GM, Webright WG, Arnold BL (2000) Duration of maintained hamstring flexibility after cessation of an acute static stretching protocol. *Journal of Athletic Training* 35: 56-59.
- Eakin EG, Lawler SP, Vandelanotte C, Owen N (2007) Telephone interventions for physical activity and dietary behavior change: a systematic review. *American Journal of Preventive Medicine* 32: 419-434.
- Ford GS, Mazzone MA, Taylor K (2005) The effect of four different durations of static hamstring stretching on passive knee-extension range of motion. *Journal of Sports Rehabilitation* 14: 95-107.

- Ford P, McChesney J (2007) Duration of maintained hamstring ROM following termination of three stretching protocols. *Journal of Sport Rehabilitation* 16: 18-27.
- Gajdosik R, Lusin G (1983) Hamstring muscle tightness. Reliability of an active-knee-extension test. *Physical Therapy* 63: 1085-1090.
- Gajdosik RL (1991) Effects of static stretching on the maximal length and resistance to passive stretch of short hamstring muscles. *Journal of Orthopaedic and Sports Physical Therapy* 14: 250-255.
- Haynes RB (1979) Determinants of compliance: The disease and the mechanics of treatment. In: Haynes RB, Taylor DW, Sackett D L (Eds) *Compliance in Health Care*. Baltimore: John Hopkins University Press.
- Henry KD, Rosemond C, Eckert LB (1999) Effect of number of home exercises on compliance and performance in adults over 65 years of age. *Physical Therapy* 79: 270-277.
- Jacobs AD, Ammerman AS, Ennett ST, Campbell MK, Tawney KW, Aytur SA, Marshall SW, Will JC, Rosamond WD (2004) Effects of a tailored follow-up intervention on health behaviors, beliefs, and attitudes. *Journal of Women's Health* 13: 557-568.
- Magnusson SP (1998) Passive properties of human skeletal muscle during stretch maneuvers. A review. *Scandinavian Journal of Medicine and Science in Sports* 8: 65-77.
- Malliaropoulos N, Papalexandris S, Papalada A, Papacostas E (2004) The role of stretching in rehabilitation of hamstring injuries: 80 athletes follow-up. *Medicine and Science in Sports and Exercise* 36: 756-759.
- Nelson RT, Bandy WD (2004) Eccentric training and static stretching improve hamstring flexibility of high school males. *Journal of Athletic Training* 39: 254-258.
- Piriyaprasarth P, Morris ME, Winter A, Bialocerkowski AE (2008) The reliability of knee joint position testing using electrogoniometry. *BMC Musculoskeletal Disorders* 9:6.
- Rancour J, Holmes CF, Cipriani DJ (2009) The effects of intermittent stretching following a 4-week static stretching protocol: a randomized trial. *Journal of Strength and Conditioning Research* 23: 2217-2222.
- Reid DA, McNair PJ (2004) Passive force, angle, and stiffness changes after stretching of hamstring muscles. *Medicine and Science in Sports and Exercise* 36: 1944-1948.
- Roberts JM, Wilson K (1999) Effect of stretching duration on active and passive range of motion in the lower extremity. *British Journal of Sports Medicine* 33: 259-263.
- Rubley MD, Brucker JB, Knight KL, Ricard MD, Draper DO (2001) Flexibility retention 3 weeks after a 5-day training regime. *Journal of Sport Rehabilitation* 10: 105-112.
- Russell PJ, Decoster LC, Enea D (2010) Effects of gastrocnemius, hamstring, and combined stretching programs on knee extensibility. *Athletic Training and Sports Health Care* 2: 67-73.
- Schneiders AG, Zusman M, Singer KP (1998) Exercise compliance in acute low back pain patients. *Manual Therapy* 3: 147-152.
- Shephard RJ, Berridge M, Montelpare W (1990) On the generality of the "sit and reach" test: an analysis of flexibility data for an aging population. *Research Quarterly for Exercise and Sport* 61: 326-330.
- Sluijs EM, Kok GJ, van der Zee J (1993) Correlates of exercise compliance in physical therapy. *Physical Therapy* 73: 771-782; discussion 783-776.
- Small K, Mc Naughton L, Matthews M (2008) A systematic review into the efficacy of static stretching as part of a warm-up for the prevention of exercise-related injury. *Research in Sports Medicine* 16: 213-231.
- Smith CA (1994) The warm-up procedure: to stretch or not to stretch. A brief review. *Journal of Orthopaedic and Sports Physical Therapy* 19: 12-17.
- Spernoga SG, Uhl TL, Arnold BL, Gansneder BM (2001) Duration of maintained hamstring flexibility after a one-time, modified hold-relax stretching protocol. *Journal of Athletic Training* 36: 44-48.
- Verrall G, Slavotinek J, Barnes P, Fon G, Spriggins A (2001) Clinical risk factors for hamstring muscle strain injury: a prospective study with correlation of injury by magnetic resonance imaging *British Journal of Sports Medicine* 35:435-439.
- Wallin D, Ekblom B, Grahn R, Nordenborg T (1985) Improvement of muscle flexibility. A comparison between two techniques. *American Journal of Sports Medicine* 13: 263-268.
- Willy RW, Kyle BA, Moore SA, Chleboun GS (2001) Effect of cessation and resumption of static hamstring muscle stretching on joint range of motion. *Journal of Orthopaedic and Sports Physical Therapy* 31: 138-144.



“This course was developed from the public domain document: The frequency of hamstring stretches required to maintain knee extension range of motion following an initial six-week stretching programme - New Zealand Journal of Physiotherapy (42(1): 22-27).”