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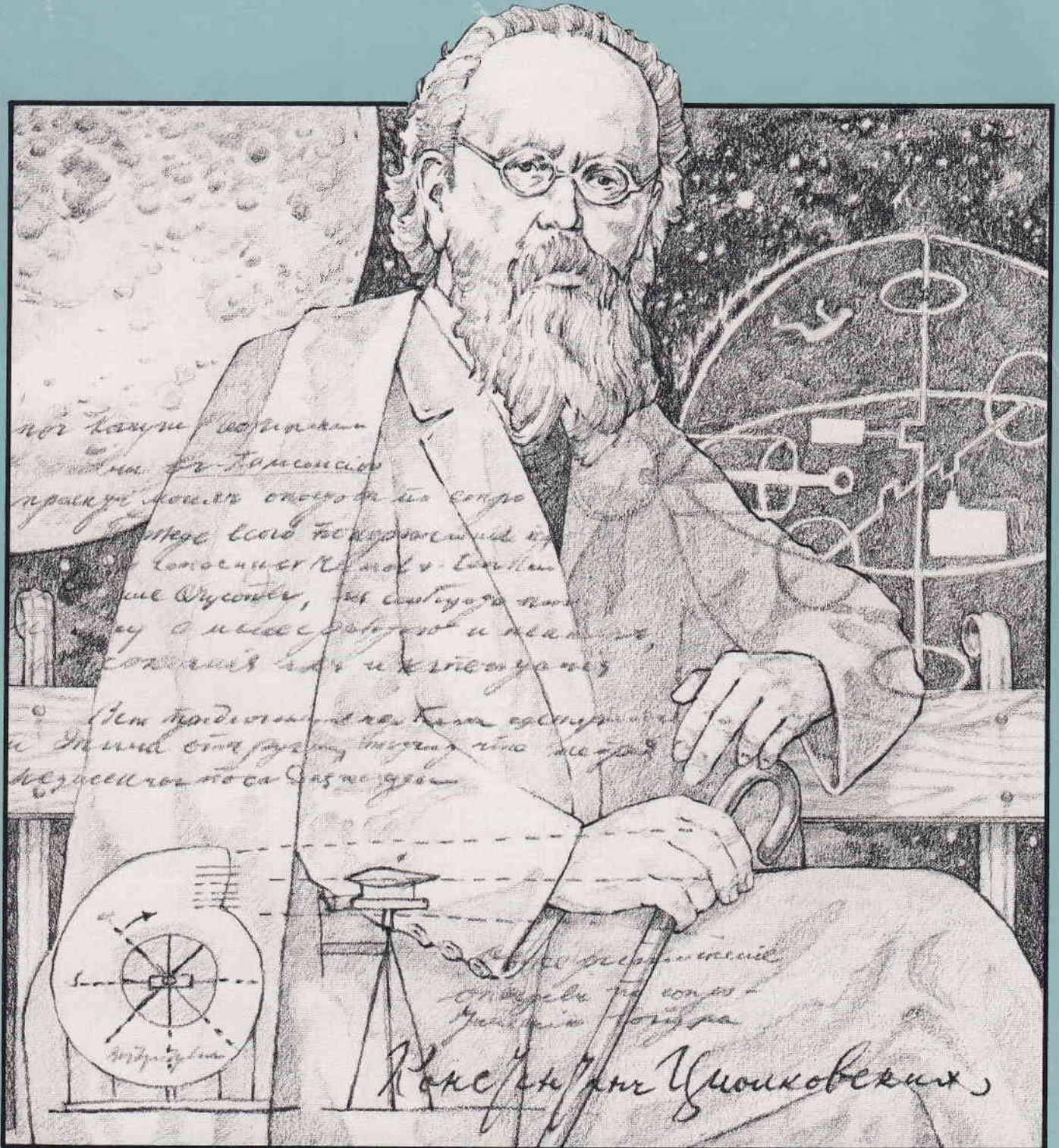
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CHANGES IN INFORMATION PROCESSING ABILITY /IPA/, EEG, EOG USING PASSIVE  
ORTHOSTATIC AND ANTIORTHOSTATIC TEST

P.Remes, J.Hideg, L.Bognár, A.Pozsgai, L.Lehoczky, Z.Sidó, Gy.G.Kiss,  
S.Kalmár

Intercosmos Council of the Hungarian Academy of Sciences  
1369 Budapest 5 P.O.B. 315 Hungary

ABSTRACT

In orthostatic position we have noticed tachycardia, bradypnea, pulse pressure decrease, lengthening of PEP and shortening of LVET, cardiac output and stroke volume values decrease while in antiorthostatic position we have seen bradycardia, tachypnea, pulse pressure increase, shortening of PEP and lengthening of LVET, stroke volume and cardiac output increase. Bit speed indicates increase both in orthostatic and antiorthostatic positions in accordance with the excitement of central nervous system. Comparison with rest both in orthostatic and antiorthostatic positions cerebral bioelectric activity increase significantly. Within it, the bigger energy level shifts toward fast frequencies. In antiorthostatic posture, nystagmoid eye movements can be noticed - characterized by fast and slow components.

INTRODUCTION

In our earlier investigations /1, 2/., corresponding to other authors we pointed out, that orthostatic and antiorthostatic loading induce substantial changes in circulation.

From the point of view of functional damage, antiorthostatic loading represents a more serious adverse factor as it is evidenced by our electroencephalographic and electrocardiographic studies /1/.

METHODS

Our investigations were performed in practically healthy pilots. On MEDICOR tilting table in horizontal position during 10 minutes, in orthostatic position during 20 minutes then in antiorthostatic position during 6 minutes, changes in pulse rate, respiratory rate, systolic and diastolic blood pressure and changes in  $PO_2$  of capillary were measured by transcutaneous oxymetry on the skin of forehead, chest and leg. Measurements were performed by Hellige device complex.

We have recorded electrocardiograms in 12 leads, carotis mechanogram, horizontal and vertical electrooculograms,

electroencephalograms by bipolar leads hemispherally and interhemispherally and their energy spectrum have been determined by Fourier analyse. We have determined pulse wave velocity and stroke volume, using a method developed by Bremser-Ranke.



Figure 1. The device "Balaton".

Preceding examination then following orthostatic and antiorthostatic loading, we have determined changes in information processing ability /IPA/: sensory-motor reaction time, four-choice reaction time, four-choice selection time, processed information quantity, bit speed under double loading /in time force and during sound disturbance/ and in undisturbed circumstance. Measurements were performed by the device "Balaton" /MEDICOR, Hungary/ that have already been used during series of Intercosmos spaceflights. Method of this device and measurement has been developed by us /3, 4/. To follow changes in emotional tension, we measured changes in pulse rate and galvanic skin resistance. Results have been elaborated by PDP-11 and APPLE-II computer.

## RESULTS

The 21 practically healthy pilots - considering the usual examination criterion - proved that they are persons with good tolerance.

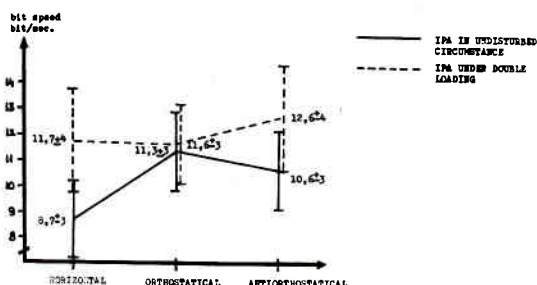


Figure 2. Change of information processing ability /IPA/ in different postures.

In Figure 2. can be seen changes in bit speed - from indices of information processing ability - in different postures in undisturbed circumstance and under double loading. Bit speed indicates increase both in orthostatic and anti-orthostatic positions in accordance with the excitement of central nervous system. However psychophysiological reserves remain, as bit speed can be more increased under double loading in both tested postures.

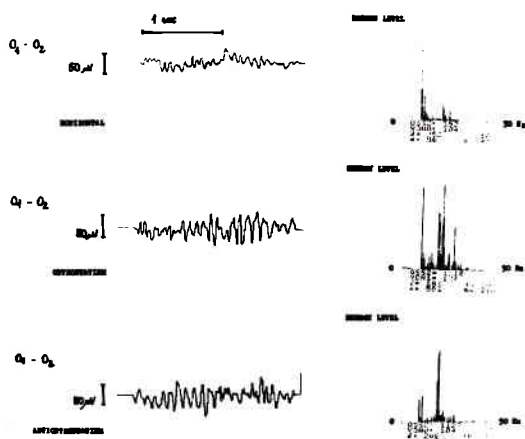


Figure 3. Changes in EEG spectrum in different postures.

Comparison with rest both in orthostatic and antiorthostatic positions cerebral bioelectric activity increase significantly /indicating increase of excitement of central nervous system. Within it, the bigger energy level shifts toward fast

frequencies.

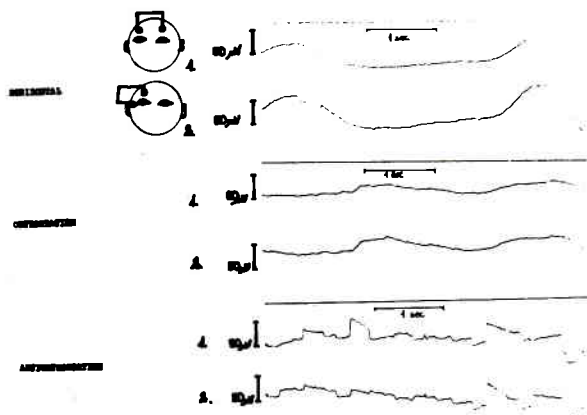


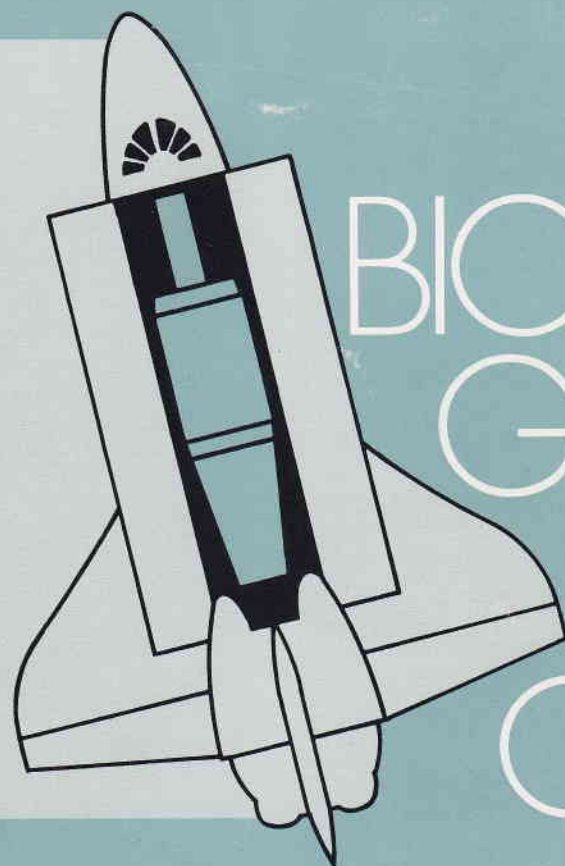
Figure 4. EOG changes in anti-orthostasis.

On the basis of our data we can state that haemodynamic changes - in addition to others - play an important role in pathomechanism of vestibular disorders, caused by weightlessness. Haemodynamic changes does not influence unfavourably information processing ability, namely the current mental work capacity, moreover they do not decrease neither psychophysiological reserves. At the same time it means excitement of central nervous system can be noticed, as the perfect compensation of haemodynamical changes, induced by postural changes.

## REFERENCES

1. P.Remes, L.Bognár, J.Hideg, L.Lehoczky, L.Dux. 1981. Changes in hemodynamics, blood oxygen saturation level and central nervous system in response to postural loading. *Gravitational Physiology /Adv. in Physiological Sciences Vol 19/*. Eds.: J.Hideg, O.Gazenko. Pergamon Press, Akadémiai Press, Budapest. pp 299-306.
2. P.Remes, J.Hideg, L.Bognár, J.Gyökössi. 1979. Fazoviy analiz serdechnogo tsikla pri izmenenii polezheniya tela kosmonavtov. Dokl. Del. VNR na XII Konf. Kosm. biol. i med. Soveta Interkosmosa.
3. J.Hideg, L.Bognár, P.Remes, V.I.Myasnikov, O.P.Zukova, O.P.Kozerenko, I.P.Ponomareva. 1980. Mnogostoronniy podhod k ocenke umstvennoy rabotosposobnosti operatorov. Dokl. Del. VNR na XIII Konf. Kosm. biol. i med. Soveta Interkosmosa.
4. J.Hideg, L.Bognar, P.Remes, O.P.Kozerenko, V.I.Myasnikov, I.P. Ponomareva. 1982. Psychophysiological performance examination onboard the orbital complex Salyut-Soyuz. Space 2000 /Selection of Papers Presented at the 33 rd Congress of the IAF 1982. Paris France/Ed. L. Napolitano.

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