

The importance of Laser-Biophotometry *in-vivo* in medicine

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Introduction

The modern medicine cannot be conceived without new medical technology, based on quantum physics' principles. One of the most discoveries in the this domain is the laser. The research concerning the interaction of laser radiation and the live matter has solved several aspects closed related to the absorption, dispersion and reflexion properties of *in vivo* tissues and opened new horizons in the diversification of medical applications of the laser.

If the research and development of therapeutical methods has prevailed initially, lately the emphasis of **noninvasive** methods of diagnosis *in vivo* has amplified itself. Thus, new noninvasive methods have appeared, based on **spectroscopic laser** for the *in vivo* determination of the germ flora, testing the vascular rheology, metabolic indices etc. The sensitivity of each method depends on frequency spectrum and technological performance.

Infrared laser biophotometry limits to a relative strait spectrum (0, 85-0,89mkm) and it's based on the absorbtion, dispersion and reflexion fenomenon from the tissues.

The absorbtion proprieties and determined by the biochemistry of the tissue and the proprieties of dispersion by the morphology of the tissue.

In the human organism, the main substratum of absorbtion in the closed infrared spectrum is the water, the oxigen, the haemoglobin, the melanin.

Objectives: Research of the interaction particularities of the closed infrared spectrum (850mm) with the normal tissues.

Determination of infrared reflexion coefficient from the intact tissues (*in vivo*). The evaluation of optical parameters of tissues **in function** of individual and constitution particularities.

Material and Method

It was taken a study group of 180 people (students and other categories of people considered healthy), 96 men, 84 women, with the age between 14 – 80 years.

The coefficient of absorption and reflexion in infrared, *in vivo*, from the intact tissues, nonmodified pathologically was evaluated by a therapeutic laser device “MILTA F-8-01 with biofotometer”. The transmittion-reception probe of the biofotometer is of 100mVt – value displayed on the display. By application of the probe on intact skin, the emitted energy by the photodiodes penetrates the **skin** layer, it disperses in the tissues (at a depth of 5-7 cm, partially it absorbs, the rest reflects). This dose of energy, which reflects from the tissues it's repected by the biofotometer probe and showed on the display (Reflection coefficient). The value of the reflection coefficient represents: 100mVt – minus the energy absorbed by the tissues. In a similar way can be determined the absorption coefficient: 100mVt – (minus) the coeficient of reflexion (shown on the display). Therefore the coefficient of absorption and reflexion of the infrared spectrum in the tissues it's an objectively parameter, measurable in milliwats (mVt).

For an evaluation and a processing more objective of the results, we've realized a topographic map of the human body with the designation of the obligatory points for the measurement of the coefficient of reflexion. **The realized mapping** allows a more rapid and exact recording of the obtained values and their comparative analyze in the same plan. Evaluation of the optic proprieties of absorption dispersion and reflexion has been effectuated in correlation with the individual constitutional particularities of the organism, which aims the structure of the tissues and the degree of **cutanat** pigmentation

Results

The evaluation parameters of the results of the Laser-biofotometer *in vivo* investigation from the intact tissues.

Table 1.

The characteristics of the lot and the CMR values in Infrared ($\lambda=0.85$) by sex

SEX	TOTAL	%	Men	%	Women	%
No. of cases	180	100	96	53	84	47
MCR %		55,7-68,3		55,7-68,3		55,7-68,3

Table 2

The characteristics of the lot and the CMR values in Infrared ($\lambda=0,85$ mkm) by age

Age	14-20	21-30	31-40	41-50	51-60	61-70	<71
No. of cases	54	36	20	22	25	15	8
%	30	20	11	12	14	8	5
CMR	66 ± 2,3	65 ± 2,1	64 ± 2,2	63 ± 2,3	61 ± 2,2	60 ± 2,1	59 ± 2,3

Graphic representation

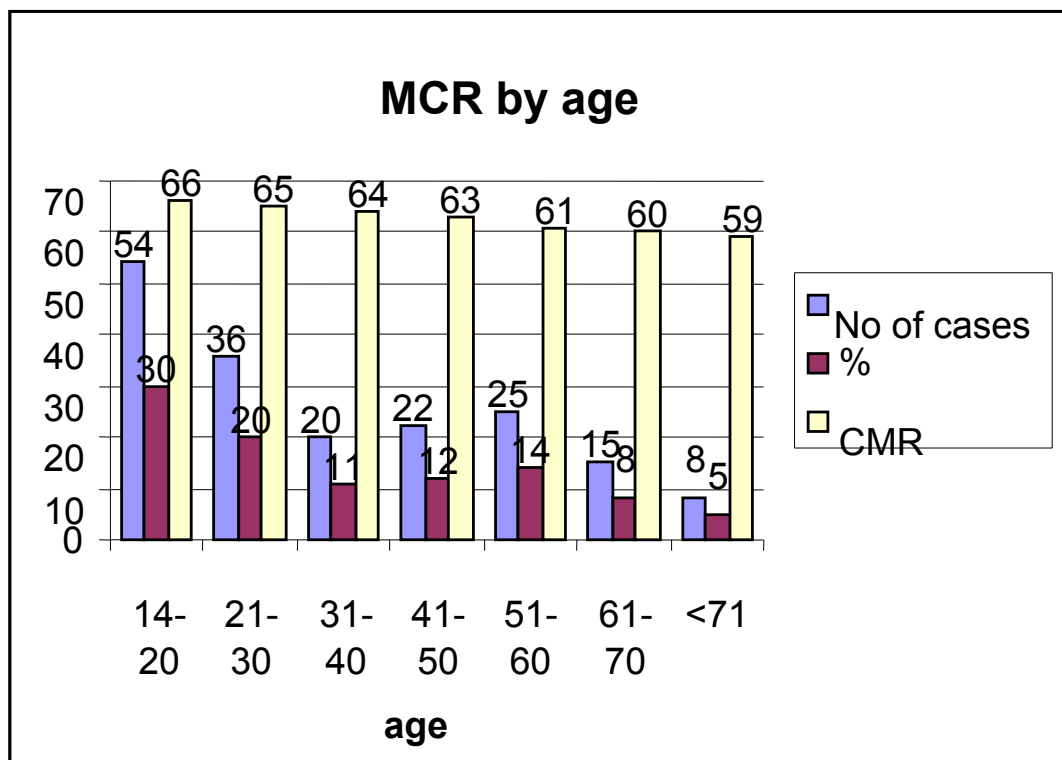
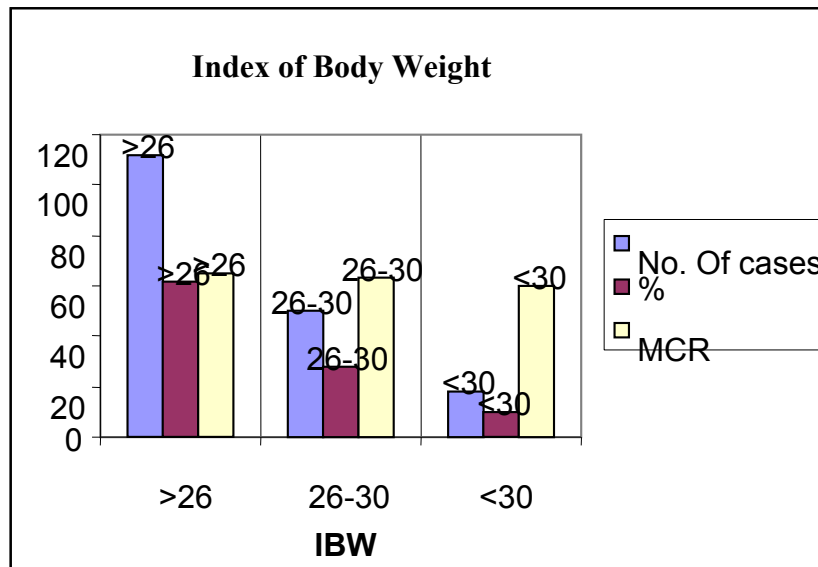


Table 3

The characteristics of the lot and the CMR values in Infrared (=0.85) by the Index of Body Weight

Index of Body Weight	>26	26-30	<30
No. of cases	112	50	18
%	62	28	10
Medium Coefficient of Reflection	65± 2,3	63±2,2	60±2,1

**Table 4**

The characteristics of the lot and the CMR values in Infrared (=0.85) by the Tissue Structure

Tissue Structure	Prevalent dense muscular,	Intermediary alternate	Hydrophilic, lax, adipose
No. of cases	58	72	50
%	32	40	28
Medium Coefficient of Reflection	65± 2,3	63±2,2	60±2,1

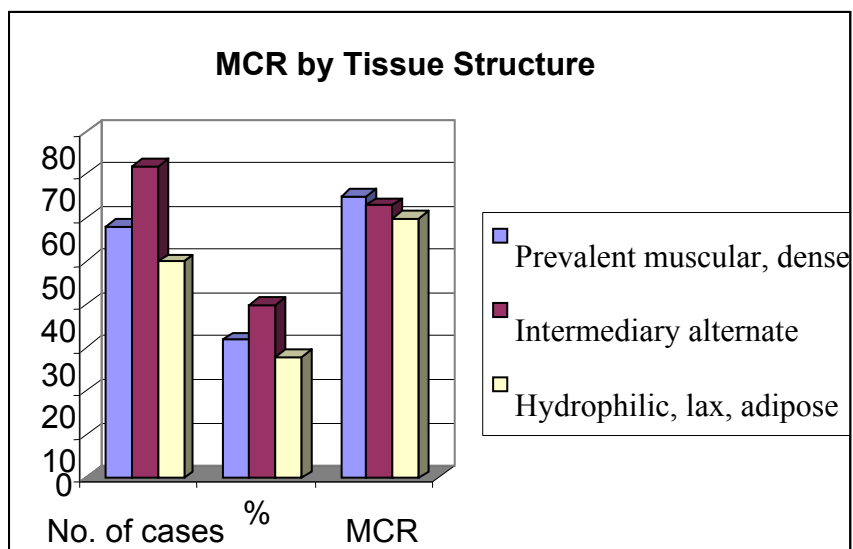
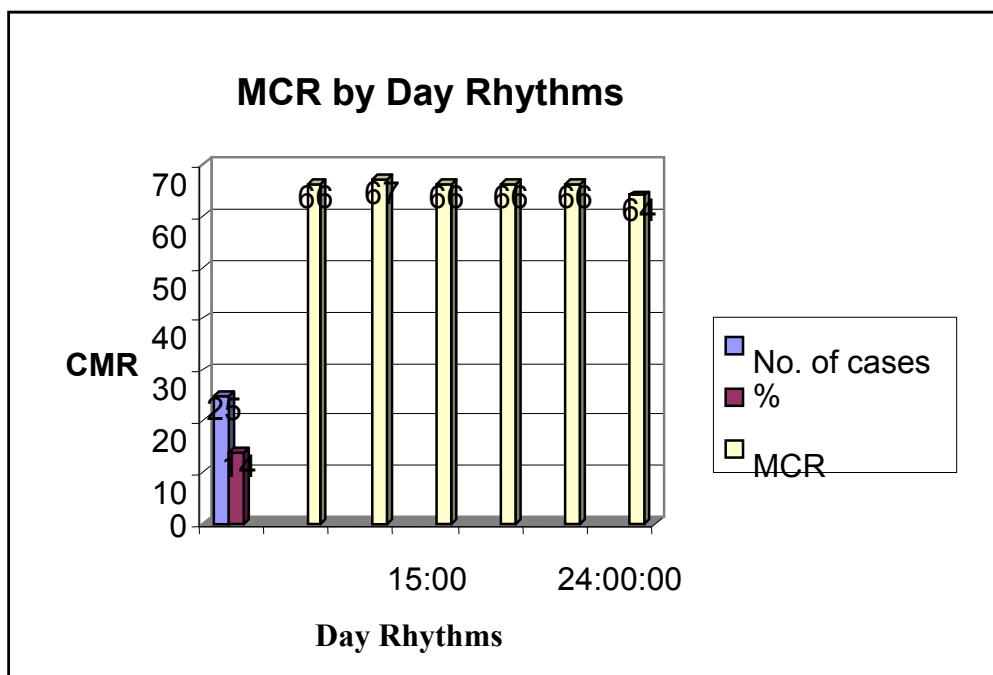


Table 5

The characteristics of the lot and the CMR values in Infrared (=0.85) by Day Rhythms

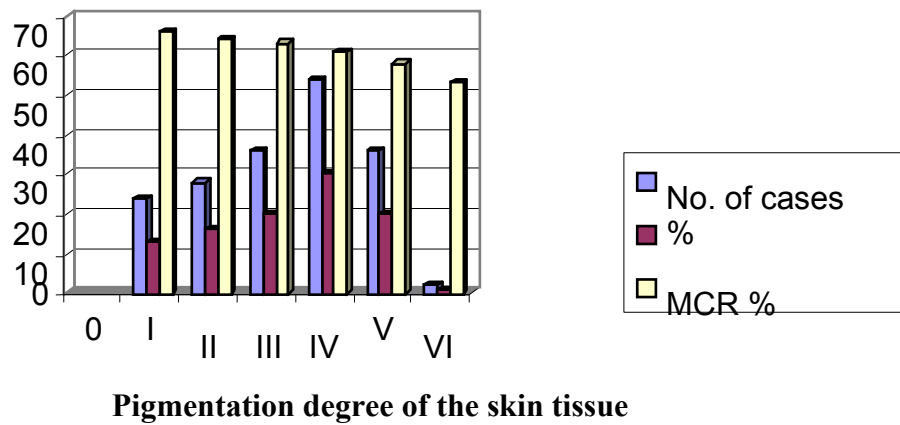
Day Rhythms		9 00	12 00	15 00	18 00	21 00	24 00
No. of cases	25						
%	14						
Medium Coefficient of Reflection			66± 2,9	67± 1,2	66± 1,8	66± 1,1	64± 3,1

**Table 6**

The characteristics of the lot and the CMR values in Infrared (=0.85) by the pigmentation degree of the skin tissue

Pigmentation degree of the skin tissue	0	I	II	III	IV	V	VI
No. of cases	-	24	28	36	54	36	2
%	-	13	16	20	30	20	1
Medium Coefficient of Reflection		66± 2,3	64± 2,0	63± 1,8	61± 2,1	58± 2,1	53± 2,3

MCR by by the pigmentation degree of the skin tissue



Discussions

Statistical procession of the results confers equally accuracy and relativity. Moreover, individual analysis of cases presents great importance in the systematization of the obtained data and the enunciation of the objective conclusions.

Any further comments concerning this matter:

- lot distribution by sex is not relevant. The Medium Coefficient of Reflexion in Infrared (MCR) is the same both for women and men, being obtained not only minimum, but maximum values, also. Individual analysis of the cases has allowed correlation between the obtained data and cause factors: for men minimum values of MCR are more frequently registered, given the abundant body pilosity. On the other hand, The Index of Body Weight has a higher value for women.
- a more accurate analysis of the cases and of MCR has revealed an interesting fact: the reflexion coefficient in infrared is not relevant if the increase of the body weight is caused by obesity (because the lipids are transparent in the infrared spectrum 0,85 – 0,89 mkm), but becomes significant, when the cause is the liquid retention. There have been discovered 14 cases during the study of the lot (with edemas of the inferior members), observing a considerable (gradual) decrease of the MCR in Infrared. As pathological modifications do not represent the object of the study in the present phase, this type of cases are to be analyzed more thoroughly in another study.
- The evaluation of the results by age. Analyzing the obtained data, age-determined variations of MCR IR values (between 59-66± 2,3 mVt, in average 7± 2,3%) have been discovered. Nevertheless, this difference is to be found in the tissue structure: hydrophilic, lax, adipose tissue is more occurente in the case of old people.
- Out of the group of all individual parameters taken into account during this study the pigmentation degree of skin tissue proved itself more significant. The difference between the minimum and maximum value is 13±1,4%.

- Daily fluctuations of the MCR in IR have been studied on a 25 people lot, for which MCR IR has been determined every 3 hours for 5 days. No major variations have been observed, MCR IR being a stable index in time.
- If the average values of MCR IR for the considered lot are $55,7-68 \pm 2,1$ mVt (variations of $12,6-2,1\%$), on the other hand individual variations of the intact tissues of the same organism do not exceed $3 \pm 2,1\%$ and the symmetric parts of the body do not differ significantly.

CONCLUSIONS

1. The MCR IR determined in the intact tissues is an index with average values between $55,7-68 \pm 2,1$ mVt, stable in time
2. The individual variations of the MCR IR for the intact tissues do not exceed $3 \pm 2,1\%$ and are similar to the symmetric parts of the body
3. Individual particularities, which significantly influence the MCR IR are: the pigmentation degree of the skin tissue and the tissue structure (**stroma** density)
4. the MCR IR values determined for intact tissues will be taken as reference point in determination of the MCR IR for pathologically modified tissues (**edem hematom, absces**) in the **next part** of the study.
5. The obtained results allow the use of Laser-**biophotometry** in vivo method in the evaluation and observation of pathological processes accompanied by water-retention in the organism, (differentiation) distinction of the processes concerning fat accumulation (obesity, Metabolic X Syndrome etc)
6. Absorbtion particularities of radiation in Infrared, observed during this study suggest physiotherapeutic factor graduation determined by individual particularities of the organism: the pigmentation degree of the skin tissue and the tissue structure(**stroma** density)

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