Using video analysis to study lacrosse injuries

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Studying the mechanisms of sport-related injuries

- To understand the causes of injuries in order to identify approaches to effective injury prevention

- Need a multi-dimensional approach including:
  - Epidemiologic
  - Biomechanical
  - Qualitative

Video analysis for sports injuries

- The systematic analysis of sporting event video to understand the dynamics of the injury event including actions occurring prior to the injury as well as during and after the injury event

- Approach has been used in other sports including soccer, football, hockey, rugby and baseball

Research data on injuries that video analysis can provide

- Athlete/opponent interactions prior to the injury
  - i.e. stick checking, loose ball situation
- Athlete movement patterns
  - i.e. running vs standing still, turning, falling (secondary impact)
- Characteristics of the game situation
  - i.e. field conditions, weather, skill differences

Lacrosse injury research using video analysis techniques

- LUCID study *(Lacrosse Concussion Epidemiology Project)*
  - Recorded 560 high school lacrosse games during the 2008-2009 seasons
  - Injury data were electronically recorded and linked to the video data
  - Videos were analyzed by researchers using a systematic coding scheme

LUCID study results for head injuries

- Boys' Concussions
  - 67 game-related concussions identified and treated by athletic training staff
    - 34 incidents had unobstructed video to analyze incident
- Girls' Concussions
  - 21 game-related concussions identified and treated by athletic training staff
    - 11 incidents had unobstructed video to analyze incident

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Girls' Concussion Mechanisms

- The majority of concussions (n=8, 72%) resulted from unintentional stick or body contact
- Most common game play scenarios:
  - shooting/defending a shot
  - loose ball situations
- 82% of concussions occurred in the attack zone (n=9)
- All concussions occurred at the varsity level
- No penalty was called in 82% (n=9) of the concussions

Boys' Concussion Mechanisms:
Lacrosse Collision Readiness Index

- The Lacrosse Collision Readiness Index (LCRI) permits standardized evaluation of player awareness for bodily collisions
- The LCRI is based on the Carolina Hockey Evaluation of Children's Checking scale developed by Mihalik et al. for use in youth ice hockey and on research examining tackle characteristics in rugby
- The 10-item LCRI provided a consistent framework for qualitatively evaluating the struck player's visual awareness and body posture in the moments before an impending bodily contact
- Player readiness was assessed using the same 3-step process described above
- LCRI Outcomes:
  - Unanticipated
  - Anticipated – poor body position
  - Anticipated – good body position

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Boys' Concussion Mechanisms

- Player-to-player contact was the mechanism for all concussions among boys.
- The striking player used his head to initiate impact in more than 75% of incidents resulting in concussion
- The struck player's head was the initial point of impact in greater than half of these collisions
- In more than half of concussive impacts the struck player did not anticipate contact (56%)
- The contact was intentional in 68% of the cases

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Video analysis of youth game characteristics

- 50 youth festival games played in NC and TX
  - Includes U11, U13, U15 boys and girls
- Objective #1: To measure physical exposures among youth players
- Objective #2: To measure skill level among youth players

Measures of physical contact

- Frequency of all types of physical contact that occur during a youth-level game
  - Contact object: body to body, stick to body, body to ground
  - Body part impacted: shoulder, leg, head
  - Characteristics of the players involved: offensive/defensive
  - Where on the field it occurred: i.e. attack zone
  - Game play at time of event: i.e. shooting, face off/draw
  - Player positioning: anticipated vs unanticipated

Measures of skill

- Frequency of specific actions that represent skill mastery at different levels of the game
  - Loss of possession: forced vs unforced turnovers, dropped balls
  - Passing: complete vs incomplete passes, dropped passes
  - Shooting: Assisted vs unassisted goals, saves, shots on vs off goal
  - Time ball is on the ground
  - Game play

Future applications of video analysis to lacrosse injury research

- Accelerometer and video data combined
  - Understanding of how body positioning/posture and anticipation of impact affect the risk of concussion
- What game play scenarios are more likely to put a player at risk for an unprepared hit?
- Multi-year comparative studies
  - Evaluation of rule changes
  - Evaluation of injury prevention effectiveness

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Limitations

- Video quality & availability
- Single cameras - incident can be obscured by other players or officials
- Time-intensive review of injury incident or game
- Inter-rater reliability
- Definitional consistency
  - Need for standardization of definitions
  - Creation & validation of instruments