Design Prospective cohort.

Setting Calgary, Canada over five ice hockey seasons (2013/14–2017/18).

Participants Male and female youth ice hockey players ages 11–18.

Assessment of Risk Factors Participant baseline reports of mouthguard use (yes/always and sometimes use, no/never use), helmet age (newer/<2 years old, older/≥2 years old), and other important covariables [i.e., weight (kilograms), age group (under-13, under-15, under-18), position (forward, defense, goalie), concussion history (yes, no), body checking policy (allowed, disallowed)] were collected near the start of each season. Moreover, each player's participation hours were collected throughout each season.

Main Outcome Measurements Number of medically diagnosed or therapist identified suspected concussions using validated surveillance methodology in games and practices over 5 seasons of play.

Results Multilevel negative binomial regression adjusted for player position, level of play, body checking policy, concussion history, weight, cluster by team, and offset by player-hours was used. The model included 426 concussions suffered by 369 players (from 394 player-seasons; 29 players had recurrent concussions in a single season) over 4,541 player-seasons (271,148.7 player hours). The model demonstrated that players who reported wearing a mouthguard had a 28% lower rate of concussion compared to those who did not (IRR=0.72, 95%CI: 0.55–0.93). Moreover, there were no differences in the concussion rate between newer and older helmet ages (IRR=0.94, 95%CI: 0.76–1.16).

Conclusions Protective equipment is an important consideration for concussion prevention and player safety. Wearing a mouthguard was associated with a lower concussion rate and policy mandating mouthguard use should be considered in youth ice hockey. More specific helmet age categories may require further investigation.

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FUNCTIONAL MOUTHGUARD DESIGN TO ENHANCE THE PROTECTIVE CAPABILITY AND ATHLETE COMFORT

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10.1136/bjsports-2021-IOC.396

Introduction Athletes of contact sports are prone to cranial, orofacial and dental injuries in case of a traumatic head impact. Mouthguards can be potentially beneficial in reducing the injury risk by changing the dynamics of an impact to teeth. Indeed, dissipative capacity of mouthguard materials influences the extent of transferred force. However, the effect of geometrical/structural attributes should not be neglected on the mouthguards performance.

Objective The aim of this study is to evaluate the role of different design variables in protective capability of mouthguards and to find an optimal configuration by means of computer aided engineering.

Design and Setting A detail anatomical human upper jaw model was developed including teeth, periodontal ligament and maxilla bone. The incisor impact with an ice hockey

puck was then simulated by finite element analysis with and without mouthguard. Various mouthguard configurations were designed by employing different material properties, laminated composite arrangement, layers thickness, and space inclusion.

Main Outcome Measurements The maximum effective stress on the incisors, contact force profile and stress distribution were compared to evaluate effect of different parameters on mouthguard protective performance.

Results While larger thickness always reduces the risk of injury in all configurations, the effectiveness of space inclusion and composite layers arrangement are design dependent. The optimal configuration was obtained when we combined graded stiffness layers (2000 to 20 Mpa) arrangement with a pre-defined gap (1 mm) in front of incisors. In this specific design, limiting the mouthguard thickness to 3 mm resulted in acceptable protective performance compared to 4 mm case and was preferred for the sake of athletes comfort.

Conclusion Both structural and material properties are playing a key role in shock absorbing capabilities of mouthguard. There is a need to practice multi-materials 3D printing for fabrication of customized mouthguards to maximize their performance and comfort.

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COVID-19 AND SPORTS – AN ONLINE SURVEY ON THE IMPACT OF THE PANDEMIC AND POSSIBLE PREVENTIVE MEASURES

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10.1136/bjsports-2021-IOC.397

Background The COVID-19 pandemic led to the implementation of worldwide governmental restrictions and preventative measures with large impact on social life.

Objective To investigate the effects of the pandemic on individual and general sport activities in an effort to provide information for safe return to community sports.

Design An electronic survey was launched in June 2020 in German and English language. The anonymous questionnaire collected epidemiological data and responses 'before', 'during' and 'after' confinement conditions. Descriptive statistics and logistic regression analysis were used.

Setting Most participants practiced their sport in Europe (93.9%); 68.5% were active athletes, 10.1% coaches, 10.1% had other sports functions, 11.3% indicated no regular sports activity.

Participants 1336 adults (30.5±11.7 years; 54.0% women) participated in the survey.

Assessment of Risk Factors Risk factors for a serious course of COVID-19 disease were queried.

Main Outcome Measurements The type, extent and intensity of physical activity were defined as main outcome measures.

Results During confinement, 15.7% could perform their main sport unrestricted, 43.5% stated a reduced amount of time spent on sporting activities, 46.4% a reduced intensity level. Most participants were neither aware of screening measures

(77.5%) nor of guidelines for dealing with infected athletes (80.0%) or for return to sports after a coronavirus infection (88.6%). Preventive measures mentioned included basic hygiene, measures to reduce personal contacts or virus transmission, or to improve traceability. During confinement, higher age ($p = 0.004$) and training in a club-setting ($p < 0.001$) were associated with reduced sporting activity, while the availability of online training ($p = 0.030$) was linked to increased extent and intensity levels. Lower age ($p = 0.001$) and recreational sports level ($p = 0.005$) were associated with decreased activity after confinement.

Conclusions While isolation is a necessary measure to protect public health, it also alters physical activity.

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THE EFFECTIVENESS OF A VOLLEYBALL INJURY PREVENTION PROGRAM TAILORED TO YOUTH PLAYERS

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10.1136/bjsports-2021-IOC.398

Background In the Netherlands, volleyball is ranked among the top 5 sports with the highest number of injuries, and over 35% of these injuries are sustained by youth players.

Objective To assess the effectiveness of a volleyball specific youth injury prevention program on injury incidence, injury severity and injury burden.

Design Quasi-experimental study based on a prospective controlled design with a follow-up period of one volleyball season. Randomization was based on competition region (2 intervention regions, 2 control regions). Exposure data of youth volleyball players were collected by trainers on a weekly basis. In case of absence due to a volleyball related injury, injury details were obtained.

Setting Youth teams playing in the Dutch volleyball competition.

Participants Players aged under 17 years who train and compete in the Dutch volleyball. In total, 518 players were included in this study (286 intervention group, 232 control group).

Intervention A volleyball specific warming-up programme tailored to youth, aimed at increasing motor ability and neuromuscular control.

Main Outcome Measurements Injury incidence, injury severity and injury burden. Subgroup analyses for injury onset (acute or overuse) and injury location (upper extremity or lower extremity).

Results No overall effect of the intervention was reported for injury incidence, injury severity and injury burden. Subgroup analysis showed that upper extremity injury rate was reduced by ~60% (HR 0.41, 95%CI 0.20 – 0.83). A trend was found suggesting that the risk for an acute injury was reduced by ~40% (HR 0.61, 95%CI 0.36 – 1.02).

Conclusions No overall effect of the youth volleyball injury prevention program was found. The preventive program was, however, very effective in reducing upper extremity injury

rates in youth players. With respect to acute volleyball related injuries, results were promising.

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COMPLIANCE WITH AN INDIVIDUALIZED VS. THE FIFA 11+ INJURY PREVENTION PROGRAM

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10.1136/bjsports-2021-IOC.399

Background Players' compliance with injury prevention programs (IPP) can significantly affect the effectiveness of such programs in injury reduction.

Objective To evaluate players' compliance with an individualized IPP to compared to the established FIFA 11+ IPP.

Design Cross-sectional study

Setting Semi-professional football. The data was obtained from a pilot study comparing the effectiveness of individualized vs. generalized (i. e. one-size-fits-all) IPPs.

Participants 72 semi-professional soccer players from 4 clubs (age: 22.3 ± 4.7 ; weight: 75 ± 10 kg; height: 177 ± 9 cm) participated in the study and were divided into two groups of 1) Individualized and 2) FIFA 11+.

Interventions The individualized group completed 6 weeks of unsupervised, individualized IPP based on their functional movement screen scores. FIFA 11+ group completed 6 weeks of FIFA 11+. After the 6 weeks (18 sessions), the compliance with programs was assessed using an online questionnaire.

Main Outcome Measurements Compliance with the IPP defined as the players' self-assessment of how correctly they followed all instructions during all sessions. Players were classified based on their self-report as fully complied (carried out 16 and more successful sessions), partially complaint (8–15 sessions) and not complaint (less than 8 session).

Results A total of 29 (81%) players in the individualized PP group said they had fully complied during the 6 weeks of individualized IPP; 5 (14%) said they had been partially compliant and 2 (5%) classified as not compliant. In FIFA 11+ group 15 (41%) had fully complied; 14 (39%) said they had been partially compliant and 7 (20%) were classified as not compliant.

Conclusions The results indicate that an individualized IPP may be superior to 11+ IPP in terms of players' compliance. Further research needs to expand the sample size and to investigate the relationship between compliance and injury reduction effect of individualized IPPs.

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HOME-BASED INJURY PREVENTION PROGRAM DURING COVID-19 LOCKDOWN REDUCED INJURIES DURING THE REMAINING SEASON IN SEMI-PROFESSIONAL FOOTBALL PLAYERS

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10.1136/bjsports-2021-IOC.400

Background The Covid-19 pandemic caused a forced lockdown longer than the normal annual season break in Iranian