Main Outcomes	Author, Year Country Study Design Sample Size	Study Characteristics	Results
	TRUNK		
SATCo	(Singh et al., 2020) USA Not Reported N=36 (SCI=26) N(TD)=10	**Population:** *SCI:* Mean age=5.0±2.0yr; Gender: males=17, females=9; Level of injury: C2-L2; Level of severity: AIS A=4, B=3, C=2, D=1, N/A=16 (younger than 6yr.); Time since injury=2.7±2.0yr. *Typically Developing (TD):* Mean age=6.0±2.0 yr; Gender: males=5, females=5. **Intervention:** Trunk Control Assessment SCI vs TD groups. **Outcome Measures:** Trunk Control Assessment (SATCo), Surface Electromyography (EMG), EMG Normalization	1. SCI group scored significantly lower on the SATCo compared to the TD group ($p<0.001$) 2. Every participant in the TD group completed all levels of the SATCo test, where 21 of the 26 individuals in the SCI group did not complete all levels 3. SCI group had significantly higher thoracic paraspinal (PST) muscle activation than the TD group over lower ribs ($p=0.01$), below ribs ($p=0.001$) and pelvis ($p=0.03$) 4. SCI group produced significantly lower PST muscle activation at inferior scapula ($p=0.03$), and significantly higher EMG magnitude at no support ($p=0.004$) level compared to the TD group
SATCo	Argetsinger et al. (2020) USA Case Study N=1	**Population:** Age=35mo; Gender: males=0, females=1; Level of injury: C5-C7; Level of severity: tetraplegia; Time since injury=32mo. **Intervention:** Activity-based therapy (ABT) for 8 months **Outcome Measures:** Neuromuscular capacity (Segmental Assessment of Trunk Control (SATCo))	5. Neuromuscular capacity improved significantly, especially for head and trunk control – allowed for major improvements in respiratory health, novel engagement with her environment, and improved physical abilities
SATCo	(Argetsinger et al., 2019) USA Prospective Study N=21	**Population:** Mean age=63.3±27.2mo.; Gender: males=10, females=11; Level of injury: cervical=9, thoracic=12; Level of severity: Not reported; Time since injury=18.3±18mo. **Intervention:** Activity-based locomotor training (AB-LT) with outcomes reported with regards to chronicity, initial score, ad injury level **Outcome Measures:** Segmental Assessment of Trunk Control (SATCo); Pediatric Balance Scale; Modified Functional Reach (MRF-Forward-Right-Left); Timed Short Sit; Timed Long Sit; Timed Stand.	1. SATCo scores increased significantly ($p<0.05$) regardless of chronicity, injury level, or initial score 2. Significant difference from first to last evaluations for MRF-Forward-Right-Left, Timed Short Sit, Timed Long Sit and Timed stand scores 3. No significant change in Pediatric Balance Scale from first to last evaluation
ABT	(Goode-Roberts et al., 2021) Switzerland Case Report N=1	**Population:** Age:2.7yr; Gender: males=1; Level of injury: C1-Sacrum; Severity of injury: Not reported; Time since injury=2.7 yr. **Intervention:** The patient received 144 sessions of Activity-Based Locomotor Training (AB-LT) and 90 sessions of Activity-Based Neuromuscular Electrical Stimulation (AB-NMES) over a seven-month period. AB-LT was provided for 1.5h/day, 5 days per week, followed by 1h/day, 5 days per week of AB-NMES.	1. The patient's resting respiratory rate steadily declined over a 4-month period from 60 to 30 BPM 2. The number of times the patient required to be suctioned during therapy sessions declined overall, with the exception of periods of viral respiratory illness 3. The patient's SATCo score increased from 0/20 to 5/20 4. Bayley-III assessment at discharge revealed dramatic developmental changes; non-verbal cognitive abilities improved from that of a 16-

		Outcome Measures: Resting respiratory rate, Segmental Assessment of Trunk Control (SATCo), Bayley-III Assessment.	day old to a 9-month developmental level and social/emotional skills from 0-3 month to 15-18 developmental level
SATCo	(A. L. Behrman et al., 2019) USA Pre-Post N=26	**Population:** Age: 5.0±3.0 yr; Gender: 15 males, 11 females; Etiology: 12 traumatic, 14 non-traumatic; Time since injury: 1.4±1.3 yr; Level of Injury: cervical=9, thoracic=15, lumbar=2; AIS: A (n=6), B 9 (n=4), C (n=3), D (n=1); Chronicity: 13 acute, 13 chronic. **Intervention:** Activity-based locomotor training (AB-LT), 5 times per week for 60 sessions, 1.5 hr per session. Body weight support (1 hr) followed by overground walking with supports, as necessary. Integration of training principles encouraged in daily activities. Neuromuscular electrical stimulation (40-100 Hz) provided 1-1.5 hr per week, 5 days per week, for 4 participants only. **Outcome Measures:** Segmental Assessment of Trunk Control (SATCo), Pediatric Neuromuscular Recovery Scale (Pediatric NRS) at baseline, sessions 20, 40, and 60 and/or discharge.	1. Pediatric NRS scores improved significantly from baseline to session 20 ($p<0.05$), from session 20 to 40 ($p<0.05$); while scores improved from session 40 to 60 they were not significant 2. On average, the inter-evaluation change in Pediatric NRS score was 3.7 ($p<0.05$) 3. SATCo scores improved significantly from baseline to session 20 ($p<0.05$), from session 20 to 40 ($p<0.05$); while scores improved from session 40 to 60 they were not significant 4. On average, the inter-evaluation change in SATCo score was 1.7 ($p<0.05$) 5. There was no significant difference in Pediatric NRS or SATCo scores by chronicity of SCI.
Supine Functional Neurophysiological Assessment	Atkinson et al. (2019) USA Observational N=43 N=43 (SCI=24)	**Population:** *SCI:* Mean age=7.5±3.4yr.; Gender: males=12, females=12; Level of injury: C1-T12; Level of severity: AIS N/A=10 (younger than 6 yr.), A=4, B=1, C=8, D=0, Not reported=1; Time since injury=4.6±3.6 yr. *Typically Developing (TD):* Mean age=6.9±2.8yr.; Gender: males=12, females=12; Level of injury: N/A; Level of severity: N/A; Time since injury: N/A. **Intervention:** None – observational, SCI were split into 2 groups – Voluntary Movements (IMA) and Non-voluntary Movements (NMA). **Outcome Measures:** Left Ankle Dorsiflexion (LADF), Right Ankle Dorsiflexion (RADF); Left Knee Flexion (LKF); Right Knee Flexion (RKF), Bilateral Hip and Knee Flexion (BHKF), Bilateral Hip and Knee Extension (BHKE); Bilateral Hip Adduction (BHA); Neck Flexion (NF); Sit-up.	1. SCI participants in both the IMA and NMA groups had significantly lower magnitudes and SI values in comparison with TD children ($p < 0.01$) 2. Magnitude significantly different between the NMA and IMA groups for all tasks ($p < 0.05$), with little variability in magnitude or SI values in the NMA group due to lack of EMG activity in these participants 3. In TD children, SI values were close to one for each task, and were not significantly correlated with age. In contrast, significantly greater variability in SI values was observed for IMA participants ($p < 0.0001$) 4. Across all tasks, SI values were significantly larger in TD group as compared with either the NMA or the IMA groups ($p < 0.01$), however no significant differences were observed between SCI groups 5. With regard to magnitude, significant differences were found for all events and all groups, with the exception of NF (IMA vs. TD) ($p < 0.05$), wherein NMA magnitude values were significantly lower than all other groups 6. IMA magnitudes were significantly larger than the NMA group, and significantly smaller than the TD group. A positive correlation was

			found between SI and qualitative scores across all tasks (CC = 0.67, p <0.0001)
	STAND		
NMRS	Ardolino et al. 2016 USA Observational N=12	**Population:** Children with SCI=5: Age Range: 48mo-143mo; Gender: males=3, females=2; Level of severity: Not reported; Time since injury: Not reported Children without SCI=7: Age Range: 22mo-126mo; Gender: males=4, females=3 **Intervention:** None - observational **Outcome Measures:** draft Pediatric NRS, revised draft Pediatric NRS, clarity of wording and scoring	1. After the Delphi process and field testing, the final Pediatric NRS consists of 13 items scored on a 12-point scale. 2. All items, except 1, achieved 80% agreement by experts, in terms of clarity of wording and scoring.
NMRS	(Andrea L Behrman et al., 2019) USA Observational $N_{(HCP)}$=14 $N_{(SCI-P)}$=32 HCP – Healthcare Professional SCI-P – Spinal Cord Injury - Pediatric	**Population:** (SCI-P) Mean age=6.0±3.0yr.; Gender: males=17, females=15; Level of injury: C1-L5; Level of severity: AIS A=6, B=5, C=2, D=5, N/A=14 (younger than 6yr.); Time since injury: Not reported. **Intervention:** None – observational. **Outcome Measures:** Interrater reliability.	1. Interrater reliability coefficient was determined to be near 1 overall for Pediatric NRS score (ICC=0.966; 95% CI, 0.89-0.98) 2. 12 of 16 individual items exhibited high concordance coefficients (Kendall's W ≥0.8) 3. 4 items were found to have concordance coefficients <0.8 and >0.69. 4. Interrater reliability was equal among groups defined by neurological level and age, but lower among non-ambulatory individuals.
	GAIT		
LEMS, Home Activities	(Behrman et al., 2008) USA Case Report N=1	**Population:** 4.5 yr, male, C8 AIS C traumatic SCI, 16 mo post-injury. **Intervention:** Body weight support, overground walking. **Outcome Measures:** Functional Independence Measure for Children II (WeeFIMII), preferred speed, fast speed, community steps	1. AIS score remained the same after session 74 2. LEMS score remained at 4/50 at session 74 3. From session 51 to 76 gait speed increased from 0.19m/s to 0.29m/s 4. From session 51 to 76 fastest walking speed increased from 0.3m/s to 0.48m/s 5. WISCI score increased from 0/20 to 13/20 6. At session 33 the child showed multiple non-cued steps 7. From session 49 to 74 the child increased from 926 steps per day to 2488 steps per day
LEMS, Berg Balance	(Behrman et al., 2012) USA Case Reports N=3	**Population:** *Case 1:* 15 yr, male, T5 SCI, AIS D. *Case 2:* 14 yr, male, T5 AIS C ruptured arteriovenous malformation; *Case 3:* 14 yr, male, C2 AIS D SCI. **Intervention:** Locomotor Training (Body weight support treadmill training, overground walking), community integration. **Outcome Measures:** 10-meter walk test (10MWT),6-minute walk test 6MWT, Berg Balance Scale (BBS),	*Case 1* 1. 10MWT with initial rolling walker (RW) device improved from 0.16m/s at initial evaluation to 1.12m/s at discharge and declined to 1.06m/s at 12mo. follow-up 2. 10MWT with current bilateral single point canes (BSPCs) devices improved from 0.77m/s at session 20 (started use of BSPCs) to 1.22m/s at discharge and declined to 1.01m/s at 12mo. follow-up (use of BSPCs stopped after session 40) 3. 6MWT with initial rolling walker (RW) device improved from 53.07m at initial evaluation to 291.69m at

			discharge and improved further to 298.4m at 12mo. follow-up 4. 6MWT with current bilateral single point canes (BSPCs) devices improved from 242.32m at session 20 (started use of BSPCs) to 308.15m at discharge and improved further to 316.11m at 12mo. follow-up (use of BSPCs stopped after session 40) 5. BBS score improved from 8/56 at initial evaluation to 48/56 at discharge and declined to 47/56 at 12mo. follow-up *Case 2* 1. 10MWT with initial rolling walker (RW) device improved from 0.12m/s at initial evaluation to 0.22m/s at session 80 and improved further to 0.38m/s at session 200 2. 10MWT with current bilateral loftstand crutches (BLCs) devices remained at 0.1m/s from session 40 (started use of BLCs) session 80 and improved to 0.45m/s at session 200 (use of bilateral single point canes (BSPCs) at session 200) 3. 6MWT with initial rolling walker (RW) device improved from 25.6m at initial evaluation to 44.8m at session 80 and improved further to 117.3m at session 200 4. 6MWT with current bilateral loftstand crutches (BLCs) devices declined from 13.6m at session 40 (started use of BLCs) to 7.6m at session 80 but improved to 123.8m at session 200 (use of bilateral single point canes (BSPCs) at session 200) 5. BBS score increased from 7/56 at initial evaluation to 23/56 at session 80 and improved further to 31/56 at session 200 *Case 3* 1. 10MWT increased from 1.3m/s at initial evaluation to 1.5m/s at session 20 and increased further to 1.72m/s at discharge 2. 6MWT increased from 435m at initial evaluation to 467m at session 20 and increased further to 500m at discharge 3. BBS score increased from 55/56 at initial evaluation to 56/56 at session 20 and sustained a score of 56/56 at discharge LEMS • LEMSs for the three reported cases were 29, 22, and 46, respectively • Only the adolescent in Case 1 demonstrated significant change (17 points) in his LEMS post-LT that could also account for improvement in function

			• For the other two instances, the LEMS change was relatively minor
BERG Balance, NRS	(Behrman et al., 2017) USA Not reported N=Not reported	**Population:** Not reported **Intervention:** Basic scientific findings that legs to locomotor training (LT) and activity-based therapies (ABT). **Outcome Measures:** Neuromuscular recovery scale (NRS), Berg Balance Scale (BBS).	1. BBS over time revealed scores that spanned the entire breadth of the scale and his variation did not reduce when this sample was divided into groups by AIS classification • To be able to make comparisons across groups in research studies, or make clinical predictions, a tool that can classify persons according to activity domain, in addition to impairment, is needed 2. NRS has been found to have strong test-retest reliability (Spearman correlation coefficients of 0.92–0.99) as well as high inter-rater reliability (Kendall coefficient of concordance ≥0.90) 3. The construct validity of the original NRS was established using Rasch analysis, which revealed that the NRS stratifies individuals with all AIS classifications into 5 distinct strata 4. No floor or ceiling effects were found for the NRS, and the scale also demonstrated a logical order of item difficulty 5. NRS was found to be a stronger predictor of recovery than AIS classification when measuring the change in performance of persons with motor-incomplete SCI on the BBS, 6MWT and 10MWT 6. Pediatric Neuromuscular Recovery Scale (Peds NRS) was developed by clinicians and researchers with pediatric expertise and consists of 13 items graded on a 12-point scale 7. The use of the adult NRS and Peds NRS in other neurological populations is also being investigated
LEMS	(O'Donnell & Harvey, 2013) Australia Case Report N=1	**Population:** 17 yr, male, T6 AIS C traumatic SCI, 16 mo post injury. **Intervention:** Body weight support treadmill training, overground walking **Outcome Measures:** Lower extremity motor score (LEMS), Walking index for spinal cord injury (WISCI II), 6-min walk test (6MWT), 10-m walk test (10MWT), Timed up and go (TUG), Pediatric Quality of Life Inventory (PedsQL).	1. LEMS score improved from 16 to 17 from pre- to post-training and from 17 to 18 from post-training to follow-up 2. WISCI score improved from 6 to 9 from pre- to post-training and remained at 9 at follow-up 3. 6MWT score improved from 67m (1 rest) at pre-training to 76m (no rests) at post-training and further improved to 80m (no rests) at follow-up 4. 10MWT score improved from 32.2s at pre-training to 30.3s at post-training but declined to 33.6s at follow-up 5. TUG score improved from 44.6s at pre-training to 40.1s at post-training but declined to 42.0s at follow-up, remaining improved compared to pre-training

			6. Overall PedsQL score improved from 38/92 at pre-training to 23/92 at post-training and remained at 23/92 at follow-up
Home activities	(Prosser, 2007) USA Case Report N=1	**Population:** 5 yr.10 mo, female, C4 AIS A SCI and mild traumatic brain injury. **Intervention:** Locomotor training including body weight support treadmill training, overground walking, inpatient rehabilitation with aquatic therapy. **Outcome Measures:** Functional Independence Measure for Children II (WeeFIMII), Walking Index for Spinal Cord Injury II (WISCI II), home activities.	1. WeeFIM score improved from 5/35 to 21/35 over 5 months of locomotor training 2. WISCI score improved from 0 to 12 over 5 months of locomotor training 3. At home, she walked most of the time and walked up the stairs to her bedroom with a handrail and minimal assistance
Home Activities, Observational Gait Analysis	(Fox et al., 2010) USA Case Report N=1	**Population:** 3.5 yr, male, C8 AIS C SCI. **Intervention:** Description of child's walking function and musculoskeletal growth and development during the 2 yr after locomotor training **Outcome Measures:** Walking Index for Spinal Cord Injury II (WISCI II), gait speed, cadence, step length, stride length, daily steps activity at home and in the community, musculoskeletal growth and development, gross motor function measure (GMFM-66).	1. Walking independence remained unchanged with WISCI score staying at 13/20 as he still used a reverse rolling walker to ambulate 2. Fastest gait speed increased from 0.45m/s at baseline (1 month post LT) to 0.67m/s at 2 yr follow-up • After 2 yr., gait pattern was improved • Able to generate reciprocal stepping with noticeable absence of shoulder and trunk compensations, particularly on his left side • Despite being able to step reciprocally, he could not walk backwards, side step, or maintain balance without upper-extremity support 3. Cadence increased from 63.35 steps/min at baseline to 70.75 steps/min at 2 yr follow-up 4. Step length increased in both legs: • Left leg: increased from 42.25cm at baseline to 51.31cm at 2 yr follow-up • Right leg: increased from 44.07cm at baseline to 63.55cm at 2 yr follow-up 5. Stride length increased in both legs: • Left leg: increased from 85.95cm at baseline to 114.79cm at 2 yr follow-up • Right leg: increased from 87.19cm at baseline to 114.47cm at 2 yr follow-up 6. Daily steps increased from about 1600 steps/day at baseline to 3000 steps/day at 2 yr follow-up 7. Over the 2-yr. period the child was not diagnosed with scoliosis, but mild coxa valga was noted at both hip joints and radiology reports indicated all findings stable 8. GMFM-66 scores remained stable over the 2-yr. period

Observational Gait Analysis	Fox et al. (2013) USA Pre-Post N=5	**Population:** Mean age:8.6±2.7yr; Gender: males=4, females=1; Level of injury: C1-C7=2, T1-T12=3; Time since injury>1yr. **Intervention:** Modular control of patients with incomplete spinal cord injury (ISCI) was examined via locomotor tasks including treadmill training, overground walking, pedaling, stair climbing, supine lower extremity flexion/extension, and crawling. **Outcome Measures:** Lower extremity motor score (LEMS), variance accounted for (VAF), electromyogram (EMG) recordings.	1. Fewer modules were needed to account for muscle activation in the lower extremities of children with ISCIs compared with controls ($p<0.05$) 2. An average of 2.11±0.71 modules was required to account for the EMG data recorded in lower extremities of children with ISCI 3. With the use of the muscle weightings from treadmill walking and task-specific timing profiles, the VAF exceeded 86% for all locomotor tasks 4. The VAF exceeded 90% for all tasks performed by the children with ISCIs 5. Modularity is constrained in children with ISCI
Observational Gait Analysis	(Heathcock et al., 2014) USA Case Report N=1	**Population:** 15 mo, male, T11-L4 in-utero spinal cord tumour resulting in SCI with subsequent removal at 5.5 wk of age. **Intervention:** Treadmill Step Training Program **Outcome Measures:** Number and pattern of walking steps, gait speed, observational gait analysis, standing.	1. An increase in the percentage of alternating steps and a matching decrease in the percentage of single steps over the 20-month intervention period were observed 2. At 30 months of age, a pattern of alternating stepping on the treadmill occurred more than 80% of the time, in sharp contrast to the initial 6 months of training when alternating steps comprised fewer than 10% of the total steps 3. Number of steps increased from 1 step at 16mo to 10 steps at 22mo. 4. At 22mo. of age, steps were measured in distance and increased from 3m at 22mo. to about 6m at 31mo. 5. Gait speed varied over the 20 mo period (0.48m/s at 31mo. and 0.40m/s at 35mo.) 6. Only the right leg accounted for most of the stepping rate from 15 through 20 months of age because there were few or no independent steps on the left 7. Over the 20-month intervention period, stepping with the right and left legs increased, with a greater rate of improvement being observed for the left leg, suggesting improvements in symmetry and bilateral function 8. Static standing improved from standing with an arm support on the walker for 30s with contact guard assistance (CGA) at 15mo. to static standing for 20s with standby assistance
NRS	Ardolino et al. 2016 USA Observational N=12	**Population:** Children with SCI=5: Age Range: 48mo-143mo; Gender: males=3, females=2; Level of severity: Not reported; Time since injury: Not reported Children without SCI=7: Age Range: 22mo-126mo; Gender: males=4, females=3	1. After the Delphi process and field testing, the final Pediatric NRS consists of 13 items scored on a 12-point scale. 2. All items, except 1, achieved 80% agreement by experts, in terms of clarity of wording and scoring.

		Intervention: None - observational **Outcome Measures:** draft Pediatric NRS, revised draft Pediatric NRS, clarity of wording and scoring	
NRS	(Andrea L Behrman et al., 2019) USA Observational $N_{(HCP)}$=14 $N_{(SCI-P)}$=32 HCP – Healthcare Professional SCI-P – Spinal Cord Injury - Pediatric	**Population:** (SCI-P) Mean age=6.0±3.0yr.; Gender: males=17, females=15; Level of injury: C1-L5; Level of severity: AIS A=6, B=5, C=2, D=5, N/A=14 (younger than 6yr.); Time since injury: Not reported. **Intervention:** None – observational. **Outcome Measures:** Interrater reliability.	1. Interrater reliability coefficient was determined to be near 1 overall for Pediatric NRS score (ICC=0.966; 95% CI, 0.89-0.98) 2. 12 of 16 individual items exhibited high concordance coefficients (Kendall's W ≥0.8) 3. 4 items were found to have concordance coefficients <0.8 and >0.69. 4. Interrater reliability was equal among groups defined by neurological level and age, but lower among non-ambulatory individuals.