**Additional file 1**

**Descriptive check-list**

|  |
| --- |
| **Descriptive check-list** **Mobilizations (oscillatory technique)** |
| **Author****year****country** | **Design** | **Source of participants** | **Symptoms** | **Age of participants**Range & means | **no of subjects****1/ recruited****2/ analyzed****(Female / Male)** | **Interventions**  | **Treatment area****- “lesion” (**restriction of mobility or pain)**- non “lesion”** | **Outcome variables**Main outcome variables related to autonomic mediated physiology |
| Petersen 1993Australia[35] | Crossover RCT | ? | no | Range 18-35 Mean:? | 1/ N: 16(0/16)2/ N: 16? | Joint manipulative technique: Grade III postero-anterior mobilization (central pressure)Sham/Placebo: same contact without movement.*Both interventions applied for 3×1 minute with a rest period between applications of 1 minute*Control: no contact | C5 “non-lesion” | Skin conductance (right hand)Skin temperature (right hand) |
| Vicenzino1994Australia[36] | Crossover RCT | Staff and students from university | no | Range:?Mean: 26  | 1/ N: 34(14/20)2/ N: 34? | Joint manipulative technique 1: Grade III left lateral glide mobilization + ULTT1Joint manipulative technique 2: Grade III left lateral glide mobilization + ULTT2Sham/Placebo: same contact without mobilization + no nerve tension test*Both interventions applied for 3×30 sec with a rest period between applications of 1 minute*Control: no contact | C5 / C6 “non-lesion” | Skin conductance (both hands)Skin temperature (both hands) |
| Slater1994Australia[37] | Crossover RCT | ? | no | Range:?Mean: 24  | 1/N: 22(8/14)2/ N: 22? | Joint manipulative technique: Grade IV postero-anterior mobilization in “sympathetic slump” position Sham/Placebo light touch in long sitting position *Both interventions applied for 3×20 sec with a rest period between applications of 1 minute*Control: no contact | T6 right costo-vertebral joint “non-lesion” | Skin conductance (both hands)Skin temperature (both hands) |
| Simon1997Australia[38] | Crossover RCT | ? | no | Range: 16 to 25Mean: 19,5 ± 2 | 1/ 19(13/6)2/ N: 19? | Joint manipulative technique: Grade III antero-posterior mobilization Sham/Placebo: same procedure without mobilization*Both interventions applied for 3×30 sec with a rest period between applications of 1 minute*Control: no contact | Right glenohumeral joint “non-lesion” | Skin conductance (both hands)Skin temperature (both hands) |
| RCT: randomized-controlled trial; PPT: pressure pain threshold  |

|  |
| --- |
| **Descriptive check-list** **Mobilizations (oscillatory technique)**  |
| McGuiness1997Australia[39] | Crossover RCT | ? | no | Range: 18-29Mean:? | 1/ N: 23(11/12)2/ N: 23? | Joint manipulative technique : Grade III postero-anterior mobilizationSham/Placebo: contact without movement*Both interventions applied for 3×1 minute with a rest period between applications of 1 minute*Control: no contact | C5 “non-lesion” | Heart rateRespiratory rateBlood pressure |
| Vicenzino 1998Australia[40] | Crossover RCT | ? | no | Range 17-35Mean: 21 ± 4,7 | 1/ N: 24(13/11)2/ N: 24? | Joint manipulative technique: Grade III left lateral glide mobilization + ULTT 2Sham/Placebo:?*Both interventions applied for 3×30 sec with a rest period between applications of 1 minute*Control:? | C5 “non-lesion” | Heart rateRespiratory rateBlood pressure (left arm) |
| Vicenzino1998Australia[41] | Crossover RCT | ? | Unilateral chronic lateral epicondylalgia | Range: 27-70 Mean: 49 ± 10 | 1/ N: 24(13/11)2/ N: 24  | Joint manipulative technique: Grade III oscillatory lateral glide mobilizationSham/Placebo: contact without movement*Both interventions applied for 3×30 sec with a rest period between applications of 1 minute*Control: no contact | C5 / C6 “non-lesion” | Skin conductance (affected limb)Skin temperature (affected limb)Skin blood flux (affected limb) |
| Sterling2001Australia[42] | Crossover RCT | ? | History of mid or lower cervical spine pain ≥ 3 months | Range:?Mean: 36 | 1/ N: 302/ N: 30(16/14) | Joint manipulative technique: Grade III postero-anterior mobilizationSham/Placebo: contact without movement*Both interventions applied for 3×1 minute with a rest period between applications of 1 minute*Control: no contact | C5 / C6 symptomatic side “lesion” | Skin conductance (both hands)Skin temperature (both hands) |
| ULTT: upper limb tension test |

|  |
| --- |
| **Descriptive check-list** **Mobilizations (oscillatory technique)** |
| Perry2008UK[43] | Independent group RCT | ? | no | Range :18-25 Mean: 21.5Mobilization: 21.4Sham: 21.5Control: 21.7 | 1/ N: 45(0/45)2/ N: 45(15 per group) | Joint manipulative technique: Grade III oscillatory mobilization at 2 HzSham/Placebo: light pressure without oscillatory movement*Both interventions applied for 3× 1 minute with a rest period between applications of 1 minute*Control: no contact | Left L4 / L5 facet joint “non-lesion” | Skin conductance (both feet) |
| Jowsey2010UK[44] | Independent group RCT | ? | no | Range :18-35 Mean: 22.7 ± 5Mobilization Mean: 23 ± 6Sham/placebo:Mean: 22 ± 4.3 | 1/ N: 36(23/13)2/ N:36  | Joint manipulative technique: Grade III rotatory postero-anterior mobilization at 0.5 HzSham/placebo: pressure without oscillation*Both intervention applied for 3×1 minute with a rest period between applications of 1 minute* | T4 « non-lesion » | Skin conductance (Both hands) |
| La Touche2013Spain[45] | Independent groups RCT  | Patients from 2 private dental clinics and 3 universities | Chronic craniofacial pain from myofascial origin (pain and dysfunction located at the cervical and masticatory muscles) | Mobilization Range:?Mean: 33.2 ± 9,5Sham group Range:?Mean: 34.5 ± 8 | 1/ N: 32 (21/11)2/ N: 32 | 3 treatment sessions over 2 weeksJoint manipulative technique: Antero-posterior upper cervical mobilizationat 0.5 HzSham /placebo: Same contact without mobilization*Both intervention applied for 3×2 minutes with a rest period between applications of 30 sec.* | C0 - C3 “lesion” | Skin conductance (left hand)Skin temperature (left hand)Heart rateBreathing rate |
| Yung2014USA[46] | Independent groups RCT  | ? | no  | Mobilization:range: mean: 24.6 ± 2.2Sham grouprange: mean: 24.8 ± 1.6 | 1/ N: 39(54 screened)2/ N: 39(25/14) | Joint manipulative technique: Antero-posterior mobilization *at* 1.5 Hz*5 sets of 10 sec of AP pressure with 10 sec rest between sets*Sham /placebo: light touch | C6 “non-lesion” | Heart rateBlood pressure |

|  |
| --- |
| **Descriptive check-list** **Mobilizations (oscillatory technique)** |
| Piekarz 2016UK[47] | Independent groups RCT  | Student population from university | no | Range: 18-25mean: 21.5 Mobilization: Mean: 22 ± 2 and 21 ± 2Sham/placebo:Mean: 22 ± 2Control:Mean: 22 ± 2 | 1/ N: 60(67 assessed)2/ N: 60(0/60) | Joint manipulative technique : - 3Hz Maitland mobilization (94-109 N)- 2Hz Maitland mobilization (94-103 N)Sham/Placebo: same contact + pressure (mean: 101 N) without oscillatory movement *Interventions applied for 3×1 min with a rest period between applications of 1 minute*Control: no manual contact | L4 “non-lesion” | Skin conductance (both feet) |
| Zegarra-Parodi2016USA[48] | Crossover RCT | Participant in a university setting | no | Mean: 25 ± 5,5 | 1/?2/32(21/11) | Joint manipulative technique:-High pressure mobilization (80% of the PPT) 0.5 Hz-Low pressure mobilization (40% of the PPT) 0.5 HzSham/Placebo mobilization (5 % of the PPT) 0.5 HzI*ntervention applied for 3× 1 minute with a rest period between applications of 1 minute.*Control: no contact | T1 (side of the dominant Hand) “non-lesion” | Skin Blood Flux (both hands)Skin temperature (non-dominant hand)Blood pressureHeart Rate |
| Yung2017[49] | Independent groups RCT  | Staff, faculty, students from 2 universities | no | Range:Mean: 23.8 ± 3Mobilization: Mean: 24 ± 4Sham/placebo:Mean: 24 ± 2 | 1/ N: 44(46 screened)2/ N: 44(18/26) | Joint manipulative technique: Postero-anterior mobilization at 1.5 Hz *5 sets of 10 sec of PA pressures with a rest period between applications of 10 sec*Sham /placebo: light touch | C6 « non-lesion » | Heart rateBlood pressure |
| Araujo2017Brazil[50] | Independent groups RCT  | ? | no | Range:Mean: 22. ± 4Mobilization: Mean: 22. ± 4Mobilization + slump: Mean: 22.3 ± 2.5Sham/placebo:Mean: 23 ± 5 | 1/ N: 60(86 screened)2/ N: 57(39/18) | Joint manipulative technique 1: Grade III posterior-to-anterior rotatory passive accessory intervertebral mobilization at 2 HzJoint manipulative technique 2: unilateral grade III posterior-to-anterior rotatory passive accessory intervertebral mobilization at 2 Hz + slumpSham/Placebo: only manual contact without mobilization*Interventions applied for 3× 1 minute with a rest period between applications of 1 minute* | T4 “non-lesion” | Heart rate variabilityHeart rate |
| RCT: randomized-controlled trial; PPT: pressure pain threshold |
| **Mobilizations (atypical technique))** |
| Henderson2010USA[51] | Independent group RCT | University campus  | no  | Invited range: 21-60 Included mean: 30.9 | 1/ N: 232/ N: 14 (7 per group)(9/5) | Joint manipulative technique: Rib raising mobilizationSham/Placebo: light touch (no lifting was done)*Both interventions applied for 3×5 cycles on each side* | T1-T4, T5-T8, T9-T12 “non-lesion” | Salivary amylaseSalivary flow rate |

|  |
| --- |
| **Descriptive check-list** **Mobilizations (SNAGs / mobilization with movement)** |
| Paungmali2003Australia[52] | Crossover RCT | From both general population and local health care practitioners | Unilateral lateral epicondylalgia | Range:?Mean: 48,5 ± 7 | 1/ N: 242/ N: 24(7/17) | Joint manipulative technique: Mobilization with movement *10 repetitions sustained 6 secs with 15 secs at rest between*Sham/Placebo: contact without glideControl: no manual force applied | Elbow: “lesion” | Skin conductance (both hands)Skin temperature (both limbs)Cutaneous blood flow (affected limb)Blood pressure (unaffected limb)Heart rate |
| Moulson2006 UK[53] | Crossover RCT | ? | no | Range: 18 - 37Mean: 23 ± 5 | 1/ N: 162/ N: 16(11/5) | Joint manipulative technique: Mulligan’s sustained natural apophyseal glides with active head rotation (3 times) Sham/Placebo: same procedure without glideControl: no contact | C5/C6 “non-lesion” | Skin conductance (both hands)Skin temperature *(*both hands) |
| Moutzouri2012UK [54] | Independent groups RCT  |  From university | no  | Treat: Range 18 - 46Mean: 25 ± 8Sham/placebo:Range 19 - 43Mean: 27 ± 8Control:Range 18 - 45Mean: 27 ± 10 | 1/ N: 45(55 screened)2/ N: 45(33/12) | Joint manipulative technique: Mulligan’s sustained natural apophyseal glides (centrally applied) while participant performed 6 repetitions of full active lumbar flexion in sitting. Sham/Placebo: same procedure without SNAG*Both with 3 sets of 6 repetitions with 1 minute rest between* Control: no contact | L4 “non-lesion” | Skin Conductance (both feet) |
| Tsirakis2015UK[55] | Independent groups RCT  | Student from university | no | Range: 18 - 35Mean: 23.6 ± 4,5Treat: Mean: 24 ± 5Sham/placebo:Mean: 23,5 ± 4,5Control:Mean: 23,5 ± 4,5 | 1/ N: 45(52 assessed)2/ N: 45 (0/45) | Joint manipulative technique: Mulligan’s sustained medial glides with passive right leg flexion movements (repeated 3 times)Sham/Placebo: lumbar contact without glide + leg slightly lifted by the belt without any movement)Control: no manual contact | L4 unilateral lamina “non-lesion” | Skin conductance (both feet) |
| Bowler2017UK[56] | Crossover RCT | People from university | no | Range: 18 - 48Mean: 30 | 1 /N: 302/ N: 30(19/11) | Joint manipulative technique: Ipsilateral or contralateral Mulligan’s sustained natural apophyseal glides with active head rotation (10 times)Sham/placebo: contact without glideControl: no manual contact  | C5 right (ipsilateral technique) or left (contralateral technique) articular pillar | Skin conductance (right hand)Skin temperature *(*right hand) |
| SNAG: sustained natural apophyseal glide |

|  |
| --- |
| **Descriptive check-list** **HVLA manipulation** |
| Budgell2001[57] | Crossover RCT | ? | no (at most a trivial level of neck discomfort) | Range: 21 to 40 Mean: 28,5 ± 6 | 1/ N: 25(5/20)2/ N: 24  | Joint manipulative technique : HVLA manipulationSham/placebo : Same procedure but thrust on the skin | C1 /C2 “non-lesion” | Heart rate variabilityHeart rate |
| Budgell2006[58] | Crossover RCT | First-year students in a health sciences program | no (at most a trivial level of cervicothoracic discomfort) | Range: 18 to 45mean: 29 ± 7 | 1/ N: 312/ N: 28 (5/23) | Joint manipulative technique: HVLA manipulationSham/placebo: Thrust on scapula | T1 – T4 with a restriction of movements “lesion”Scapula for the Sham | Heart rate variabilityHeart rate |
| Roy2009Canada[59] | Independent groupsRCT | Patients from different chiropractic clinic | Acute low back pain | Range:?Mean Treat: 36 ± 12Mean Sham: 45 ± 10 | 1/ N: 20(12/8)2/ N: 20 | Joint manipulative technique : HVLA manipulationSham/placebo :5 sec pressure without thrust |  L5 “lesion” | Heart rate variability |
| Sillevis2010USA[60] | Independent groups RCT | Patients from 5 outpatient physical therapy clinics | Chronic cervical pain | Invited: 18-65Mean Treat: 43Mean Sham: 47 | 1/ N: 101(135 assessed)2/ N: 100 (77/23) | Joint manipulative technique : HVLA manipulationSham/placebo : same contact + pressure without thrust | T3 / T4 “non-lesion” | Pupil diameter |
| Puhl2012Canada[61] | Independent groups RCT | Staff, students from CMCC as well as their friends and relatives | no | Invited: 20 to 45 Mean Treat: 26Mean Sham: 26 | 1/ N: 562/ N :36(17/19) | Joint manipulative technique:HVLA manipulationSham/placebo: contact without thrust | T1-T6 hypomobile segment « lesion » | Plasma norepinephrinePlasma epinephrine |
| Ward2013USA[62] | Independent groups RCT | Chiropractic students | no | Range:?Mean Treat: 27 ± 3,Mean Sham: 26,5 ± 6,5Mean Control :25,5 ± 1,5 | 1/N: 36(48 assessed)2/N: 36(18/18) | Joint manipulative technique: HVLA manipulationSham/Placebo: activator with no forceControl: no manual contact | T1- T4 “non-lesion” | Heart rateBilateral Blood pressure |
| Sampath 2017New Zealand[63] | Independent groups RCT | General population | no | Invited: 18 to 45Mean Treat: 28Mean Sham: 27 | 1/ N: 24(37 assessed)2/ N: 24(0/24) | Joint manipulative technique: HVLA manipulationSham: contact without thrust | T5 | Heart rate variabilityNear infrared spectroscopy: oxy-hemoglobin  |
| HVLA: high velocity low amplitude  |