ESTIMATION OF CAPILLARY OXYGEN SATURATION BY NON INVASIVE OPTICAL METHOD

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1. Introduction

Today's rapidly evolving technology has led to significant improvements in the medical field diagnosis and treatment methods. One of these important developments is in medical imaging technology. Scientists are working to make available imaging techniques more accessible, economical and qualified. Most of today's imaging technology uses electromagnetic waves that can pose a threat to human health. But it is possible to produce new imaging technologies using infrared and visible light, which does not damage live health.

In this project, reflecting infrared and visible light beams to dye solution representing the blood and the human skin, taking an image with the help of an infrared camera, processing it with written algorithm to calculate the oxygen saturation ratio of the blood in the related area and making the prototype with the targeted features was aimed.

2. Method

The study consists of two stages. In the first step, red dye solution to represent oxygen-rich blood and blue dye solution to represent oxygen-poor blood were prepared at different ratios and then under visible light and infrared light images were taken (in vitro). The optical system is shown in Figure 1.

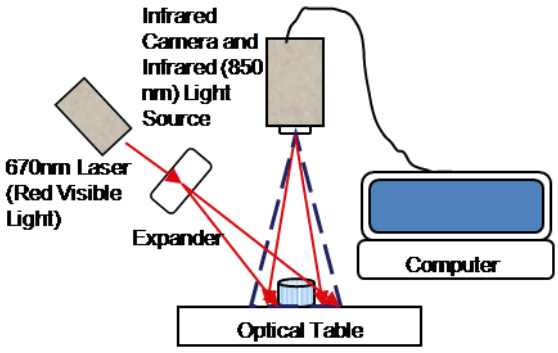

Figure 1. Measurement System

These images were processed with an algorithm which prepared in the frame of effective optical laws and the red and blue ratio was calculated during the penetration of the light to the sample. In the second step, images of injured and healthy areas of the patient were algorithmically processed using the same method (in vivo) (Figure 2).

Figure 2. O_2 saturation measurement of human skin (in vivo)

3. Results

Based on the data obtained, the color calculated with images taken in in vitro specimens is suitable for dye ratios of the prepared solutions (Table 1).

Table 1. In vitro results (Taken from dye solutions)

In vitro Fantom Mixing Concentrations	**Oxygen Saturation**
100% red (100% HbO_2)	0.97
90% red-10%% blue	0.90
80% red-20% blue	0.79
70% red-30% blue	0.68
60% red-40% blue	0.62
50% red-50% blue	0.53
0% red-100% blue	0.30

In vivo measurements performed after, the oxygen saturation ratio in the injured part calculated using the blood oxygen saturation and with the change in blood color was lower than the oxygen saturation ratio in the healthy part (Table 2). This result is in agreement with the knowledge that the oxygen saturation of injured part reported in the literature is lower than in healthy areas.

	Healthy Part Oxygen Saturation (%)	Unhealthy (Injured) Part Oxygen Saturation (%)
Measurements taken from the wounded patient	93	86

4. Conclusion

According to the literature, the method used in the study comes to foreground due to the portable formability of the apparatus used when compared to other methods, and the low cost of design. In addition, the optical method used allows measurement of oxygen saturation without harming the patient since it can measure without any spontaneous exposure.

5. References

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