

## CROSS-SECTIONAL CHANGE OF BALL IMPACT IN INSTEP SOCCER KICKING

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### Introduction

To kick the ball faster is essential ability for soccer players. Through daily training, the players learn how to impart the foot and leg momentum into the ball effectively. The purpose of this study was to investigate the change of ball impact characteristics in instep kicking from childhood to adolescent players by the cross-sectional method.

### Methods

Fifty one skilled soccer players from 8 to 24 years old participated. The shank and foot motions during ball impact of maximal instep kicking were captured by two ultra-high-speed video cameras at 2000 fps. 3D foot angular motion was detected, and the ball-foot velocity ratio (BFVR) was calculated as the index of ball impact efficiency. To quantify how much the mass was imparted for the collision, effective striking mass of kicking limb was estimated from the equation of momentum conservation.

### Results & Discussion

Foot velocity before ball impact, ball velocity, and BFVR increased systematically with age. In most trials, the foot was forced into plantar flexion, abduction and eversion during ball impact regardless of age. In contrast to Asami and Nolte (1983) who suggested that the rigidity of the foot is critical factor for good foot-ball impact, these passive foot angular displacements have no relationship to BFVR. The effective striking mass was strongly correlated with their body mass ( $r = 0.89$ ), foot mass ( $r = 0.91$ ), and BFVR ( $r = 0.88$ ). The sum of the mass of the foot and shoe corresponded to  $84.0 \pm 9.6$  % of the striking mass. Lees and Nolan (1998) also speculated that if the ankle becomes more rigid at ball impact, the effective striking mass would increase by adding some part of the shank mass on the foot. However, our results suggested that if the foot hit the ball with appropriate position (i.e. around the centre of mass), the ball impact is most likely assumed to be a collision between the shod foot and the ball.

### Conclusion

The physical size of the soccer players has great influence on the ball impact efficiency. Therefore, due to the small mass of the foot, younger players have some disadvantage to kick the ball effectively even if their kicking technique is well skillful.

### References

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