

# Spasticity in children and young people with non-progressive brain disorders: management of spasticity, co-existing motor disorders and their early musculoskeletal complications

## Selective dorsal rhizotomy

Bibliographic details	Number of Participants Characteristics	Intervention characteristics	Outcome measures and results	Quality assessment	Reviewer comment
<p><b>Periodical</b> Developmental Medicine and Child Neurology</p> <p><b>Authors</b> Steinbok,P., Reiner,A.M., Beauchamp,R., Armstrong,R.W., Cochrane,D.D., Kestle,J.</p> <p><b>Year of publication</b> 1997</p> <p><b>Study location</b> Canada</p> <p><b>Ref ID</b> 76280</p> <p><b>Type of study</b> Randomised controlled study</p> <p><b>Aim of study</b> Prospective, single-blinded RCT to compare the efficacy of SDR with intensive physiotherapy to intensive physiotherapy alone in improving GMFM at 9 months in children</p>	<p><b>Inclusion Criteria</b></p> <ol style="list-style-type: none"> <li>1) Age 3–7 years</li> <li>2) Diagnosis of spastic diplegia CP (with no athetoid or ataxic component).</li> <li>3) Spasticity severe enough to impair gross motor function.</li> <li>4) Ability to sit on the edge of an examining table with arms in the air and able to stand up while holding on with hands.</li> <li>5) Availability of sufficient PT services in child's home community</li> <li>6) SDR considered appropriate for the child</li> <li>7) Parental consent to randomisation of treatment</li> </ol> <p><b>Exclusion Criteria</b></p> <ol style="list-style-type: none"> <li>1) Other neuromuscular problem.</li> <li>2) Planned surgical procedure during the period of the study.</li> <li>3) The child's problems were of such severity that a 9-month delay in performing a definitive procedure might</li> </ol>	<p><b>Comparison</b> SDR + intensive therapy vs intensive therapy only</p> <p>Included in analysis: SDR+PT n = 14 PT only n = 14</p> <p><b>SDR</b> Operation performed within 1 month of assignment to treatment Partial rhizotomies from L2 to S2 performed via laminotomies from L1 to S1 Each posterior root was split into 3-6 rootlets and rootlets were stimulated within 4cm of the root exit foramen with 2 unipolar electrodes Responses to electrical stimulation determined which rootlets to cut to achieve predetermined desired effect. The general plan was to cut no more than 50% of S2 (to avoid bladder dysfunction) 40-50%</p>	<p>Primary outcome: Total score of GMFM Secondary outcome: Spasticity—Ashworth scale, muscle strength, range of motion, physiological cost index, Peabody fine motor scale, self-care assessment score and ambulatory status</p> <p>Follow-up: 9 months with comparison to baseline assessments</p> <p>Mean difference in GMFM dimensions at 9m (positive value in favour of SDR + Therapy group) Lying/rolling : -0.2 Sitting : 15 Crawl/kneel : -7.5 Standing : 2.3 Walk/run/jump : 6</p> <p>Mean increase in total GMFM SDR+Therapy : 11.3% Therapy alone : 5.2% p= 0.007</p>	<p>Appropriate randomisation method: treatments assigned by random number table, by independent party not involved with patient care) Allocation concealment adequate : Yes Sample size calculation: 5.1% improvement in GMFM with 90% power at <math>\alpha = 0.05</math> (estimated by reference to a previous study) Analysis: By treatment received Groups comparable at baseline : yes Participants blinded to treatment allocation : no Caregivers blinded to treatment allocation : yes Length of follow up similar for each group : yes No of participants not completing treatment (by group) : SDR + Therapy group n=1 Therapy only n=1 (both dropped out after randomisation)</p>	<p>Funding : Grants from British Columbia Health Care Research Foundation</p> <p>Consent: details not provided</p> <p>Ethical approval : Ethics Committee of the University of British Columbia</p>

	<p>compromise health</p> <p><b>Baseline characteristics</b>  Mean age (range)  SDR + Therapy: 4.2 y (2.9–6.3);  Therapy only : 3.9 y (2.9–6.4)</p> <p>Male % not reported</p> <p>No significant differences for GMFM, Ashworth scale, muscle strength, range of motion, physiological cost index, Peabody fine motor scale, self-care assessment score and ambulatory status at baseline</p>	<p>of L4 (to avoid excessive quadriceps hypotonia) and 50-79% of L2, L3 L5 and S1. Actual percentage of dorsal root tissue transected: 40% for S2  42% for L4  58% for L2, L3, L5 and S1 combined</p> <p>Postoperative management standardised : gradual mobilisation after 48 hours bed rest, discharge on 6th postop day. Intensive physiotherapy received at home</p> <p><u>Therapy</u>  Therapy group started therapy within one month of assignment to treatment group and received the same amount and type of physiotherapy as the SDR + therapy group</p> <p>Children in both groups received :  9-month sequence for PT:  1) 3 hrs times per week for 3 months  2) 2 hrs times per week for 6 months</p> <p>All children wore leotards for sessions to obscure SDR surgical incisions from the therapist  Therapy consisted of passive</p>	<p>Ashworth scale mean score reduction  Hip  SDR+Therapy : -1.4 (0.6)  Therapy alone : -0.3 (0.6)  p&lt;0.001</p> <p>Knee  SDR+Therapy : -1.1 (0.5)  Therapy alone : -0.1 (0.7)  not given</p> <p>Ankle  SDR+Therapy : -1.5 (0.6)  Therapy alone : 0.0 (0.8)  not given</p> <p>Range of motion (° diff)  Hip  SDR+Therapy : 15.8 (10.6)  Therapy alone :-3.3 (8.6)  p&lt;0.001</p> <p>Knee  SDR+Therapy : 15.6 (15.6)  Therapy alone : -2.1 (10.9)  not given</p> <p>Ankle  SDR+Therapy : 18.0 (5.9)  Therapy alone : 17.5 (14.1)  not given</p> <p>Self-care assessment score  SDR+Therapy : 10.5  Therapy alone : 11.5  p= 0.78</p>	<p>Outcome assessors blinded to treatment : yes  Outcome assessment methods valid : yes  Investigators blinded to treatment allocation : unclear</p>	
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		<p>ROM of the lower limb joints ; strenthening to hip abductors and extensors, knee extensors and ankle dorsiflexors ; for 40 mins of each hour long session, practice of normal patterns of movement based on neurodevelopmental theory. Physiotherapists were instructed to place as much emphasis on weightbearing as if the child had undergone SDR, in the sessions for children in both groups.</p> <p>Mean amount of therapy received over 9m study period (range) SDR + Therapy group = 81.8 (72 to 90 hours) Therapy only group = 81.3 hours (70 to 89 hours)</p> <p>Caregivers were advised no to stitue additional treatments for the children during the study period - this was monitored by the investigators</p>	<p>Ambulation status improvement SDR+Therapy : 50% (5/10) Therapy alone : 0% (0/11)</p> <p>Adverse events SDR+PT: Back pain (7%), urinary (7%), postoperative infection (7%) Therapy group : No complications</p>		
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<p><b>Periodical</b> Pediatric Neurosurgery</p> <p><b>Authors</b> Abbott,R.</p> <p><b>Year of publication</b> 1992</p> <p><b>Study location</b></p> <p><b>Ref ID</b> 96090</p> <p><b>Type of study</b> Non-comparative study</p> <p><b>Aim of study</b> To review 10 years experience of SDR with an emphasis on surgical outcome concentrated on improvements in functional ability and adverse effects</p>	<p><b>Inclusion Criteria</b> Total population N = 250 children who underwent SDR at New York University Medical Centre from 1986 - 1992 (approx)</p> <p><b>Exclusion Criteria</b> Not stated</p> <p><b>Baseline characteristics</b> Not stated</p>	Not reported	<p>SDR Adverse Effects</p> <p>Postoperative urinary retention (requiring intermittent catheterisation) = 13/250 (5.2%)</p> <p>Catheterisation required 18m post op = 1/250 (0.4%)</p> <p>Postoperative ileus (requiring 48H of NG suctioning) = 3/250 (1.2%)</p> <p>Loss of muscle range (requiring tendonotomy) = 8/250 (3.2%)</p> <p>Progressive hip dislocation (requiring varus derotation osteotomies of femur) = 6/250 (2.4%) (all crawlers pre-op who walked post -op)</p>		

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<p><b>Periodical</b> Journal of Neurosurgery</p> <p><b>Authors</b> Engsberg,J.R., Ross,S.A., Collins,D.R., Park,T.S.</p> <p><b>Year of publication</b> 2006</p> <p><b>Study location</b></p> <p><b>Ref ID</b> 75889</p> <p><b>Type of study</b></p> <p><b>Aim of study</b></p>	<p><b>Inclusion Criteria</b> Diagnosis of spastic diplegic CP GMFCS classification Levels I to III The ability to walk (with or without orthoses, including crutches and canes) A minimum level of cognitive skills for active participation No surgical intervention within the preceding year Hypertonicity of the lower extremity measured with the modified Ashworth scale Ankle clonus Exaggerated deep tendon reflex in the legs Babinski sign Abnormal postures while sitting, standing, and walking Ability to perform barefoot walking for approximately 8 minutes for six to eight repetitions</p> <p><b>Exclusion Criteria</b> Less than six months since any casting procedures or injections of botulinum toxin serotype A Age under 4 years (for reasons of cooperation with assessments) Children who had motor deficits resulting from</p>	<p>SDR intervention Needle electrodes were placed bilaterally in six major muscles of the lower extremity in preparation for intraoperative EMG examinations. A single-level laminectomy was performed at the L-1 vertebra. The L-1 spinal dorsal nerve roots were identified at the foraminal exit and separated from the ventral root. Next, individual dorsal roots were identified at the level of the cauda equina. Each root was then subdivided into four to seven smaller rootlets, and these rootlets were individually suspended over rhizotomy probes. Electrical stimulation was used to grade a reflex response from the lower-extremity muscles. Rootlets were then cut according to the response. This procedure was repeated on the remaining L-2 through S-2 dorsal roots, and the entire procedure was repeated on the contralateral side. The number of rootlets that were cut varied depending on the EMG response. Approximately 65% of the rootlets were cut.</p> <p>PT intervention</p>	<p>SDR-PT Group (29 children)</p> <p>ankle DF at initial contact Preop = <math>-5 \pm 7</math> Postop (8 mos) = <math>-4 \pm 6</math> Postop (20 mos) = <math>-4 \pm 6</math></p> <p>ankle DF/PF ROM Preop = <math>15 \pm 8</math> Postop (8 mos) = <math>16 \pm 6</math> Postop (20 mos) = <math>16 \pm 4</math></p> <p>knee flex at initial contact Preop = <math>32 \pm 12</math> Postop (8 mos) = <math>28 \pm 11</math> Postop (20 mos) = <math>28 \pm 12</math></p> <p>knee flex/ext ROM‡ Preop = <math>44 \pm 13</math> Postop (8 mos) = <math>49 \pm 12</math> Post-PT (20 mos) = <math>52 \pm 13</math>§</p> <p>hip flex/ext ROM‡ Preop = <math>43 \pm 7</math> Postop (8 mos) = <math>46 \pm 7</math> Postop (20 mos) = <math>46 \pm 8</math></p> <p>pelvic tilt ROM‡ Preop = <math>8 \pm 3</math> Postop (8 mos) = <math>7 \pm 3</math> Postop (20 mos) = <math>6 \pm 3</math>‡§</p> <p>pelvis rotation ROM Preop = <math>19 \pm 7</math> Postop (8 mos) = <math>17 \pm 6</math> Postop (20 mos) = <math>18 \pm 4</math>§</p>	<p>Prospective or retrospective : Prospective Cross-sectional or longitudinal : longitudinal Design : observational Randomised : No Allocation concealment: no allocation concealment Similar prognosis at baseline : yes Blinded subjects : no Blinded therapists : no Blinded assessors : no &gt;85% follow up : no ITT analysis : yes</p>	

	<p>neurological injury or illness that began after the 1st month of life Children with malformations of the central nervous system Moderate to severe dystonia, athetosis, ataxia, or severe cognitive delay Children whose parents reported that they were unable to follow simple commands and understand concepts such as “push as hard as you can” and “relax your muscles.”</p> <p><b>Baseline characteristics</b> n=77 children with spastic diplegic CP were included, n=68 in final cohort</p> <p>SDR-PT group n=37 children included (mean <math>\pm</math> SD, 9 <math>\pm</math> 5.3 years of age) 6 children dropped out : no SDR after initial testing (3),lack of cooperation (1),no contact after the initial visit (1), because of the distance between the research site and the participant’s home (1) 31 children remained in the study Age (yrs) mean <math>\pm</math> SD = 9.0 <math>\pm</math> 5.3 Male = 15 Weight (kg) mean <math>\pm</math> SD = 30.1 <math>\pm</math> 17.8 GMFCS I = 12 GMFCS II = 11 GMFCS III = 8 Independent walking = 25</p>	<p>The SDR-PT group received PT from therapists in their hometowns four times per week for 8 months after discharge. Then treatments were reduced to three times per week for an additional 12 months. The PT-only group received the same number of PT sessions. Treatment in both groups was focussed on the trunk and lower extremities, on strengthening, and on functional activities. Billing data were used to confirm that both groups received the similar amounts of therapy.</p>	<p>trunk rotation ROM Preop = 15 <math>\pm</math> 9 Postop (8 mos) = 11 <math>\pm</math> 5 Postop (20 mos) = 12 <math>\pm</math> 7</p> <p>ext foot progression angle<math>\ddagger</math> Preop = -3 <math>\pm</math> 18 Postop (8 mos) = -7 <math>\pm</math> 15 Postop (20 mos) = -9 <math>\pm</math> 15</p> <p>Gait speed (cm/sec)<math>\ddagger</math> Preop = 81 <math>\pm</math> 22 Postop (8 mos) = 91 <math>\pm</math> 25 Postop (20 mos) = 101 <math>\pm</math> 24<math>\S</math></p> <p>GMFM (%) Preop = 87 <math>\pm</math> 10 Postop (8 mos) = 88 <math>\pm</math> 9 Postop (20 mos) = 92 <math>\pm</math> 8<math>\S</math></p> <p>PT-Only Group (36 children)</p> <p>ankle DF at initial contact Pre-PT -3 <math>\pm</math> 7 Post-PT (8 mos) = -3 <math>\pm</math> 7 Post-PT (20 mos) = -2 <math>\pm</math> 6</p> <p>ankle DF/PF ROM Pre-PT = 17 <math>\pm</math> 7 Post-PT (8 mos) = 17 <math>\pm</math> 6 Post-PT (20 mos) = 19 <math>\pm</math> 7</p> <p>knee flex at initial contact Pre-PT = 29 <math>\pm</math> 8 Post-PT (8 mos) = 28 <math>\pm</math> 9 Post-PT (20 mos) = 30 <math>\pm</math> 8</p> <p>knee flex/ext ROM<math>\ddagger</math></p>		
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	<p>Needs device to walk = 6</p> <p>PT group n= 40 children included (mean <math>\pm</math> SD, 9.7 <math>\pm</math> 4.5 years) 3 children dropped out : lack of cooperation (1), shunt malfunction (1), severe change in scoliosis after the initial visit (1) 37 children remained in the study Age (yrs) mean <math>\pm</math> SD = 9.7 <math>\pm</math> 4.5 Male = 19 Weight (kg) mean <math>\pm</math> SD = 34.5 <math>\pm</math> 19.8 GMFCS I = 12 GMFCS II = 20 GMFCS III = 5 Independent walking = 35 Needs device to walk = 2</p> <p>No disability group Data from 40 participants with no disability were also collected but are not relevant to this review .</p>		<p>Pre-PT = 45 <math>\pm</math> 12 Post-PT (8 mos) = 46 <math>\pm</math> 13 Post-PT (20 mos) = 47 <math>\pm</math> 13</p> <p>hip flex/ext ROM<math>\ddagger</math> Pre-PT = 43 <math>\pm</math> 7 Post-PT (8 mos) = 43 <math>\pm</math> 7 Post-PT (20 mos) = 43 <math>\pm</math> 7</p> <p>pelvic tilt ROM<math>\ddagger</math> Pre-PT = 7 <math>\pm</math> 3 Post-PT (8 mos) = 8 <math>\pm</math> 3 Post-PT (20 mos) = 7 <math>\pm</math> 3</p> <p>pelvis rotation ROM Pre-PT = 17 <math>\pm</math> 7 Post-PT (8 mos) = 18 <math>\pm</math> 7 Post-PT (20 mos) = 18 <math>\pm</math> 7</p> <p>trunk rotation ROM Pre-PT = 12 <math>\pm</math> 6 Post-PT (8 mos) = 12 <math>\pm</math> 6 Post-PT (20 mos) = 12 <math>\pm</math> 6</p> <p>ext foot progression angle<math>\ddagger</math> Pre-PT = -7 <math>\pm</math> 13 Post-PT (8 mos) = -8 <math>\pm</math> 12 Post-PT (20 mos) = -5 <math>\pm</math> 11</p> <p>Gait speed (cm/sec)<math>\ddagger</math> Pre-PT = 91 <math>\pm</math> 26 Post-PT (8 mos) = 90 <math>\pm</math> 22 Post-PT (20 mos) = 93 <math>\pm</math> 22</p> <p>GMFM (%) Pre-PT = 89 <math>\pm</math> 7 Post-PT (8 mos) = 90 <math>\pm</math> 7 Post-PT (20 mos) = 91 <math>\pm</math> 7§</p>		
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			<p>‡ Significantly different pre- to 20m post-treatment change compared with that found for the PT group (<math>p &lt; 0.05</math>).</p> <p>§ Significantly different from pretreatment or initial visit (<math>p &lt; 0.05</math>).</p>		
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<p><b>Periodical</b> Developmental Medicine and Child Neurology</p> <p><b>Authors</b> Wright,F.V., Sheil,E.M., Drake,J.M., Wedge,J.H., Naumann,S.</p> <p><b>Year of publication</b> 1998</p> <p><b>Study location</b> Canada</p> <p><b>Ref ID</b> 76369</p> <p><b>Type of study</b> Randomised controlled study</p> <p><b>Aim of study</b> To determine whether SDR leads to improved functional outcome after 1 year in children with spastic diplegia compared with a control group receiving the equivalent amount of physiotherapy and occupational therapy.</p>	<p><b>Inclusion Criteria</b> (1) Diagnosis of CP. (2) Predominant spastic diplegia that interferes with functional tasks such as sitting, standing and walking (3) Ability to walk <math>\geq 3</math> m with an assistive device of underarm support (4) Adequate trunk control to allow at least 60 s of independent sitting. (5) Reasonable underlying lower-extremity strength (minimum grade 3 at hip and knees)</p> <p><b>Exclusion Criteria</b> (1) Major fixed contractures of lower extremity ie <math>&gt;30</math> degrees at hips and knees. (2) Major previous orthopaedic surgery eg rectus femoris transfers</p> <p><b>Baseline characteristics</b> 31/100 children attending a rhizotomy clinic were eligible for inclusion in the study 7/31 declined to participate as families wanted the rhizotomy procedure to start as early as possible Therefore total N=24 All had spastic diplegia that interfered with functional tasks such as sitting, standing or walking and the spasticity</p>	<p>Comparison: SDR + Therapy vs Therapy only</p> <p>SDR + therapy group: n = 12</p> <p>Therapy only : n = 12</p> <p>SDR : Performed under general anaesthesia No neuromuscular blocking agents used Urinary catheter inserted after anaesthesia EMG activity recorded using surface electrodes over the quadriceps, hamstrings, anterior tibial and gastrocnemius muscles A partial laminectomy of L2 to L5 was performed and the posterior roots of L2 to S2 were isolated and confirmed as being sensory. The roots were subdivided along natural planes into between 2 and 6 rootlets which were tested in sequence for their threshold to constant current stimulation at 50Hz. Those rootlets with the lowest threshold were divided (on average 50% of each dorsal root was transected). All procedures were performed by the same</p>	<p>Follow-up: 6 months, and 1 year</p> <p>Primary outcome : GMFM-88 NB A change of 6 percentage points in the total score or within a dimension is considered to be clinically important.</p> <p>Mean GMFM scores</p> <p>Lie/roll @ baseline SDR + Therapy group = 92.8 (9.4) Therapy only group = 91.2 (8.3)</p> <p>Lie/roll @ 6 m SDR + Therapy group = 94.4 (6.7) Therapy only group = 95.9 (2.8)</p> <p>Lie/roll @ 12m SDR + Therapy group = 98.7 (1.9) Therapy only group = 96.2 (3.1)</p> <p>Sit @ baseline SDR + Therapy group = 74.3 (22.2) Therapy only group = 83.7 (16.1)</p>	<p>Randomisation method: Appropriate Sample size calculation: Not given Analysis: Intention to treat Loss to follow-up: 0% Blinding: None (in effect)</p> <p>Appropriate randomisation method : Yes, blocking by age was performed prior to randomisation (&lt;6 yrs and <math>\geq 6</math> yrs) then assignment of values from a uniform distribution on the interval (0, 1). Allocation concealment adequate : Yes Groups comparable at baseline : Yes for age and sex.</p> <p>Participants blinded to treatment allocation : No Caregivers blinded to treatment allocation : Yes (but could distinguish treatment groups)</p> <p>Length of follow up similar for each group : Yes No of participants not completing treatment (by group) : None Outcome assessment methods valid : Yes Investigators blinded to treatment allocation : Yes (but</p>	<p>Funding : the Easter Seal Research Institute of Canada and the United Cerebral Palsy Research and Education</p> <p>Consent: Informed consent obtained from parents</p> <p>Ethical approval : Not stated</p>

	<p>was considered to be a major limiting factor to gross motor progress. 4/24 also had upper extremity spasticity that was strongly evidence during functional activities. Sex : Female =10, Male = 14 Mean age at enrollment = 58.0 months <math>\pm</math> SD 12.7 months Age range at enrollment = 41 - 91 months</p> <p>Baseline physiotherapy and biomechanical assessments were conducted. In the SDR group, these were conducted no more than 3 wks before surgery was performed and follow up was conducted from the day of surgery for 1 year. In the therapy only group, follow up for 1 year started on the baseline assessments completion.</p> <p>No significant differences between the groups for mean age (SDR+therapy group = 57.8m vs Therapy only group 58.3), for sex ratio in each group (Male - 58% in both groups)</p>	<p>neurosurgeon Postoperative analgesia was IV morphine (typically 30<math>\mu</math>g/kg/hr) usually for 3 or 4 days. Patients were nursed in bed during this time and were turned every 4 hours. Physiotherapy to amintain ROM was started on the second or third postoperative day.</p> <p>Therapy programs Each child's local physiotherapist and occupational therapist developed a list of pre-randomisation therapy goals and the behaviours that would indicate goal accomplishment for the next 3-6 months</p> <p>These treatment goals were followed by the therapy only group in 2 hour-long sessions/wk (c120mins/wk) and focussed on ROM, strengthening through functional activities, facilitation of normal movement patterns and postural control, standing and gait-related activities and work on fine motor skills and functional abilities.The physiotherapist generally concentrated on lower limb,</p>	<p>Sit @ 6m SDR + Therapy group = 87.9 (15.1) Therapy only group = 85.6 (17.9)</p> <p>Sit @ 12m SDR + Therapy group = 87.7 (15.2) Therapy only group = 87.9 (15.8)</p> <p>Crawl/kneel @ baseline SDR + Therapy group = 62.9 (26.9) Therapy only group = 71.1 (19.4)</p> <p>Crawl/kneel @ 6m SDR + Therapy group = 68.4 (24.0) Therapy only group = 76.3 (15.8)</p> <p>Crawl/kneel @ 12m SDR + Therapy group = 77.3 (19.2) Therapy only group = 76.9 (10.4)</p> <p>Stand @ baseline SDR + Therapy group = 21.8 (15.9) Therapy only group = 19.6 (17.2)</p> <p>Stand @ 6m SDR + Therapy group = 30.1 (23.4)</p>	<p>could distinguish treatment groups)</p> <p>Limitations : None Other considerations :None</p>	
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		<p>whilst the occupational therapist focussed on upper limb and functional skills.</p> <p>Children in the SDR and therapy group were given a new set of short term goals determined postoperatively by the hospital physiotherapist and occupational therapist team. In the initial post-operative period these were consistent for all children as they were based on local post-SDR rehabilitation guidelines. For the remainder of their 6 week in-patient stay the same physiotherapist and occupational therapist treated all 12 children for 45 mins of physiotherapy each day and for 45 mins of occupational therapy twice/wk. The focus initially was on ROM and positioning, upper and lower extremity strengthening, particularly of the trunk musculature, hip extensors and abductors and knee extensors via work on isolated movements and facilitation of more normal movement patterns and postural control. Standing and gait related activities and work on fine motor</p>	<p>Therapy only group = 23.7 (12.1)</p> <p>Stand @ 12m SDR + Therapy group = 33.1 (23.5) Therapy only group = 27.1 (19.6)</p> <p>Walk/run/jump @ baseline SDR + Therapy group = 10.6 (8.2) Therapy only group = 13.2 (14.2)</p> <p>Walk/run/jump @ 6m SDR + Therapy group = 14.8 (7.8) Therapy only group = 14.5 (15.4)</p> <p>Walk/run/jump @ 12m SDR + Therapy group = 23.4 (19.5) Therapy only group = 15.7 (17.1)</p> <p>Total score @ baseline SDR + Therapy group = 51.9 (13.4) Therapy only group = 56.5 (12.2)</p> <p>Total score @ 6m SDR + Therapy group = 58.7 (13.5) Therapy only group = 58.5 (10.7)</p>		
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		<p>skills and functional activities were gradually introduced as the child's strength and control improved. On transfer to outpatient care, the child's regular community therapists were sent specific treatment guidelines and set individual treatment goals for the remainder of the child's study year with therapy frequency set at 2 hour-long sessions/wk (c120mins/wk)</p>	<p>Total score @ 12m SDR + Therapy group = 64.0 (13.2) Therapy only group = 60.9 (12.5)</p> <p>Secondary outcomes Tone using modified Ashworth Active ROM lower limb Passive ROM lower limb Distance walked in 60 secs using the child's usual gait device scoring for the foot-floor contact pattern ankle-stretch reflex isometric contractions video gait analysis</p> <p>Modified Ashworth @ elbow baseline SDR + Therapy group = 4.0 (1.3) Therapy only group = 5.0 (0.5)</p> <p>Modified Ashworth @ elbow 6m SDR + Therapy group = 4.0 (0.7) Therapy only group = 4.0 (0.6)</p> <p>Modified Ashworth @ elbow 12m SDR + Therapy group = 4.0 (1.2) Therapy only group = 4.0</p>		
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			<p>(0.6)</p> <p>Modified Ashworth @ knee baseline SDR + Therapy group = 5.0 (1.2) Therapy only group = 5.0 (0.7)</p> <p>Modified Ashworth @ knee 6m SDR + Therapy group = 4.0 (0.9) Therapy only group = 5.0 (0.6)</p> <p>Modified Ashworth @ knee 12m SDR + Therapy group = 4.0 (0.7) Therapy only group = 5.0 (0.7)</p> <p>Modified Ashworth @ ankle baseline SDR + Therapy group = 5.0 (0.7) Therapy only group = 6.0 (0.4)</p> <p>Modified Ashworth @ ankle 6m SDR + Therapy group = 4.0 (0.7) Therapy only group = 6.0 (0.4)</p> <p>Modified Ashworth @ ankle 12m</p>		
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			<p>SDR + Therapy group = 4.5 (0.7) Therapy only group = 6.0 (0.4)</p> <p>Active ROM hip extension @ baseline SDR + Therapy group = -22.5 (25.3) Therapy only group = -44.2 (31.3)</p> <p>Active ROM hip extension @ 6m SDR + Therapy group = -26.5 (20.0) Therapy only group = -28.6 (15.3)</p> <p>Active ROM hip extension @ 12m SDR + Therapy group = -20.3 (18.7) Therapy only group = -38.3 (27.9)</p> <p>Active ROM knee extension @ baseline SDR + Therapy group = -26.7 (18.7) Therapy only group = -32.5 (17.4)</p> <p>Active ROM knee extension @ 6m SDR + Therapy group = -10.2 (10.9) Therapy only group = -28.6 (15.3)</p>		
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			<p>Active ROM knee extension @ 12m SDR + Therapy group = - 11.3 (15.4) Therapy only group = - 24.3 (14.9)</p> <p>Active ROM ankle dorsiflexion @ baseline SDR + Therapy group = -25.8 (18.1) Therapy only group = -27.9 (21.4)</p> <p>Active ROM ankle dorsiflexion @ 6m SDR + Therapy group = -13.0 (19.9) Therapy only group = -32.7 (20.1)</p> <p>Active ROM ankle dorsiflexion @ 12m SDR + Therapy group = -6.3 (10.3) Therapy only group = -35.4 (19.9)</p> <p>Passive ROM hip extension @ baseline SDR + Therapy group = -15.0 (10.2) Therapy only group = - 20.4 (12.7)</p> <p>Passive ROM hip extension @ 6m SDR + Therapy group =</p>		
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			<p>-7.7 (9.1) Therapy only group = -18.6 (7.7)</p> <p>Passive ROM hip extension @ 12m SDR + Therapy group = -7.5 (9.9) Therapy only group = -12.9 (12.7)</p> <p>Passive ROM knee extension @ baseline SDR + Therapy group = -12.9 (18.3) Therapy only group = -12.1 (12.7)</p> <p>Passive ROM knee extension @ 6m SDR + Therapy group = -8.4 (15.9) Therapy only group = -11.1 (11.3)</p> <p>Passive ROM knee extension @ 12m SDR + Therapy group = -6.5 (12.5) Therapy only group = -8.7 (11.1)</p> <p>Passive ROM popliteal angle @ baseline SDR + Therapy group = 37.1 (17.5) Therapy only group = 46.7 (14.4)</p>		
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			<p>Passive ROM popliteal angle @ 6m SDR + Therapy group = 32.5 (16.6) Therapy only group = 50.5 (14.7)</p> <p>Passive ROM popliteal angle @ 12m SDR + Therapy group = 32.5 (19.3) Therapy only group = 46.8 (9.8)</p> <p>Passive ROM ankle dorsiflexion (knee extended) @ baseline SDR + Therapy group = -5.0 (20.2) Therapy only group = -9.6 (17.9)</p> <p>Passive ROM ankle dorsiflexion (knee extended) @ 6m SDR + Therapy group = 6.9 (13.7) Therapy only group = -11.8 (17.6)</p> <p>Passive ROM ankle dorsiflexion (knee extended) @12m SDR + Therapy group = 3.8 (11.5) Therapy only group = -12.0 (16.4)</p>		
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			<p>Timed walk @ baseline SDR + Therapy group = 23.9 (25.9) Therapy only group = 30.1 (25.1)</p> <p>Timed walk @ 6m SDR + Therapy group = 28.9 (27.7) Therapy only group = 38.1 (25.9)</p> <p>Timed walk @ 12m SDR + Therapy group = 39.8 (32.2) Therapy only group = 26.6 (18.6)</p>		
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Bibliographic details	Number of Participants Characteristics	Intervention characteristics	Outcome measures and results	Quality assessment	Reviewer comment
<p><b>Periodical</b> Archives of Physical Medicine and Rehabilitation</p> <p><b>Authors</b> Buckon,C.E., Thomas,S.S., Piatt,J.H.,Jr., Aiona,M.D., Sussman,M.D.</p> <p><b>Year of publication</b> 2004</p> <p><b>Study location</b> USA</p> <p><b>Ref ID</b> 75792</p> <p><b>Type of study</b> Non-randomised controlled study</p> <p><b>Aim of study</b> To compare the efficacy of selective dorsal rhizotomy versus orthopaedic surgery using multidimensional outcomes measures (National Centre for Medical Rehabilitation Research disablement framework)</p>	<p><b>Inclusion Criteria</b> Children found by an MDT to be appropriate for SDR or orthopaedic soft tissue procedures.</p> <p><u>Eligibility for SDR:</u> -aged between 4 and 10 years -predominantly spastic -have good trunk control -history of prematurity -no significant ataxia or athetosis -good lower extremity antigravity strength -no significant scoliosis -ambulatory with or without assistive devices -cooperative -ability to isolate lower extremity movements -lower extremity contracture &lt; 10°</p> <p><u>Eligibility for orthopaedic surgery:</u> -kinematic dysfunction with evidence of dynamic limitation of motion -spasticity on static examination, which would benefit from muscle and tendon lengthening, release or transfer</p> <p><b>Exclusion Criteria</b></p>	<p><u>Interventions</u></p> <p>- 1. Selective Dorsal Rhizotomy (SDR) (n=18) SDR performed through osteoplastic laminotomy. Posterior nerve roots from L2 to S1 divided into 3–6 rootlets. At L2, 30%– 50% of rootlets sectioned without stimulation. Rootlets from L3 to S1 sectioned on basis of electromyographic results after stimulation and presurgical assessment results (mean of 42% of rootlets cut, range 36%–48%).</p> <p>Post-SDR hospitalisation for 1 month. Twice daily PT and once daily OT from day 4 to discharge. PT 2–3 times a week and OT 1–2 times a week for first 6 months, then PT 1–2 times a week to 1 year.</p> <p>2. Orthopaedic surgery (n=7) Aponeurotomy/tenotomy, between 4 and 7 procedures performed per patient.</p> <p>Patients received post-surgical therapy that was standard for interventions received. Children with soft tissue procedures began PT on days 2</p>	<p>(p values refer to significant within-group change)</p> <p>GMFM total (change scores) (mean (SD))</p> <p>a. SDR 6 months: 1.98 (5.22); p=0.13 (NS) 1 year: 3.39 (7.82); p=0.08 (NS) 2 years: 6.32 (8.38); p=0.01</p> <p>b. Orthopaedic surgery 6 months: 0.96 (4.45); p=0.59 (NS) 1 year: 5.90 (4.89); p=0.02 2 years: 7.51 (8.04); p=0.05</p> <p>PEDI Functional skills</p> <p><u>PEDI-self care (change scores) (mean (SD))</u></p> <p>- a. SDR 6 months: 3.27 (4.37); p≤0.006 1 year: 6.18 (6.91); p≤0.001 2 years: 11.89 (6.81); p≤0.0001</p> <p>b. Orthopaedic surgery 6 months: 1.1 (4.82); p≤0.57 (NS) 1 year: 5.5 (5.27); p≤0.03 2 years: 8.17 (6.29); p≤0.02</p> <p><u>PEDI-mobility (change scores) (mean (SD))</u></p>	<p><u>Follow-up issues:</u> Completeness of follow-up not reported.</p> <p><u>Study design issues:</u> Prospective study</p> <p>Sample size calculation not reported</p> <p>The post-surgical physiotherapy care was not standardised between the groups as it was focused to the remedial need, and may have influenced outcome. All outcomes were evaluated by two investigators who were trained in using the scales. Assessors were not blinded to treatment allocation.</p> <p><u>Study population issues:</u> Ambulatory = 92% There were no significant differences between groups at baseline in any of the clinical outcomes measured.</p> <p>Mean proportion of dorsal nerve rootlets sectioned in the SDR group: 43.3% (reported by NICE IPG analyst)</p>	<p>Recruitment period: over 3 years (dates not reported) Follow-up: 2 years No safety data was presented in the study report Conflict of interest/source of funding: no commercial party conferred a benefit on the author.</p>

	<p>Not stated</p> <p><b>Baseline characteristics</b></p> <p><u>Total sample size</u> n=25 children</p> <p><u>Characteristics</u> Children with spastic diplegia -Age: SDR group: 71.3 months (mean); orthopaedic surgery group: 78.6 months (mean) -Sex: 76% (19/25) male -GMFCS (I, II, III):</p> <p>SDR: 17%, 44%, 39% Orthopaedic surgery: 29%, 14%, 57%</p>	<p>and 3. 5/7 received casting. Discharged on day 5. Casts removed after 2–4 weeks. Readmitted for 2 weeks of PT twice daily and OT (where indicated) once daily. Patients then discharged and received weekly outpatient therapy for 2–4 months.</p> <p><u>Comparison</u> SDR vs. orthopaedic surgery with post-surgical physiotherapy in both groups.</p> <p>Parents chose the treatment therapy after discussions with clinicians.</p>	<p>-</p> <p>a. SDR 6 months: 1.41 (3.80); <math>p \leq 0.13</math> (NS) 1 year: 3.73 (7.94); <math>p \leq 0.06</math> (NS) 2 years: 7.51 (7.11); <math>p \leq 0.001</math></p> <p>b. Orthopaedic surgery 6 months: -1.50 (6.26); <math>p \leq 0.55</math> (NS) 1 year: 1.84 (5.79); <math>p \leq 0.43</math> (NS) 2 years: 7.34 (7.52); <math>p \leq 0.04</math></p> <p><u>PEDI-social skills (change scores) (mean (SD))</u></p> <p>-</p> <p>a. SDR 6 months: 1.22 (5.95); <math>p \leq 0.39</math> (NS) 1 year: 3.19 (6.56); <math>p \leq 0.06</math> (NS) 2 years: 7.82 (6.63); <math>p \leq 0.0004</math></p> <p>b. Orthopaedic surgery 6 months: 7.41 (5.23); <math>p \leq 0.01</math> 1 year: 2.59 (3.73); <math>p \leq 0.12</math> (NS) 2 years: 7.67 (4.95); <math>p \leq 0.006</math></p> <p>PEDI Caregiver assistance</p> <p><u>PEDI-self care (change scores) (mean (SD))</u></p> <p>-</p> <p>a. SDR 6 months: 2.82 (9.77); <math>p \leq 0.24</math> (NS)</p>		
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			<p>1 year: 3.07 (10.73); <math>p \leq 0.22</math> (NS)  2 years: 10.53 (8.33);  <math>p \leq 0.0002</math></p> <p>b. Orthopaedic surgery  6 months: 0.59 (12.13);  <math>p \leq 0.90</math> (NS)  1 year: 1.60 (9.66); <math>p \leq 0.67</math> (NS)  2 years: 5.50 (5.27); <math>p \leq 0.033</math></p> <p><u>PEDI-mobility (change scores) (mean (SD))</u></p> <p>-</p> <p>a. SDR  6 months: 0.78 (5.15);  <math>p \leq 0.53</math> (NS)  1 year: 8.01 (11.97); <math>p \leq 0.11</math>  2 years: 13.58 (13.76);  <math>p \leq 0.02</math></p> <p>b. Orthopaedic surgery  6 months: 2.59 (8.63);  <math>p \leq 0.46</math> (NS)  1 year: 4.84 (6.82); <math>p \leq 0.11</math> (NS)  2 years: 5.83 (9.64); <math>p \leq 0.16</math> (NS)</p> <p><u>PEDI-social skills (change scores) (mean (SD))</u></p> <p>-</p> <p>a. SDR  6 months: 1.12 (13.56);  <math>p \leq 0.73</math> (NS)  1 year: 3.07 (10.40); <math>p \leq 0.23</math> (NS)  2 years: 7.00 (10.31); <math>p \leq 0.02</math></p>		
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			<p>b. Orthopaedic surgery</p> <p>6 months: 1.44 (14.67); 0.80 (NS)</p> <p>1 year: -3.14 (8.89); <math>p \leq 0.39</math> (NS)</p> <p>2 years: 2.53 (14.59); <math>p \leq 0.66</math> (NS)</p>		
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Bibliographic details	Number of Participants Characteristics	Intervention characteristics	Outcome measures and results	Quality assessment	Reviewer comment
<p><b>Periodical</b> Developmental Medicine and Child Neurology</p> <p><b>Authors</b> McLaughlin,J.F., Bjornson,K.F., Astley,S.J., Graubert,C., Hays,R.M., Roberts,T.S., Price,R., Temkin,N.</p> <p><b>Year of publication</b> 1998</p> <p><b>Study location</b> USA</p> <p><b>Ref ID</b> 96092</p> <p><b>Type of study</b> Randomised controlled study</p> <p><b>Aim of study</b> To investigate the efficacy and safety of SDR in children with spastic diplegia</p>	<p><b>Inclusion Criteria</b></p> <ol style="list-style-type: none"> <li>1) Age 3 – 18 years</li> <li>2) Diagnosis of spastic diplegia.</li> <li>3) Good prognosis for community or indoor ambulation with conventional treatment.</li> <li>4) Ability to participate for the duration of study.</li> <li>5) Availability of sufficient PT services in child's home community.</li> <li>6) Intellectual function at 36-month-old level or higher.</li> <li>7) Expressive language: 36-month-old level or higher</li> </ol> <p><b>Exclusion Criteria</b></p> <ol style="list-style-type: none"> <li>1) Other neurological motor abnormalities.</li> <li>2) Fixed musculoskeletal contractures of more than 15° at hips or knees and 30° at ankles.</li> <li>3) Other musculoskeletal problems requiring effective conventional intervention.</li> <li>4) Medical contraindications to a prolonged elective anaesthetic, abnormal spine anatomy, uncontrolled seizure disorder, or other chronic conditions that would compromise either the postoperative course after SDR or the child's participation in an intensive PT program</li> </ol>	<p>Comparison: SDR+PT vs PT only SDR+PT : n = 21 PT only : n = 17</p> <p><u>SDR</u> One surgeon performed all SDRs Inhalational anaesthesia was used and monitored to avoid suppression of EMG responses Neuromuscular blockers were not used A narrow laminectomy (bone rongeurs)or laminotomy (Anspach lamina cutter) was performed from T12 to S2 Bilateral visual and EMG identification of each ventral (0.2mA) and dorsal (1-20mA) roots Dorsal rootlets giving abnormal repnses subdivided by blunt dissection 4 channel EMG recording unit , clinical inspection and muscle palpation used to detect muscle group responses to rootlet stimulation Postoperative pain managed with IV morphine and IV midazolam for 2-3 days Children hospitalised for 5-7 days Percentage of dorsal root tissue transacted:26%</p>	<p>Primary outcome: Spasticity—spasticity measurement system. Functional mobility—GMFM score Secondary outcome: Spasticity—Ashworth scale and clinical assessment of signs of spasticity. Functional mobility—rating of child's ambulation status Adverse events : A structured adverse event questionnaire was administered to parents either face-to-face or over the telephone every 3 m for 24 m by the investigators. Adverse events were rated for severity and whether they were related to treatment or CP.</p> <p><u>Changes in spasticity</u> Mean Ashworth scale score reduction @ 6 m (read from graph) SDR+Therapy : -1.0 Therapy alone : -0.15 Mean difference = 0.85</p> <p>Median Ashworth scale score reduction @ 12 m SDR+Therapy : -0.88 Therapy alone : -0.13 Median difference -1.0 (-1.3 to -0.7) &lt;0.001</p>	<p>Appropriate randomisation method: Yes, sealed envelope technique with statistician uninvolved with study. Allocation concealment adequate : Unclear, two children swapped from the therapy group to the SDR + therapy group Patients were stratified by age (3-11 yrs and 12-18yrs) and ambulatory (ability to walk 50 feet without upper extremity aids) status by a block with a cell size of 4 Sample size calculation: 10% difference in GMFM with 90% power at <math>\alpha = 0.05</math> (2-sided) and spasticity measurement system difference of 10 Nm/rad with 80% power at <math>\alpha = 0.05</math> (2-sided) Sample size obtained (ie SDR + Therapy vs Therapy alone, n=21 vs n=17) sufficient for 10% difference in GMFM with 90% power and 10 Nm/rad difference in total SMS path with 46% power. Analysis: By treatment Groups comparable at baseline : yes Participants blinded to treatment allocation : no Caregivers blinded to treatment allocation : no</p>	<p>Funding : Was sought to purchase therapy services for the Therapy only group and for the SDR+therapy group where insurance did not cover the children's therapy costs.</p> <p>Consent: Consent from children (if functioning at 7 year old level or higher), written consent from adolescents and each guardian</p> <p>Ethical approval : Children's Hospital Regional Medical Centre Institutional review board</p>

	<p><b>Baseline characteristics</b>  N = 38  Mean age (range)  SDR+PT: 6.1 y (2.9–14.3)  PT: 6.8 y (3.0–17.3)</p> <p>Male Sex%  SDR+PT: 52%  PT: 55%</p> <p>No significant difference between groups for  -Race  -Caregiver's marital status  -Socioeconomic status  -Insurance coverage  -Gestational age  -Birthweight  -Cause of CP  -Ambulatory ability  -Cognitive status  -Number of children with associated impairments</p>	<p>(14%–50%) from L1 to S2</p> <p><u>Therapy</u>  Over a 12-month sequence each child within the SDT + therapy or Therapy group only was scheduled to receive :</p> <ol style="list-style-type: none"> <li>1) 2 hrs per day for 5days/wk for 4 wks performed by experienced therapists for which the families stayed in hospital</li> <li>2) 1 hr per day, 4–5 days/wk for 5 m prescribed by investigators and performed by community therapists</li> <li>3) 1 hr per day, 1–4 days/wk for 6 m prescribed by investigators and performed by community therapists on a voluntary basis</li> </ol> <p>The emphasis and techniques used in the SDR group were appropriate for this group. 20 difference categories of treatment were documented by the treating therapists</p>	<p>Median Ashworth scale score reduction @ 24 m  SDR+Therapy : - 0.88  Therapy alone : 0.00  Median difference -1.0 (-1.4 to -0.7) &lt;0.001</p> <p><u>Changes in function</u></p> <p>Mean difference in GMFM dimensions at 12m (95% CI) (positive value in favour of SDR + Therapy group)  Lying/rolling : -0.8 (-3.5 to 1.8) p=0.53  Sitting : 1.2 (-5.8 to 8.2) p=0.73  Crawl/kneel : -0.1 (-6.8 to 6.6) p=0.98  Standing : 2.6 (-8.4 to 14.0) p=0.63  Walk/run/jump : 0.5 (-6.0 to 7.0) p=0.88</p> <p>Mean difference in GMFM dimensions at 24m (95% CI)  Lying/rolling : -0.1 (-2.2 to 2.1) p=0.97  Sitting : -1.6 (-8.5 to 5.4) p=0.65  Crawl/kneel : -0.3 (-7.0 to 6.4) p= 0.93  Standing : 1.6 (-16.0 to 9.1) p= 0.59  Walk/run/jump : 1.6 (-8.0 to 11.0) p=0.74</p> <p>Mean increase in total GMFM score @ 12m</p>	<p>Length of follow up similar for each group : yes  No of participants not completing treatment (by group) : SDR + Therapy group n=2, Therapy only n=2 (and 1 child stopped participating after 6 month intensive treatment )  Outcome assessment methods valid : yes  Investigators blinded to treatment allocation : no</p>	
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			<p>SDR+Therapy : 4.9% Therapy alone : 4.2% 0.72</p> <p>Mean increase in total GMFM score @24 m SDR+Therapy :7.0% Therapy alone :7.2% 0.94</p> <p>Ambulation status improvement @ 12 m SDR+Therapy :19% Therapy alone :18% NS</p> <p>Ambulation status improvement @ 24 mo SDR+Therapy : 38% Therapy alone :18% 0.20</p> <p><u>Adverse events</u> No severe adverse events related to either treatment Back pain SDR+Therapy: 29% Therapy alone: 0%</p> <p>Lower-extremity pain SDR+Therapy: 48% Therapy alone: 94%</p> <p>Weakness SDR+Therapy: 19% Therapy alone: 18%</p> <p>Urinary problem SDR+Therapy: 14%</p>	
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			<p>Therapy alone: 0%</p> <p>Emotion/behavioural SDR+Therapy: 29% Therapy alone: 35%</p> <p>Other (musculoskeletal) SDR+Therapy: 14% Therapy alone: 0%</p> <p>Sensory SDR+Therapy: 19% Therapy alone: 0%</p>		
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Bibliographic details	Number of Participants Characteristics	Intervention characteristics	Outcome measures and results	Quality assessment	Reviewer comment
<p><b>Periodical</b> Childs Nervous System</p> <p><b>Authors</b> Kim,D.S., Choi,J.U., Yang,K.H., Park,C.I.</p> <p><b>Year of publication</b> 2001</p> <p><b>Study location</b> Korea</p> <p><b>Ref ID</b> 96093</p> <p><b>Type of study</b> Non-randomised controlled study</p> <p><b>Aim of study</b> To review 10years experience of SDR with an emphasis on surgical outcomes, concentrating on the improvement in functional ability and adverse events</p>	<p><b>Inclusion Criteria</b> Selection criteria were patients with spastic hemiplegia of cerebrovascular sequelae or spastic quadriparesis resulting from an incomplete cervical cord who had undergone SDR more than one year previously to the start of the study.</p> <p><b>Exclusion Criteria</b> Not stated</p> <p><b>Baseline characteristics</b> N=208</p> <p>Patients with spastic CP =198 Patients with hemiplegia after a cerebrovascular insult = 8 Patients with spastic quadriparesis after cervical cord injury = 2 Mean age = 5.9 years (range 2-13 years)</p>	<p>Surface ENG electrodes were placed on selected muscle groups on both legs. Gastrocnemius was used to identify S1, the hamstrings for L5, anterior tibialis for L4, quadriceps for L3 and hip adductors for L2. The anal sphincter muscle was monitored for S2.</p> <p>Laminectomies were performed from L1 to S1 in the first 58 patients (48 children and 10 adults). Subsequently, laminoplasties from L1 to L5 followed by upper sacral laminectomies were performed in 150 children. At each level the posterior root was separated into three or four rootlets which were each stimulated and the EMG pattern recorded on surface electrodes. Rootlets' spasticity were ranked from grade 0 - 4. Those that demonstrated gradually decreasing or steady squared off electrical responses were spared, but any rootlets ranked higher were cut. The testing cutting or sparing procedure was repeated on all rootlets from S2 to L2 and was continued at L1 where 50% of the bilateral</p>	<p>Average duration of follow up = 4.2 years (range 1-9 years)</p> <p>20/208 (9.6%) patients experienced post-op temporary urinary retention resolving spontaneously in 18 patients within 4 wks of SDR surgery. 2 patients suffered from long-standing urinary incontinence because of atonic bladder. Post-op urinary incontinence in 1 child markedly improved after clean intermittent catheterisation for 2 years, however it did not return to normal in one child after 3 years.</p> <p>A post-op spinal deformity was seen in 12/208 (5.8%) patients - radiological only, and not functionally important</p> <p>Scoliosis was found in 5/58 patients undergoing laminectomy and in 2/150 patients undergoing laminoplasty</p> <p>2/208 patients required orthopaedic surgery because of progressive hip migration&gt;</p> <p>208/208 patients experienced post-op back pain which was</p>	<p>Case series providing non-comparative data. Only outcomes pertaining to specific adverse events related to surgery are extracted.</p> <p>Observational study (low)</p>	

		<p>roots were cut without EMG testing.</p> <p>A continuous IV fentanyl or morphine drip was administered as needed for pain relief until post-op day 3. Foley catheters were discontinued on post-op day 1 or 2. Patients were transferred to a rehab dept on post-op day 7 if there were no complications. Children then began gentle stretching, rolling and mat exercises and were allowed to sit as they tolerated this.</p>	<p>well controlled with iv fentanyl or morphine drip. 7/208 (3.4%) patients experienced long standing back pain.</p> <p>Lower limb spasticity (Ashworth score), passive range of motion, muscle strength, ambulatory function (Peacock grade) and gait pattern were assessed (but not presented here as is non comparative data)</p>		
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