

Reviewer ID: Christie Chan, Joanne Chi																											
Outcome Measure: Short version of the Van Lieshout Test (VLT-SV)			Total articles: 4																								
Author ID Year	Study Design	Setting	Population (sample size, age) and Group																								
Berardi et al. 2019	Psychometric study Italian version	Three Italian spinal units	N=61 80% Male Mean age: 47±14.76 years AIS: 25A, 15B, 15C, 6D Level of injury number: 3 C3, 13 C4, 20 C5, 19 C6, 6 C7																								
Franke et al. 2013	Prospective longitudinal cohort study to assess responsiveness of the VLT to changes in arm hand skilled performance. Long-term follow up (1 and 5 years after start of inpatient rehabilitation)	SCI Units in 8 rehabilitation centres in the Netherlands	N=55 participants (40M, 15F) mean (SD) age: 38 (12.93) years [range: 18-64] C3-C6: N=49 C7-T1: N=6 AIS A-B: N=38 AIS C-D: N=17 5 measurement moments: t1 = start of active rehabilitation (N=47) t2 = at 3 months after the start (N=45) t3 = at discharge from the rehabilitation centre (N=54) t4 = 1 year after discharge (N=42) t5 = 5 years after discharge (N=29)																								
Post et al. 2006	Two validation studies Study 1: The VLT-SV was administered twice (7 days between both) to a sample of 12 persons with tetraplegia. Designed to assess inter-rater reliability. Study 2: Cross-sectional study designed to assess convergent validity.	Two specialized rehabilitation centers in The Netherlands	Study 1: N=12 (9M, 3F) Mean (SD) age=43.2 (12.7) Mean (SD) time since injury=13.0 (11.2) years Hand surgery performed: 8.3% for left hand, 41.6% for right hand <table border="1"> <thead> <tr> <th>International classification (% in each category)</th> <th>Left hand</th> <th>Right hand</th> </tr> </thead> <tbody> <tr> <td>0-2</td> <td>16.6</td> <td>25.0</td> </tr> <tr> <td>3-5</td> <td>74.9</td> <td>50.0</td> </tr> <tr> <td>6-8</td> <td>8.3</td> <td>25.0</td> </tr> <tr> <td>9-10</td> <td>0</td> <td>0</td> </tr> </tbody> </table> AIS impairment scale: A=50%; B=16.7%; C=0%; D=33.3% Study 2: N=55 (46M, 9F) Mean (SD) age=42.1 (13.5) Mean (SD) time since injury=11.0 (8.5) years Hand surgery performed: 18.2% for left hand, 29.1% for right hand <table border="1"> <thead> <tr> <th>International classification (% in each category)</th> <th>Left hand</th> <th>Right hand</th> </tr> </thead> <tbody> <tr> <td>0-2</td> <td>21.8</td> <td>20.0</td> </tr> <tr> <td>3-5</td> <td>49.1</td> <td>49.1</td> </tr> </tbody> </table>	International classification (% in each category)	Left hand	Right hand	0-2	16.6	25.0	3-5	74.9	50.0	6-8	8.3	25.0	9-10	0	0	International classification (% in each category)	Left hand	Right hand	0-2	21.8	20.0	3-5	49.1	49.1
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			9-10	18.2	18.2
			AIS impairment scale: A=43.6%; B=30.9%; C=9.1%; D=16.4%		
Spooren et al. 2006	Longitudinal cohort study to assess responsiveness of the VLT to changes in arm hand skilled performance.	SCI Units in 8 rehabilitation centres in the Netherlands	<p>n = 60 participants (46M, 14F) with incomplete SCI (cervical level) Mean age = 38.9 (range: 18.42-64.5)</p> <p>C3-C6 = 42 C7-T1 = 18</p> <p>AIS A-B = 34 AIS C-D = 26</p> <p>Mean number of days between t1 (start of rehab) and t2 (3 months later): 93 (range: 64-178) Mean number of days between t1 and t3 (discharge): 288 (range: 76-713)</p>		

1. RELIABILITY

Author ID	Internal Consistency	Test-retest, Inter-rater, Intra-rater
Berardi et al. 2019	Cronbach's α : Left hand=0.95 Right hand=0.95	Test-retest reliability (VLT-SV-IT) ICC=0.90 Inter-rater reliability (original VLT-SV) ICC=0.98
Post et al. 2006	<p>Study 2: Cronbach's α Left hand=0.88 Right hand=0.94</p> <p>Most item-rest correlations were above 0.60; only the left-hand scores of the 3 bimanual items showed relatively poor correlations with the rest of the items, although these were still above 0.30.</p> <p>The distribution of total scores for the left and right hand did not deviate significantly from the normal distribution (left hand: Z=0.443, P=.990; right hand: Z=0.714, P=.687).</p> <p>Spearman correlation between left- and right- hand scores = 0.50</p>	<p>Study 1: Interrater reliability ICC Left hand=0.98 (95% CI: 0.94-0.99) Right hand=0.99 (95% CI: 0.94-1.00)</p> <p>Weighted Kappa=0.74-0.99 for 9 out of 10 items ("writing"=0.47 and 0.48).</p>

2. VALIDITY

Author ID	Validity
Berardi et al. 2019	Pearson coefficient with level of injury =0.51

	<p>Concurrent validity: Pearson's correlation between VLT-SV-IT and Italian version of Jebsen Taylor Hand Function Test (JTHFT) (Negative Linear correlations)</p> <p>Right hand: -0.94- (-0.15) Left hand: -0.82-(-0.06)</p> <p>Pearson correlation between VLT-SV-IT and Italian version of SCIM III =0.07</p>																																							
<p>Post et al. 2006</p>	<p>Study 2: Spearman Correlation between: [L= left hand, R=right hand] VLT-SV and GRT =0.87 (L) and 0.90 (R) VLT-SV and motor level of injury: 0.58 (L) and 0.65 (R) VLT-SV and ASIA impairment scale: 0.35 9L) and 0.69 (R) VLT-SV and International classification (motor): 0.67 (L) and 0.85 (R) VLT-SV and FIM self-care: 0.61 (L) and 0.69 (R) VLT-SV and FIM transfers: 0.71 (L) and 0.72 (R)</p> <p>As expected, correlations between the VLT-SV scores and scores on the other measures besides the GRT were lower than correlations between the VLT-SV and GRT. However, 8 out of 10 correlations were still strong.</p>																																							
<p>Spooren et al. 2006</p>	<p>The VLT-SV showed significant differences in the same time intervals as the scores of the Grasp and Release Test (GRT), the Functional Independence Measure (FIM) and the Quadriplegia Index of Function (QIF) (Wilcoxon, $P < .001$). The SRM values indicated a large degree of responsiveness for all test batteries used in the intervals t1-3 and t1-2. The ES_{FIM} and ES_{QIF} indicated a large degree of responsiveness for the intervals t1-3 and t1-2, whereas the ES_{VLT} and ES_{GRT} were moderate for these intervals.</p> <p>For the interval t1-3: (Spearman's correlations) - the correlation between responsiveness of the VLT and GRT = 0.531 ($P < .01$) -the correlation between the responsiveness of the VLT and the FIM ($r=0.075$) and the VLT and the QIF ($r=0.194$) was very low. - correlation between responsiveness of the FIM and QIF = 0.714 ($P < .01$)</p>																																							
<p>Franke et al. 2013</p>	<p>Motor completeness, MSUE and pain were significantly related to the VLT score ($P < .001$, $P < .001$, $P = 0.015$, respectively). Age, gender and lesion level had no significant relationship.</p> <p>Final multilevel regression model for the total score of the VLT-SV:</p> <table border="1" data-bbox="207 1293 802 1738"> <thead> <tr> <th></th> <th colspan="2">VLT total score</th> </tr> <tr> <th></th> <th>β (s.e.)</th> <th>P</th> </tr> </thead> <tbody> <tr> <td>Intercept</td> <td>2.074 (2.569)</td> <td>--</td> </tr> <tr> <td>Change from t1-t3</td> <td>-0.518 (1.739)</td> <td>.766</td> </tr> <tr> <td>Change from t2-t3</td> <td>-1.239 (1.350)</td> <td>.359</td> </tr> <tr> <td>Change from t3-t4</td> <td>0.474 (1.379)</td> <td>.731</td> </tr> <tr> <td>Change from t3-t5</td> <td>10.258 (2.816)</td> <td><.001</td> </tr> <tr> <td>Completeness</td> <td>-2.966 (1.161)</td> <td><.001</td> </tr> <tr> <td>Motor score – upper extremity</td> <td>1.115 (0.059)</td> <td><.001</td> </tr> <tr> <td>Pain tested arm</td> <td>-2.595 (1.068)</td> <td>.015</td> </tr> <tr> <td>Lesion level</td> <td>NS</td> <td>--</td> </tr> <tr> <td>Age</td> <td>NS</td> <td>--</td> </tr> <tr> <td>Gender</td> <td>NS</td> <td>--</td> </tr> </tbody> </table> <p>After the backward selection procedure, three independent variables, namely, incomplete lesion ($P < .001$), high motor score upper extremity ($P < .001$) and no pain in the tested arm ($P = 0.015$) were found to be significantly related to the total score of the VLT-SV. The relationship was positive, that is, an incomplete lesion adds 3.0 extra points, no pain in</p>		VLT total score			β (s.e.)	P	Intercept	2.074 (2.569)	--	Change from t1-t3	-0.518 (1.739)	.766	Change from t2-t3	-1.239 (1.350)	.359	Change from t3-t4	0.474 (1.379)	.731	Change from t3-t5	10.258 (2.816)	<.001	Completeness	-2.966 (1.161)	<.001	Motor score – upper extremity	1.115 (0.059)	<.001	Pain tested arm	-2.595 (1.068)	.015	Lesion level	NS	--	Age	NS	--	Gender	NS	--
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the tested arm adds 2.6 points and every point of the MSUE adds 1.1 point to the total VLT-SV score.

3. RESPONSIVENESS

Author ID	Responsiveness
Spooren et al. 2006	<p>t=time t1-t3 = from start of rehab to discharge t1-t2 = from start of rehab to 3 months later t2-t3 = from 3 months after the start of rehab to discharge. For the interpretation of SRM and ES, a value of 0.20 was considered small, a value between 0.50 and 0.80 was moderate and > 0.80 was large degree of responsiveness.</p> <p>Total VLT: there was a significant difference in the VLT scores across the three measurements (Friedman, P<.001). There was a significant difference between all time intervals (Wilcoxon; P<.001)</p> <p>SRM_{VLT3-1} = 1.1 SRM_{VLT2-1} = 0.95 SRM_{VLT3-2} = 0.67 ES_{VLT3-1} = 0.71 ES_{VLT2-1} = 0.54 ES_{VLT3-2} = 0.19</p> <p>Groups A-B (motor complete) and C-D (motor incomplete): There was a significant difference across the three measurements for both groups (Friedman, P<.001). There were significant differences between all time intervals (Wilcoxon, P<.003)</p> <p>Group A-B SRM_{VLT3-1} = 1.21 SRM_{VLT2-1} = 1.03 SRM_{VLT3-2} = 0.69 ES_{VLT3-1} = 0.74 ES_{VLT2-1} = 0.52 ES_{VLT3-2} = 0.25</p> <p>Group C-D SRM_{VLT3-1} = 1.04 SRM_{VLT2-1} = 0.96 SRM_{VLT3-2} = 0.65 ES_{VLT3-1} = 0.78 ES_{VLT2-1} = 0.64 ES_{VLT3-2} = 0.2</p> <p>Groups C3-C6 (high CSCI) and C7-T1 (low CSCI): There was a significant difference across the three measurements for both groups (Friedman, P<.001). There were significant differences between all time intervals (Wilcoxon, P<.015). The SRM_{VLT} of both groups indicated a large degree of responsiveness for the interval t1–3 and t1–2, whereby the SRM values for the C3–C6 group (1.24 and 1.02) were somewhat higher than for the C7–T1 group (0.88 and 0.81). For the interval t2–3, the SRM_{VLT} of both groups indicated a moderate degree of responsiveness. The ES_{VLT} was for the interval t1–3 large for the C7–T1 group and moderate for the C3–C6 group. For both groups, the ES_{VLT} was moderate for the interval t1–2 and low for the interval t2–3.</p> <p>Group C3-C6 SRM_{VLT3-1} = 1.24 SRM_{VLT2-1} = 1.02 SRM_{VLT3-2} = 0.67 ES_{VLT3-1} = 0.69 ES_{VLT2-1} = 0.53 ES_{VLT3-2} = 0.18</p>

	<p>Group C7-T1 $SRM_{VLT3-1} = 0.88$ $SRM_{VLT2-1} = 0.81$ $SRM_{VLT3-2} = 0.65$ $ES_{VLT3-1} = 0.81$ $ES_{VLT2-1} = 0.61$ $ES_{VLT3-2} = 0.29$</p>																																									
Franken et al. 2013	<p>Scores of VLT improved significantly during in-patient rehabilitation (mean: t1=25; t3=33) (P=.005), scores remained unchanged at 1 year (t4=32) and 5 years (t5=32) (P=.903) after in-patient rehabilitation.</p>																																									
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Post et al. 2006	<p>The limit of agreement was defined to be +/- 2 SDs of the difference score, indicating the minimum difference between scores exceeding chance. The Bland Altman plot showed that agreement between scores of both raters was independent of the height of the mean score. The limits of agreement was about +/- 0.5 points, indicating that an increase of 0.5 points on the VLT-SV represents an improvement of functioning exceeding measurement error.</p> <table border="1"> <thead> <tr> <th>Item</th> <th>Left hand Mean (SD)</th> <th>Right hand Mean (SD)</th> </tr> </thead> <tbody> <tr> <td>Forward reaching</td> <td>3.4 (1.7)</td> <td>3.5 (1.6)</td> </tr> <tr> <td>Arch task</td> <td>3.4 (1.9)</td> <td>3.5 (1.9)</td> </tr> <tr> <td>Thumb closure</td> <td>2.9 (1.8)</td> <td>3.1 (1.7)</td> </tr> <tr> <td>Grip function thumb</td> <td>2.3 (1.7)</td> <td>2.2 (1.6)</td> </tr> <tr> <td>Thumb strength</td> <td>2.7 (1.5)</td> <td>3.1 (1.3)</td> </tr> <tr> <td>Finger closure</td> <td>3.0 (1.8)</td> <td>3.1 (1.8)</td> </tr> <tr> <td>Finger strength</td> <td>3.0 (1.9)</td> <td>3.5 (1.7)</td> </tr> <tr> <td>Pen grip</td> <td>1.6 (1.8)</td> <td>3.1 (1.4)</td> </tr> <tr> <td>Lighting a match</td> <td>1.6 (1.9)</td> <td>3.1 (1.8)</td> </tr> <tr> <td>Opening a bottle</td> <td>1.4 (1.8)</td> <td>2.7 (1.4)</td> </tr> <tr> <td>Mean total VLT score</td> <td>2.6 (1.3)</td> <td>3.1 (1.3)</td> </tr> </tbody> </table>						Item	Left hand Mean (SD)	Right hand Mean (SD)	Forward reaching	3.4 (1.7)	3.5 (1.6)	Arch task	3.4 (1.9)	3.5 (1.9)	Thumb closure	2.9 (1.8)	3.1 (1.7)	Grip function thumb	2.3 (1.7)	2.2 (1.6)	Thumb strength	2.7 (1.5)	3.1 (1.3)	Finger closure	3.0 (1.8)	3.1 (1.8)	Finger strength	3.0 (1.9)	3.5 (1.7)	Pen grip	1.6 (1.8)	3.1 (1.4)	Lighting a match	1.6 (1.9)	3.1 (1.8)	Opening a bottle	1.4 (1.8)	2.7 (1.4)	Mean total VLT score	2.6 (1.3)	3.1 (1.3)
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