EFFECT OF SENSORY INTERACTION ON BALANCE CONTROL ABILITY OF FREESTYLE SKI AERIALS ATHLETES AND HEALTHY INDIVIDUALS

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Introduction

Human balance is a complex combination of information, which mainly depends on the coordination of visual system, vestibular system and proprioceptive system to achieve its own stability[1]. These inputs not only provide important information about body orientation and position, and they interact with each other.

Methods

6 elite and 10 national-standard freestyle ski aerials athletes and 14 healthy individuals participated in experiments, recorded AP(Anterior-posterior)and ML(Mediolateral) direction center of pressure(COP) displacement of in four conditions, including stable surface eyes opening(T1), stable surface eyes closed(T2), unstable surface eyes opening(T3), unstable surface eyes closed(T4) for 30 seconds test, and calculated Sample Entropy(SE), Plantar Quotient(PQ) and Romberg Quotient(RQ), analysis different sensory function.

Results

Elite and national-standard athletes balance control have more effect of plantar stimulation than visual afferents, the opposite feature in healthy individuals. Interaction of visual afferents and plantar stimulation, athletes balance ability in AP and ML direction is better than healthy individuals, visual afferent condition shows opposite features.

Discussion

Elite and national-standard athletes are more sensitive to proprioception, visual sense do not affect athlete balance control. Meanwhile, the balance ability of ML direction is better than AP direction was common feature of athletes and healthy individuals, but visual afferents can cause a deviation in the direction of the ability of healthy individuals to control balance.

Figure and Tables

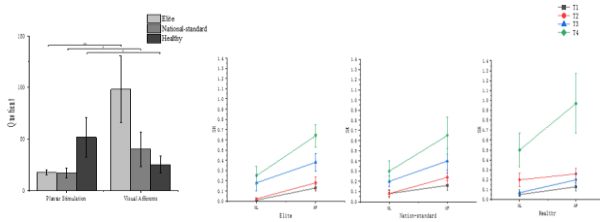

*Figure1 and Figure2. Compare the effects of visual afferents and plantar stimulation on balance control ability. Feature of COP direction in elite athletes, national-standard athletes, healthy people in T1-T4 test conditions. Error bars represent the standard errors. Asterisks indicate significant differences, with*P <0.05；**P <0.01.*

Condition	Direction	Group		
		Elite	National-standard	Healthy
Eyes closed	ML	98.3±32.5	40.0±16.9	25.0±8.2
	AP	40.1±11.9	27.1±9.7	37.6±13.7
Eyes open	ML	131.8±55.1	35.1±26.3	14.7±7.2
	AP	30.7±6.8	30.1±13.9	15.8±5.0
Firm	ML	25.4±15.3	10.9±6.1	31.7±6.7
	AP	15.2±5.0	15.6±5.0	65.5±19.4
Foam	ML	13.75±3.7	15.5±4.6	22.1±9.6
	AP	17.3±2.5	16.8±4.8	51.6±19.2

Table 1: Plantar Quotient and Romberg Quotient of different group

Equations

(1) Plantar Quotient calculation

$$PQ = {SE_{foam}}/{SE_{firm}} \times 100 \qquad (1)$$

(2) Romberg Quotient calculation

$$RQ = {SE_{eyes\ closed}}/{SE_{eyes\ open}} \times 100 \qquad (2)$$

The PQ provides information on the weight of plantar cutaneous afferents used in postural control. The PQ consists of the ratio between the COP sample entropy while the subjects stand on foam while they stand on firm surface. Likewise, this ratio betrays the influence of visual afferents in postural control. RQ is composed of the ratio of COP sample entropy when volunteer eyes are open and closed[2].

References

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