EFFECT OF FILTERING PARAMETERS ON LOWER EXTREMITY MUSCLE ACTIVATION ONSET TIMES DURING DROP JUMPS
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A COMPARISON OF COLLEGIATE MEN’S LACROSSE INJURY RATES DEPENDING ON HELMET STYLE
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FACTORS THAT PREDICT TYPE I DIABETES KNOWLEDGE LEVELS OF CERTIFIED ATHLETIC TRAINERS
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OBJECTIVE: Surface electromyography (sEMG) is extensively used to examine muscle activation relative to absolute timing and sequencing of muscles during activity (e.g., drop jumps). While it is common to filter the raw sEMG signal with a Root Mean Square (RMS) algorithm prior to extraction of onset times, there is little agreement as to the time constant that is used, with previous researchers using windows ranging from 3 ms to 25 ms. Thus, our objective was to examine the effect of different RMS filtering windows on muscle onset times during a drop jump. Design and Setting: Single-session, within-subject design in a controlled laboratory setting. Subjects: Fifty-five healthy females (20.4 ± 2.2 yrs, 166.5 ± 7.1 cm, 66.0 ± 12.1 kg) Measurements: Participants performed 5 double-leg drop jumps from a 45 cm box. Muscle activity was recorded via sEMG for the lateral gastrocnemius (LG), medial and lateral hamstring (MH, LH) and lateral quadriceps (LQ) of the preferred landing leg during the initial landing phase. The trigger sweep acquisition mode was used to obtain identically timed trials from 500 ms prior to 3000 ms following contact with the forceplate (>10 N). Muscle onset (ms) was defined as time prior to ground contact when muscle activity exceeded 2 standard deviations above quiet standing baseline activity for at least 25 ms. sEMG signals were digitally filtered using a centered RMS algorithm with time window constants of 3 ms, 10 ms, 20 ms, and 25 ms. The ensemble average of 5 trials for each RMS window was used for analyses. Separate repeated measures ANOVAs for each muscle compared onset times between the 4 RMS window conditions. Post hoc analyses consisted of Bonferroni pairwise comparisons at p = .05. Results: Significant differences in onset times across RMS windows were found in LG (F(3,162) = 4.48, p = .01; 3 ms = 133.3 ± 32.4, 10 ms = 145.3 ± 32.0, 20 ms = 155.6 ± 41.1, 25 ms = 141.5 ± 44.1), MH (F(3,162) = 5.22, p = .002; 3 ms = 114.5 ± 22.9, 10 ms = 122.0 ± 22.1, 20 ms = 127.6 ± 27.9, 25 ms = 130.4 ± 36.8), and LH (F(3,162) = 8.76, p = .000; 3 ms = 95.5 ± 43.9, 10 ms = 88.6 ± 42.1, 20 ms = 104.7 ± 42.7, 25 ms = 124.4 ± 42.9), but not in LQ (F(3,162) = 1.50, p = .14; 3 ms = 38.3 ± 26.3, 10 ms = 42.6 ± 22.2, 20 ms = 46.8 ± 26.7, 25 ms = 45.2 ± 26.3). Pairwise comparisons indicated earlier onset times in LG using a 3 ms vs. 20 ms window; in MH using a 3 ms vs. 20 ms and 25 ms windows, and in LH using a 10 ms vs. 25 ms window. Conclusions: Our findings suggest that extraction of muscle activation onset times for the gastrocnemius and the hamstring muscles during a drop jump can be substantially affected (as much as 20–30 ms) when filtering raw sEMG data using RMS windows from 3 ms to 25 ms. To limit the negative effects of signal processing on raw sEMG data, a compromise is therefore needed between maximizing signal fidelity while still retaining meaningful time differences. Further research is necessary to determine the optimal RMS smoothing window to appropriately examine muscle timing variables during functional activity.

Key Words: Surface electromyography, Root Mean Square, Signal Processing, Muscle Onsets
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Context: Concussions and lacerations of the face are common injuries among men’s collegiate lacrosse players. However, few studies to date have compared injury rates of athletes wearing different styles of lacrosse helmets. Objective: Evaluate concussion and facial laceration rates of men’s lacrosse athletes in relationship to helmet style. Design & Setting: All NCAA sponsored institutions offering men’s lacrosse were asked to complete the cross-sectional survey. Subjects: Athletic trainers (AT) completed an online survey following the 2005 and 2006 seasons. The response rate was 25% (110 out of 448), with 25, 12, and 63 AT’s participating from NCAA Division 1, 2, and 3 sponsored institutions, respectively. Measurements: The independent variable was helmet style. AT’s reported the number of participating athletes, the brand/style of helmets, the number of games and practices, and the number of concussions and facial lacerations sustained in practices and games. Face validity of the survey instrument was deemed acceptable by a panel consisting of experts from lacrosse and sports medicine. Exposures were calculated by multiplying the number of athletes wearing each style helmet by the number of practices or games that each helmet was worn. Injury rates (IR) per 10,000 exposures and injury rate ratios (IRR) were calculated with 95% confidence intervals (CI). The null value was set at 1.0. Therefore, an IRR CI’s that included 1.0 indicated no significant difference between rates. Concussion and facial laceration rates for games and practices for each helmet style. Concussions were defined as all mild traumatic brain injuries assessed as such by a physician or AT that caused cessation of participation. Lacerations were defined as any open wound necessitating wound care from an AT, or sutures. Results: Data on 11 helmets were collected. There were a total of 301 concussions and 204 lacerations reported. Practices accounted 83.1% of the 339056 exposures. The game concussion rate (IR=25.7, CI 21.6-29.9) was significantly higher than the practice rate (IR=5.4, CI 4.6-6.3), with an IRR of 4.7 (CI 3.8-6.0). The game laceration rate (IR=18.4, CI 14.9-22.0) was significantly higher than the practice rate (IR=3.5, CI 2.8-4.2), with an IRR of 5.3 (CI 4.0-7.0). The IR’s for concussions in individual helmets ranged from 3.5 (CI 0.4-6.6) to 13.0 (CI 7.2-18.9) while IR’s for lacerations ranged from 1.7 (CI 0.5-2.8) to 6.8 (CI 2.6-11.1). Conclusions: Consistent with previous research, game concussion and laceration injury rates are higher than practice. In addition, various helmet styles may protect athletes from concussion and facial lacerations differently. Further research is needed to examine possible explanations for style differences. Key Words: Concussion, Injury Rates, Lacrosse.
FACTORS THAT PREDICT TYPE I DIABETES KNOWLEDGE LEVELS OF CERTIFIED ATHLETIC TRAINERS
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Objective: Certified athletic trainers (ATCs) are required to recognize symptoms of diabetes and have knowledge and skills to provide proper care for patients with metabolic emergencies. This study examined factors that predict ATCs’ knowledge level of type I diabetes using the Brief Diabetes Knowledge Test (BDKT). Design and Setting: Participants completed the BDKT in a descriptive design investigation. The instrument was developed by the Michigan Diabetes Training and Research Foundation. The BDKT consisted of 23 questions of two subsets: the first 14 questions tested general diabetes knowledge, the last nine questions examined knowledge of insulin use. The total BDKT scores ranged from 0 to 23 points. A score of 0 indicated no knowledge of diabetes while a score of 23 indicated a subject had answered all diabetes related questions correctly. The reliability analysis yielded an acceptable internal consistency \( (\alpha = .52) \). Subjects: The participants were 224 ATC members of the National Athletic Trainers’ Association in Districts I (52.7\% ) and II (41\%), and were chosen via an equal probably selection method. Subject demographic information included the following: mean age of 34.77 ± 8.23, years as an ATC=11.18 ± 7.19, 41.8% male, 51.9% female. The response rate was 22.4\%. The independent variables were employment settings (high school, clinic, NCAA and NAIA division I, II, or III university), number of years as an ATC, personal experience with diabetic athletes, and route to certification (NATA approved, CAAHEP/ CAATE accredited program, internship, or other). Measurement: A stepwise regression analysis was used to determine which factors were best predictors of type I diabetes knowledge levels of ATCs. Results: The average score received on the BDKT was 16.67 ± 2.857. The regression analysis revealed 3 variables (age, ATC years, and route of ATC education) as significant predictors of ATCs’ diabetes knowledge scores. Conclusions: Age, ATC years, and route of ATC education are identified predictors of diabetes knowledge scores received on the BDKT. Additionally, subjects that had completed their athletic training education through an accredited program were found to have significantly higher scores on the BDKT than their internship education counterparts. This finding supports the recent educational reform in athletic training; program content standardization has resulted in an increase in athletic trainers’ knowledge on diabetes patients care. Key Words: Type I diabetes, knowledge, metabolic emergency, Brief Diabetes Knowledge Test