1. Title of Proposed Study

Inversion therapy in patients with pure single level discogenic disease: a randomised trial

2. Research objectives

To assess whether use of an inversion device in patients aged 18-45 years with pure single level lumbar discogenic disease producing unilateral sciatica improves outcome and lowers the incidence of the need for surgery as compared with usual physiotherapy treatment.

3. Full Background

The United Kingdom has a very high incidence of disc protrusion. In this condition protrusion of the contents of the disc occurs. This can compress and cause damage to the nerves exiting from the spinal column. They provide function and sensation to the lower limbs. In many patients this condition settles spontaneously. In others surgery is required since insufficient space exists for the nerves as healing takes place. Surgery is expensive, does not guarantee relief of symptoms and carries risk.

In a report in The New England Journal of Medicine, General Practitioners in Maastricht analysed the benefits of bed-rest versus activity in the management of patients with lumbar discogenic backache[1]. They identified no benefit from bed-rest and patients who carried on with their daily activities did equally well, or alternatively, had the same incidence of surgical intervention and recovery. These results were confirmed in a Cochrane Review[2]. Surgery, where indicated, is generally successful[3] but there are significant postoperative problems and there can be major complications. Economic costs of backache and back surgery complications are well documented, and are currently estimated at around £6 billion per annum. Although the Cochrane review of discectomy[4] has demonstrated benefit compared with chemonucleolysis no prospective randomised controlled trial has been undertaken with inversion therapy. The only trial of inversion therapy has shown that in healthy employees with a history of low back pain it reduced the number of days of sick leave[5].

The natural history of lumbar discogenic disease is well described. A distinct variation occurs when the disc fragment becomes sequestered. Patients exhibiting symptoms relating to bladder dysfunction or with increasing neurological deficits despite treatment should also be viewed in a different light. Generally however, the protruded disc fragment decreases in size due to disruption in the normal route of “nutrition”, followed by a process of fibrosis and contraction. The anatomical relationship between the disc and the exiting nerve is an extremely close one and it is supposed that inflammatory reaction in the adjacent nerve root occurs due to movement and activity. This inflammation should settle over time and as the disc decreases in size, and may also be influenced by appropriate medication. The presence of additional pathology as well as the anatomical size of the nerve exit zone are also important factors.

Work initiated by Nachemson[6], and carried on by others has raised awareness of the importance of intradiscal pressure, particularly relating to posture. Reduction in this pressure may well alter the natural history of discogenic disease to the advantage of the patient. The inversion device aims to reduce intradiscal pressure by means of gravity and the body’s own weight, on a tilting device, thereby facilitating the achievement of a reduction in size of the protrusion and subsequent relief of symptoms. Although traction is the subject of a non-completed Cochrane Review[7] it is likely to be far less effective than inversion therapy at distracting the vertebrae simply because inversion therapy uses the whole weight of the patient’s upper body to distract across the protruded disc.

The aim of the proposed study is to determine whether the use of the inversion device will accelerate or improve upon the healing process following disc protrusion. The anti-gravity effect of the device is intended to reduce pressure in the joint, thereby reducing protuberance and effects on the adjacent nerve roots. It will be determined whether patients thus treated have anatomical improvement on MRI and have a lower incidence of need for surgery and its potential complications.

We have already randomised 14 out of 20 proposed cases in a pilot feasibility study and shown that we can conduct a trial in this condition with a likelihood of demonstrating a favourable outcome.

4. Methods including study design, and where appropriate sample data (including criteria, sample size, description of exclusions from the study, why and how was the sample size determined, level of significance in sample size calculations), formal statistical input to the overall study design.

Study design

This will be a randomised, controlled trial in which patients will be allocated on a 1:1 ratio to usual management alone or usual management plus inversion therapy. Outcome assessment will be by a blinded assessor. The study will be conducted in accordance with GCP guidelines.

Informed Consent

Written, informed consent will be obtained from the patient by a suitably trained member of the neurosurgical medical team in accordance with UK and local requirements. Information will be given both in oral and written form as approved by the LREC. The patient will be given adequate opportunity to enquire about details of the study. Patients have the right to refuse consent or to withdraw at any time without prejudice to their management. Consent will be documented by the dated signature of the patient and the physician and a copy given to the patient.

Sample size

The study will aim to recruit a total of 100 patients, over a period of two years. These patients will have proven pure single level lumbar discogenic disease at the levels of either L4/5 or L5/S1. With an expected 80% requiring surgery in the usual therapy group a sample size of 90 would be required to show a 30% benefit from inversion therapy ($2p<0.05$) with 80% power. A safety margin of 10% has been built in to allow for protocol violations or crossovers making a total sample size of 100.

Inclusion Criteria

1. Male or female patients aged 18 to 55 years (inclusive)
2. Unilateral, nonsequestered protrusion shown on MRI imaging. The protrusion should be shown to be impinging upon the adjacent nerve root.
3. Appropriate neurological findings or symptoms corresponding to the affected nerve root.
4. No radiological evidence of disc protrusion at any other lumbar level.
5. First attack of discogenic disease.
6. Weight within 20% of the idealised norms for height and age (and not exceeding 22 stones/140kg).

Exclusion criteria

a. Pregnancy
b. Use of analgesics or anti-inflammatory drugs for any other reason
c. Age less than 18 years or greater than 45 years at randomisation
d. Any significant cardiorespiratory disorder in the last six months or any other medical condition precluding a head down position
e. Symptoms which have been present for more than six months
f. Symptoms or signs of bladder impairment or an increase in neurological deficit
g. Allergy to any medication or other medical condition precluding the use of analgesics and anti-inflammatories.

5. Experiments or studies proposed including end points

The patients will be randomised to one of two groups using a computer generated system. All patients enrolled will undergo a standard form of physiotherapy. All patients will also be given a standardised regime of analgesics and anti-inflammatory drugs and will be blinded as to the exact nature of the drugs. The use of the medication will be controlled with respect to

frequency and dosage. One group will receive treatment using the inversion device and the other group will receive no treatment on the inversion device but will otherwise be managed identically. The treated group will be given standardised access and time on the inversion device for a period of four weeks. All patients will be assessed at six weeks and six months by a blinded observer.

The assessment will include:

a. MRI prior to and within 24 hours of randomisation and at six weeks, evaluated by a "blinded" radiologist in order to assess reduction in disc size.
b. Referral for surgical intervention.
c. The straight leg-raising test and evaluation of the nerve stretch test and degree of back flexion.
d. The presence or absence of reflexes relevant to the nerve root.
e. Evaluation of motorsensory function in a standardised format.
f. Pain on a visual analogue pain scale
g. SF36
h. The absence/presence and degree of muscle spasm and/or trigger spots
i. Oswestry Low Back Pain Questionnaire
j. Roland Morris Questionnaire
k. EuroQol EQ-5D
l. Resource use including hospital inpatient and outpatient visits, physiotherapy contacts and equipment use, primary care contacts, prescribed medication and patient costs.

Study duration
Total duration of the study would however be 3 years with three months to set up the study, two years of recruitment, six months of follow up and three months to analyse and write up the findings.

End points
The primary end points with regard to the formal evaluation of patients will be a decision by the "blinded" observer "for surgical intervention". Any case which undergoes surgery or where there is a decision to intervene surgically will be regarded as a treatment failure. The reduction in size of the disc on MRI will be the other primary end point.

Secondary end points: Return to work; frequency of use and dosage of medication; time scale for relief of pain and for the disappearance of objective signs, in particular with reference to directly related symptoms and straight leg raising. Health questionnaire SF36 will be used as a general outcome measure and Oswestry Low Back Pain questionnaire will be used as disease specific outcome measure. Costs associated with both treatment groups will be assessed and quality adjusted life years calculated.

6. The value of the research to Public health and patient care

A robust finding of efficacy for inversion therapy would drastically reduce the need for operative intervention with its associated risks and costs.

7. Details of support requested (staff, consumables etc.) including detailed justification

A trial director is required to set up the system within the region to fast track suitable patients, design data collection forms, monitor recruitment and data collection, collect out come data, analyse and write up the study.

A research physiotherapist will be required to help set up the system, design data collection forms, collect data on patients about admission and treatment characteristics administer treatment and analyse and write up the report.

A part time secretary will be required to arrange patient appointments and trial documentation, and to monitor receipt of data collection forms and undertake data entry.

Three inversion devices will be required to ensure that that there is always one available for a potential subject.

Each patient will require an additional MRI scan to assess outcome at a cost of £400.

A laptop and printer will be required to collect data and produce questionnaires together with associated stationery and computer software.

Travel expenses are also required for additional patient visits and to present the results of the study at conferences.

8. Project milestones

Months 1-3 Appoint staff, design trial documentation, raise profile of trial within region.
Months 4-27 Recruit 100 patients, complete case report forms
Months 28-33 Complete outcome assessments and data validation.
Months 34-36 Complete analysis and report writing.

9. References

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5. Dimberg L., Josefsson L, Eriksson B. Effects of gravity-facilitated traction of the lumbar spine in persons with chronic low back pain at the workplace. http://www.mastercare.se/Studie-1.txt

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