자속에 노출된 인체의 혈중 산소 포화농도의 변화에 관한 연구

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A Study on the Oxygen Saturation Level Changes in the Blood Exposed to the Static Magnetic Field

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Abstract : The effects of static magnetic field on the human biological system are becoming increasingly more important with the adaption of static magnet in the medical community. It is the goal of this paper to review the effects of static magnetic fields on oxygen saturation level in blood. The results of this paper show that the oxygen saturation level increased in the blood in index finger when the static magnetic dipole was fitted on index finger.

초 록 : 최근 의료분야에서 인체의 생리학적 조직에 정자계가 영향을 미치는 것으로 밝혀짐에 따라 정자계를 사용하는 의료장비의 중요성이 대두되고 있다. 본 연구의 목적은 자속의 영향에 의한 혈중 산소 포화 농도의 변화를 평가하는 것이다. 본 연구의 결과는 검지 손가락에 정자계 쌍극자가 맞추어졌을 때 혈중 산소포화 농도가 증가한다는 것을 보여준다.
Key Words : electrostatics, electromagnetic fields, oxygen saturation level

1. Introduction

Recently in the medical community it became known the fact that biological system is quite influenced by static magnetic fields, so importance of medical equipment using static magnetic fields is getting more serious. The first study about static magnetic fields was analysis of blood cells exposed to EMF(Electro Magnetic Field) emitted through radars and high frequency communication apparatuses[1-3]. These studies statistically treated interrelation between time exposed by static magnetic fields and white cell in the blood. The other studies were performed to study some influences on human bodies by intensity of static electromagnetic field and various frequency. The latest literatures on medical world tell static magnetic fields having an effect on the human biological system, but up to now it has not advanced studies on the blood, As the mechanism about correlation between static magnetic field and blood is not known yet, more advanced studies should be done here after[4,5].

For investigation about the effect of static magnetic field on the oxygen saturation level in blood in this study, following experimentation was performed to get the variations of the oxygen saturation level in blood on the pulse oximetry using 0.4T static magnetic field for 20 young men and women respectively. The result will be available for the medical treatment.

II. Materials and Experimental Methods

The oxygen saturation level in blood was measured by using pulse oximetry system. That system was

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fitted with a forefinger. Probe was used to measure the effect that the magnet fitted with a forefinger influences the oxygen saturation level in blood.

For preventing interference from external electromagnetic wave, pulse oximetry system should be grounded. The arrangements with cylindrical magnets are at 90 degrees(vertical and horizontal arrangement) to the blood flow.

Cylindrical magnets were put vertically and horizontally on the index finger in righthand. For accurate experiment the persons are tested after recovering equilibrium. At the first test, the experiment was performed the oxygen saturation levels in blood before exposed to the magnetic field, and at the second and third, the same experiments were performed the oxygen saturation levels in blood after exposed to the magnetic field on the index finger vertically and horizontally were measured. The magnets were horizontally held in place using medical tape. After horizontal test the magnets were vertically held on the index finger and the test was carried out for 30 minutes. Fig. 1 and Photo 1 shows the dipole arrangement.

Table 1. Anthropometric measurements from subjects(male)

experimenter	height(㎝)	weight(kg)	age(Year)
Male 1	172	60	24
Male 2	176	80	25
Male 3	172	68	22
Male 4	170	55	29
Male 5	182	82	28
Male 6	172	77	25
Male 7	176	75	25
Male 8	174	68	29
Male 9	175	82	28
Male 10	168	62	24
Male 11	180	76	27
Male 12	173	72	25
Male 13	177	65	25
Male 14	178	79	27
Male 15	172	70	24
Male 16	170	68	26
Male 17	176	74	25
Male 18	169	63	24
Male 19	174	68	24
Male 20	177	76	26
average±deviation	173.7±3.88	70.9±9.72	25.9±2.49

Table 2. Anthropometric measurements from subjects(female)

experimenter	height(㎝)	weight(kg)	age(Year)
Female 1	171	52	20
Female 2	170	50	23
Female 3	167	53	24
Female 4	160	50	23
Female 5	172	57	22
Female 6	164	54	24
Female 7	165	52	24
Female 8	164	53	24
Female 9	164	60	23
Female 10	157	48	22
Female 11	162	46	25
Female 12	166	52	25
Female 13	167	55	22
Female 14	160	50	23
Female 15	155	45	24
Female 16	159	51	26
Female 17	163	49	25
Female 18	168	53	22
Female 19	170	59	22
Female 20	165	50	23
average±deviation	165.4±4.76	52.9±3.51	22.9±1.28

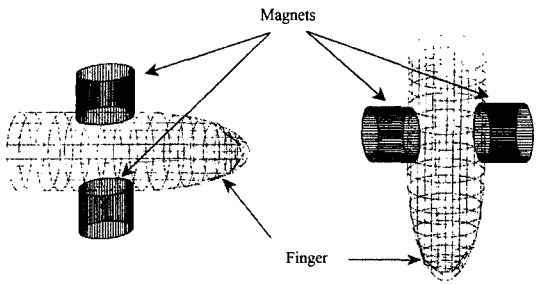

Fig. 1. Schematic Diagram of the dipole arrangement.

Vertical Horizontal

Photo.1. The dipole arrangement.

The following table 1 & 2 show the height, weight and age for 20 young men and women respectively.

III. Experimental Results

Variations of the oxygen saturation levels in blood are the difference between the oxygen saturation levels in blood before exposed to the magnetic field and the oxygen saturation levels in blood after exposed to the static magnetic field arranged vertically and horizontally on the index finger.

The following equation (1) means the variation of the oxygen saturation level.

$$\text{Variation} = x - y \quad (1)$$

where,

x : The oxygen saturation level in blood before exposed to the magnetic field

y : The oxygen saturation level in blood after exposed to the magnetic field

Fig. 2 and 3 show the variation of the oxygen saturation levels in blood for each person when the dipole arrangement is set in a vertical and horizontally on the index finger.

Fig. 2 shows the difference of the oxygen saturation level in blood according to dipole arrangement in case of male. From Fig. 2, the oxygen saturation level in blood increased 17% in a vertical arrangement, but increased 9.5% only in a horizontal arrangement.

Fig. 3 shows the difference of the oxygen saturation level in blood according to dipole arrangement in case of female. From Fig. 3, the oxygen saturation level in blood increased 13.6% in a vertical arrangement. but increased 17.4% in a horizontal arrangement.

Fig. 4 shows the comparison of the oxygen saturation level in blood exposed to the dipole arrangement between male and female subjects. It increased averagely 17.4% in case of male, but increased 13.6% in case of female when the dipole arrangement is set vertically. It increased 9.5% in case of male, but increased 17.4% in case of female when the dipole arrangement is set horizontally. The oxygen saturation levels for male increased more than the oxygen saturation levels when the dipole arrangement is set in a horizontal line.

For the male, the oxygen saturation levels increased in a vertical dipole arrangement more than in a horizontal dipole arrangement. For the female, conversely the oxygen saturation levels increased in a horizontal dipole arrangement than in a vertical dipole arrangement.

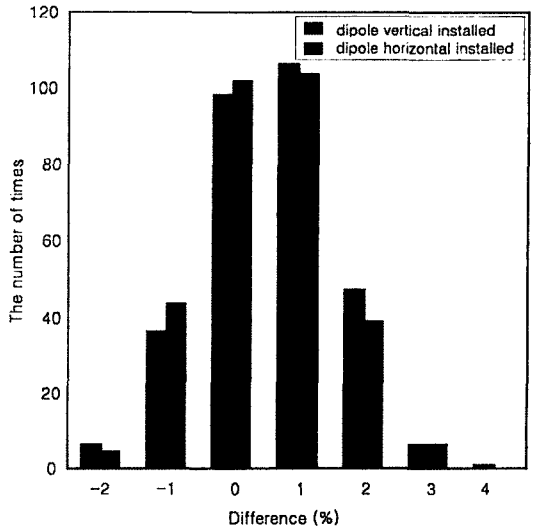

Fig. 2. The Difference of the Oxygen Saturation Level in Blood according to Dipole Arrangement(in case of male).

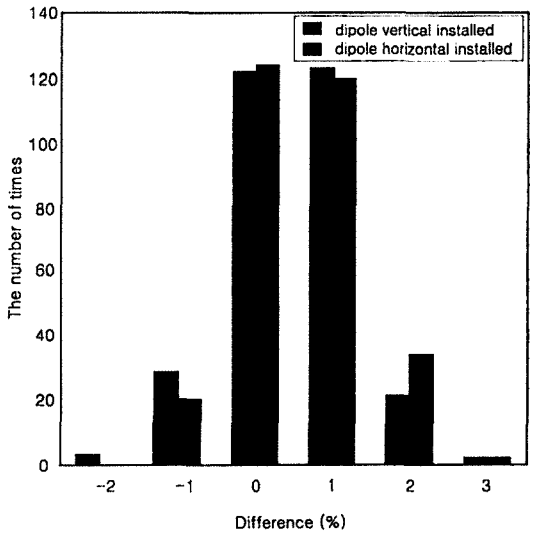

Fig. 3. The Difference of the Oxygen Saturation Level in Blood according to Dipole Arrangement(in case of female).

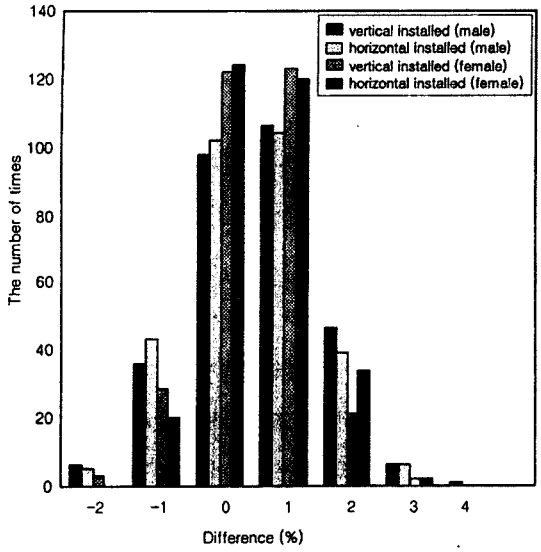

Fig. 4. The Comparisons of Oxygen Saturation Level in Blood exposed to the Dipole Arrangement between male and female specimen.

The oxygen saturation levels for male were mostly 97~99%, the oxygen saturation levels for female were measured mostly 98~100% before exposed to magnetic field. It shows the oxygen saturation levels for male is 1~2% less than female before exposed to magnetic field. The reason why the female's level was higher than the male's is that a female have longer finger and less fat surrounding the blood vessel because probe measures an amount of light passing through the blood vessel.

IV. Conclusions

In this study the following results are as follows by variations of the oxygen saturation level in blood on the pulse oximetry by using 0.4T static magnetic field for 20 young men and women respectively.

1) In case of arrangement vertically and horizontally on the index finger, the oxygen saturation level in blood increased. When the dipole static magnetic fields were arranged horizontally or vertically, the oxygen saturation level in blood of women increased much more than men's.

2) When the dipole static magnetic fields were arranged vertically, the oxygen saturation levels in blood of men and women averagely increased 17.4% and the 13.6% each.

3) When the dipole static magnetic fields were arranged horizontally, the oxygen saturation level in blood of young men averagely increased 9.5% and the oxygen saturation level of women increased 17.4%.

4) The oxygen saturation level variation in blood of young men and women was an increase of 0~1%. The oxygen saturation level variation in blood of young men was much more than women's.

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