**Table 2.** Relationship between head/neck injury in the playing season and pre-season sensorimotor function

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Variable | N | No head/neck injury during the playing season | | Head/neck injury during the playing season | | P value |
| **Demographics** | | | |  |  |  |
| Age, years | 190 | 22.3 (4.6) | | 23.7 (5.5) | | 0.20 |
| Height, cm | 190 | 187.4 (7.9) | | 186.5 (6.2) | | 0.62 |
| Mass, kg | 190 | 91.3 (11.5) | | 95.4 (10.7) | | 0.11 |
| **Stability evaluation Test, degrees/second** | | | | | | |
| Firm – Feet together | 189 | 0.8 (0.2) | | 0.7 (0.2) | | 0.60 |
| Firm – Single leg | 189 | 2.0 (0.8) | | 2.2 (1.2) | | 0.31 |
| Firm – Tandem | 189 | 1.8 (1.2) | | 1.6 (1.2) | | 0.56 |
| Foam – Feet together | 189 | 2.2 (0.7) | | 2.1 (0.6) | | 0.58 |
| Foam – Single leg | 189 | 4.7 (1.6) | | 5.1 (1.7) | | 0.41 |
| Foam – Tandem | 189 | 5.2 (2.8) | | 4.6 (3.1) | | 0.35 |
| Variable | N | No head/neck injury during the playing season | | Head/neck injury during the playing season | |  |
| Right | Left | Right | Left | P value |
| **Muscle cross-sectional area, cm2** | | | | | | |
| MF L2 CSA | 174 | 4. 0 (1.0) | 4.0 (1.0) | 3.3 (1.0) | 3.4 (1.0) | 0.23 |
| Average | 4.0 (0.9) | | 3.4 (0.9) | | **0.008** |
| MF L3 CSA | 176 | 6.9 (2.0) | 6.8 (2.0) | 5.6 (2.0) | 5.5 (2.0) | 0.87 |
| Average | 6.9 (1.9) | | 5.5 (1.9) | | **0.004** |
| MF L4 CSA | 176 | 10.1 (2.2) | 10.2 (2.3) | 8.6 (2.2) | 8.9 (2.3) | 0.22 |
| Average | 10.1 (2.2) | | 8.8 (2.2) | | **0.009** |
| MF L5 CSA | 176 | 10.7 (1.8) | 10.7 (1.7) | 9.9 (1.8) | 10.2 (1.7) | 0.11 |
| Average | 10.7 (1.7) | | 10.0 (1.7) | | **0.09** |
| QL CSA | 175 | 9.2 (2.0) | 9.5 (2.4) | 10.1 (2) | 11.0 (2.4) | 0.10 |
| Average | 9.4 (2.1) | | 10.6 (2.1) | | **0.016** |
| **Muscle relax and contraction, mm** | | | |  | |  |
| MF L2/3 resta | 186 | 23.8 (4.5) | 23.9 (4.0) | 25.3 (4.5) | 25.4 (4.0) | 0.96 |
| MF L2/3 contractionb | 1.9 (1.9) | 2.0 (1.6) | 2.5 (1.9) | 2.5 (1.6) | 0.84 |
| % Change | 7.9% | 8.3% | 9.8% | 9.8% |  |
| Average contraction | 1.9 (1.4) | | 2.5 (1.4) | | **0.09** |
| MF L3/4 resta | 186 | 27.0 (4.5) | 26.8 (4.2) | 29.0 (4.5) | 29.4 (4.2) | 0.43 |
| MF L3/4 contractionb | 2.0 (2.0) | 1.9 (1.7) | 2.3 (2.0) | 2.8 (1.7) | 0.29 |
| % Change | 7.6% | 7.2% | 8.0% | 9.4% |  |
| Average contraction | 2.0 (1.5) | | 2.5 (1.5) | | 0.11 |
| MF L4/5 resta | 186 | 31.3 (4.8) | 31.2 (4.9) | 33.7 (4.8) | 33.5 (4.9) | 0.87 |
| MF L4/5 contractionb | 2.7 (1.9) | 2.7 (2.0) | 2.4 (1.9) | 3.3 (2.0) | **0.029** |
| % Change | 8.8% | 8.7% | 7.0% | 9.9% |  |
| Average contraction | 2.7 (1.7) | | 2.9 (1.7) | | 0.77 |
| MF L5/S1 resta | 186 | 32.26 (5.2) | 32.28 (5.2) | 34.91 (5.2) | 35.72 (5.2) | 0.19 |
| MF L5/S1 contractionb | 2.8 (2.0) | 3.0 (2.3) | 2.7 (2.0) | 2.9 (2.3) | 0.83 |
| % Change | 8.7% | 9.4% | 7.8% | 8.0% |  |
| Average contraction | 2.9 (2.0) | | 2.8 (2.0) | | 0.77 |
| TrA resta | 186 | 4.2 (1.2) | 4.1 (1.1) | 4.6 (1.2) | 4.5 (1.1) | 0.62 |
| TrA contractionb | 2.0 (1.2) | 1.8 (1.1) | 2.4 (1.2) | 1.8 (1.1) | **0.09** |
| % Change | 47.0% | 44.3% | 52.5% | 40.9% |  |
| Average contraction | 1.9 (1.0) | | 2.12 (1.0) | | 0.32 |
| IO resta | 186 | 12.4 (2.9) | 11.3 (2.6) | 12.9 (2.9) | 12.7 (2.6) | 0.17 |
| IO contractionb | 1.9 (1.8) | 1.9 (1.7) | 2.3 (1.8) | 2.6 (1.7) | 0.49 |
| % Change | 15.3% | 16.4% | 18.0% | 20.5% |  |
| Average contraction | 1.9 (1.5) | | 2.5 (1.5) | | 0.11 |
| **Cervical proprioception test** | | | | | | |
| Joint position error, degrees | 190 | 3.92 (1.8) | 3.74 (1.7) | 3.58 (1.8) | 4.52 (1.7) | **0.044** |
| ***3.83 (1.3)*** | | ***4.05 (1.3)*** | | 0.45 |
| **Vestibular function (vHIT)** | | | | | | |
| 60 ms | 190 | 1 (0.1) | 0.96 (0.1) | 0.96 (0.1) | 0.95 (0.1) | 0.28 |
| 0.98 (0.1) | | 0.95 (0.1) | | 0.29 |
| 80 ms | 190 | 0.94 (0.1) | 0.93 (0.2) | 0.91 (0.1) | 0.93 (0.2) | 0.43 |
| 0.94 (0.1) | | 0.92 (0.1) | | 0.56 |

Values are reported as the estimated marginal means (EMM) and sd.

CSA = cross-sectional area

a Relaxed muscle thickness; b Difference in muscle thickness between the contracted and relaxed

condition; % change refers to the percentage change in muscle thickness between the relaxed and contracted condition. MF - Mutlifidus muscle; TrA - Transversus Abdominis muscle; IO - Internal Oblique muscle; L4/5- L4/5 zygapophyseal joint; L5/S1-L5/S1 zygapophyseal joint.