



Ultra-Low-Level Laser Stimulation of LU7 Lieque Promotes Breath Functionality: Could it be of help in Covid 19 Rehabilitation? - A Multiple Case Report

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Abstract

The burden of post COVID rehabilitation is and will be a strong concern for healthcare stakeholders. The Traditional Chinese Medicine is suggesting the application of acupuncture as a dependable tool to be inserted in the rehabilitation project. Libralux, an ultra-low-level-laser stimulator has proven its effectiveness as acupuncture stimulator. In this paper we report the respiratory cycle modifications obtained through the stimulation with Libralux of the acupoint LU7 LieQue of three healthy individuals. Modifications were observed instrumentally by means of an innovative high-resolution camera plotting the chest expansion vs. time. The results demonstrate a remarkable increase in respiration depth and in the contemporary reduction of the respiration frequency within 20 minutes from the 20 sec bilateral stimulation of LU7 LieQue acupoint. The worthiness of a specific full double-blind trial is suggested also in view of the marginal contra-indications, the rapid execution and, most of all, the great potential benefit of the inclusion of a laser acupunctural stimulation in the post COVID rehabilitation project.

Keywords: *Acupuncture, Laser-acupuncture, Covid 19 rehabilitation, Respiratory efficiency*

Introduction

COVID 19 pandemics is leaving behind the acute phase a great quantity of functional deficits requiring rehabilitation ^[1,2].

Rather obviously, among the suggestions for rehab, emphasis has been given to several interventions to restore effective respiration. Among them also the application of acupuncture has been suggested.

In previous papers we described the surprising effectiveness of the stimulation of acupoints ^[3,4], by means of a patented specific pulsed laser operating at ultra-low-power/energy, beyond musculoskeletal conditions ^[5] also in specific ophthalmological symptomatology such as amblyopia ^[6] and the eye blood perfusion in Wide Angle Glaucoma ^[7].

Efficacy of this peculiar stimulation has been demonstrated on animal models ^[8-10], and, while trying to understand its action mechanism, on cellular models ^[11,12]. Further studies did suggest a possible action mechanism involving the Extra Cellular soft tissue Matrix (ECM) ^[13-16].

In view of possible application in Covid 19 Rehabilitation we decided to test the effects of the stimulation of the LU7 LieQue Acupoint.

Main purpose of the present paper is the description of the observed effects on breathing performances of healthy subjects using an un-invasive method using a special camera capable of measuring the chest movements during the breath cycle.

Materials and Methods

Volunteers

Three healthy subjects (MV1, MV2, CP) volunteered to be bilaterally treated on the LieQue acupoint with Libralux (Fremslife - Genoa - Italy).

Libralux

The internationally patented device is endowed with the following main characteristics

- Laser emission wavelength 650 nm (visible red emission)
- Peak radiated power 7 mW
- Spot size 10 mm²
- Radiance (Peak) 0.7 mw/mm²
- Total modulation Duty Cycle 0.25%
- Mean radiated power 17.5 uW
- Mean Radiance 1.75 uW/mm²
- Stimulation time 20 sec
- Administered energy 35 uJ per each point
- Administered energy density 3.5 uJ/mm²



Figure 1: Libralux device and its “meridian stimulation selection page”

The emission/application levels are well under the ones that, according to the most credited sources [17], might produce any biological effect. The effectiveness is probably due to the combination of modulations capable of eliciting biological responses travelling along the acupuncture meridians in the ECM /Fascia substrate [18].

Its square wave modulations are obtained by the logical product among:

- A “Carrier” Frequency 100 Hz Duty Cycle 1%
- A “Meridian” Frequencies (12 values 5.5 through 11 Hz) Duty Cycle 50%
- A “Anti-addiction” [19] Frequency 1Hz Duty Cycle 50%

MIRA Camera

The functionality of respiration was measured with MIRA (Hyperspectral Imaging Srl – Bologna – Italy): a digital camera HIS capable to provide affordable solutions to vision recording problems so far solved by expensive solutions. MIRA strongholds are in fact a great image processing performance with extremely low power consumption (batteries/solar cells), small size and a limited cost.

The device can record, process, save images and communicate with remote stations exploiting three main functions:

1. Image acquisition by means of low power consumption CMOS sensors endowed with high sensitivity and resolution over the whole band from the near UV to the near IR but can also use hyper-spectral CMOS sensors;
2. Great Image Processing capabilities thanks to a powerful DSP (Digital Signal Processor) capable of over 800 MIPS and with a 64Mbytes SDRAM work memory and a NAND of 8 GBytes;
3. Utter flexibility in data recording and great computing capabilities to measure micromovements (as needed to process face expressions) or perform more usual tasks as Shape Analysis, Tracking, Dynamic Analysis, Vector analysis, Distance measurements, Vibrational analysis, Delta pixel analysis, Interferometer analysis, Differential biophoton analyser, Polarimetry analysis, etc.

MIRA can collect several frames and quickly compare them pixel by pixel: whenever just a few ADU differences are observed the system amplifies this weak signal through complex algorithms (pyramidal FFT) giving colour to monochrome areas according to a pre-set colour code table: This allows to exponentially amplify the electromagnetic field and the photon flux. The last being un-stable and depending on micro-variations and oscillations of optical field luminance and chrominance that are probably of quantum nature.

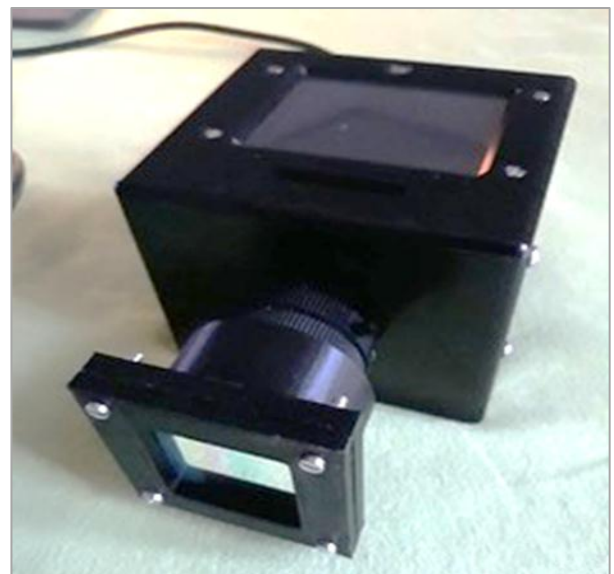


Figure 2: The MIRA camera device

Measurement sequence

For each individual 4 measurements were performed:

- Just before treatment
- 5 min after treatment
- 20 min after treatment
- 60 min after treatment

The acupuncture stimulation

The LU7 LieQue is of great importance in Traditional Chinese Medicine applications [20,21]. It is the Luo opening point of the Ren Mai, the extraordinary Meridian governing all the yin meridians. It can be stimulated to nourish the yin energy of the whole body and lower the symptoms of Kidneys yin deficit in heat or emptiness syndrome [22-24].

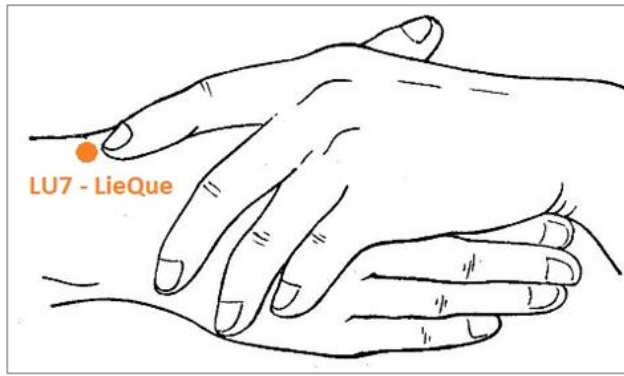


Figure 3: LU7 LieQue

Its stimulation is recommended for externally originated pathologies, acute and in the excess and out-bound movements syndromes. It opens water passages. As so it promotes the descent and the diffusion of Lungs qi with benefits for cough and asthma. It dissolves the Phlegm causing the descent of qi and stimulates the defensive qi (weiqi) circulation. Finally, it frees from the cold wind invasions or of the external Heat-Wind. Due to the all above reasons the stimulation of LieQue is indicated to effectively treat Covid-19 infection. Worth remarking that the Lu9 Taiyuan, a tonification point indicated to treat chronic conditions, is less appropriate and does not open water passages.

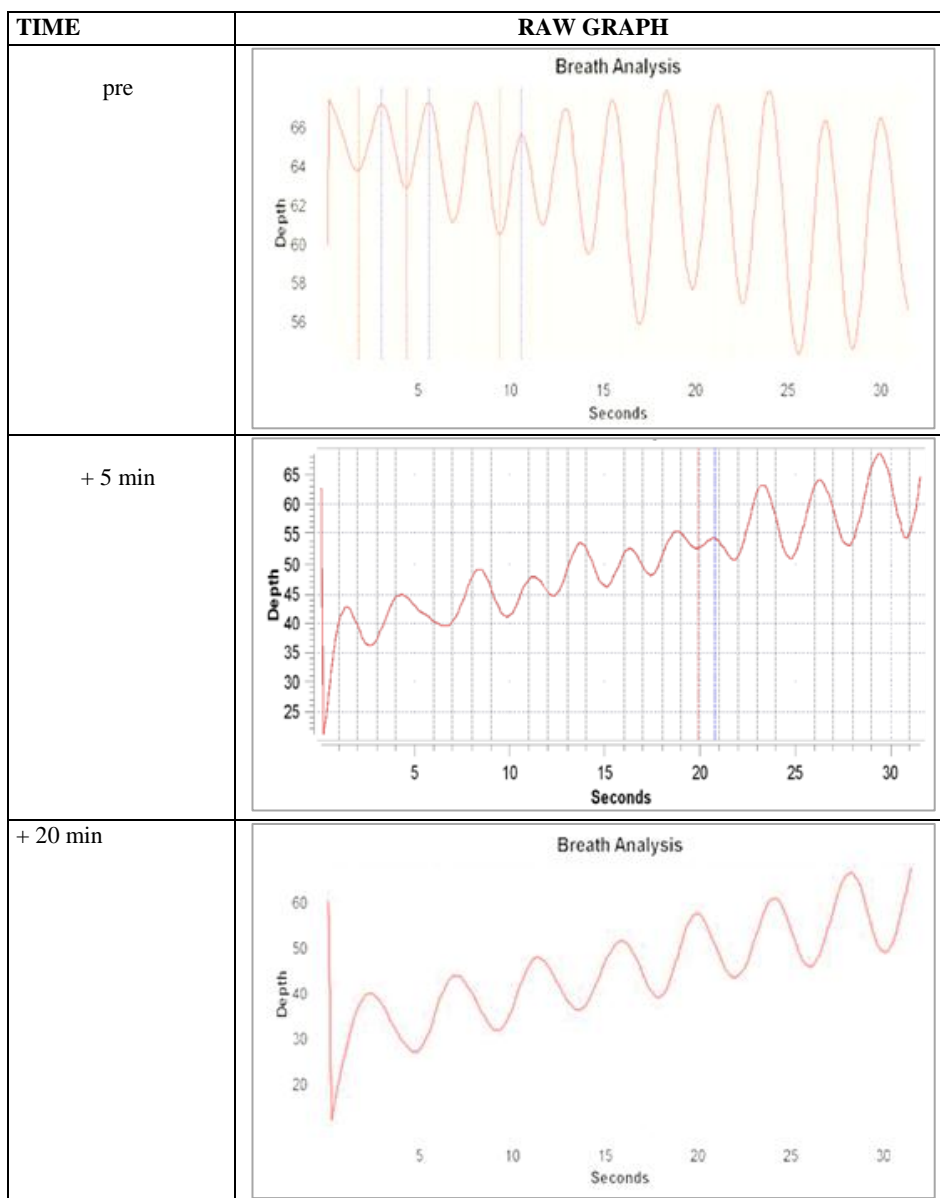
Results

As shown in Figure 4, by the raw graph of the thorax excursion (MV1 Subject) the amplitude grows and the frequency of the respiration decreases. The most relevant effect can be noticed at some 20 minutes after the stimulation.

Worth noticing that breathing anomalies - probably slight spasms demonstrated by the automatic signal analysis (vertical blue and pink interrupted lines) - are much more evident immediately after the stimulation but are disappearing 5 min after treatment. The couples of vertical dotted lines limit the anomaly between its start, shown by the pink line and its stop, shown by the light blue line.

To enhance the visibility of the phenomenon the graphs have been re-drawn in Figure 5 indicating in different colours the four plots on the same time scale.

It is fairly evident both the progressive increase of the breathing depth and the progressive slowdown of the respiratory acts after the treatment. Similar results were obtained on the other two volunteers as shown in the graphs of Figure 6 and in the Table 1.



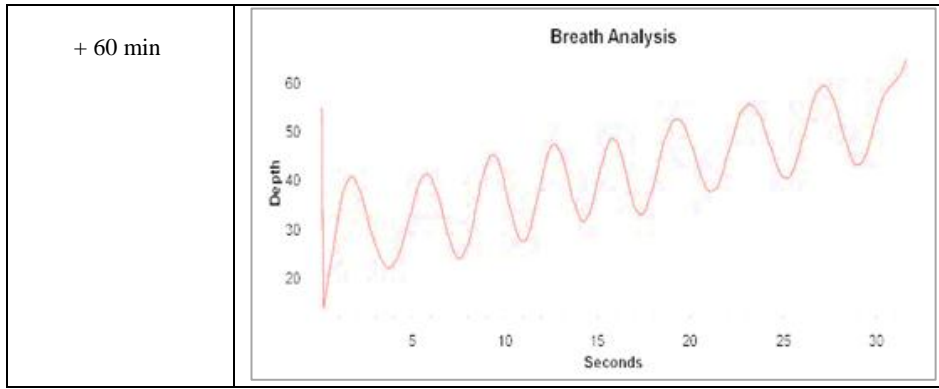


Figure 4: MV1 Raw graphs from the recording device.

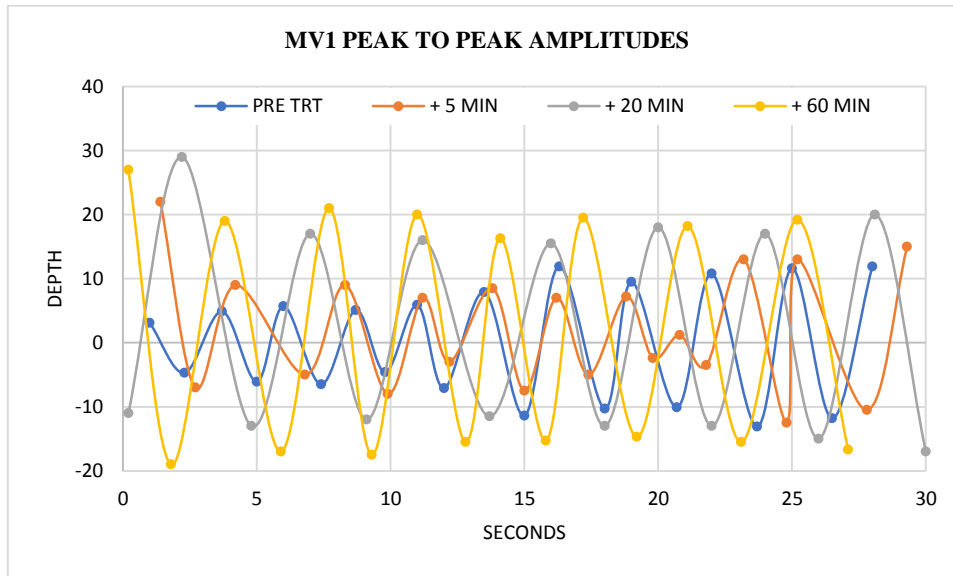


Figure 5: MV1 Peak-to-Peak breathing depth plotted on the same timescale

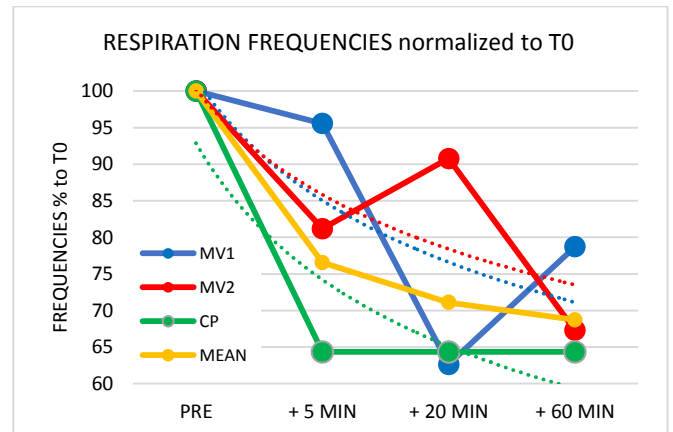
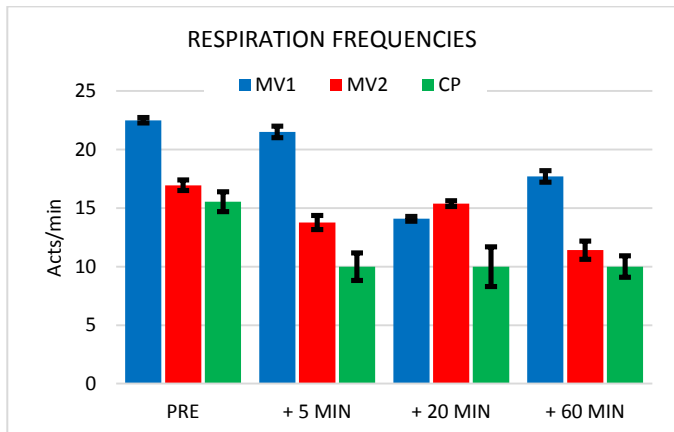
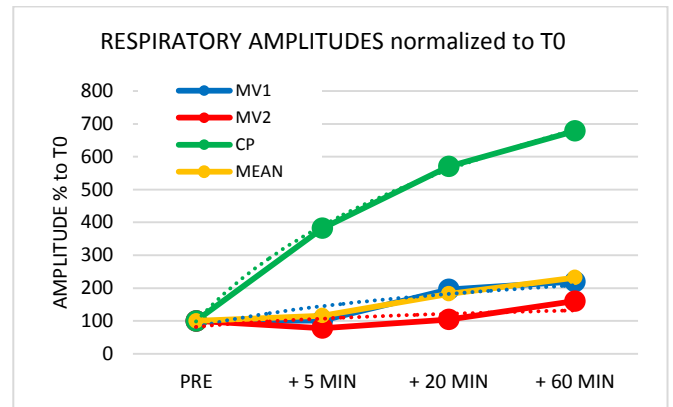
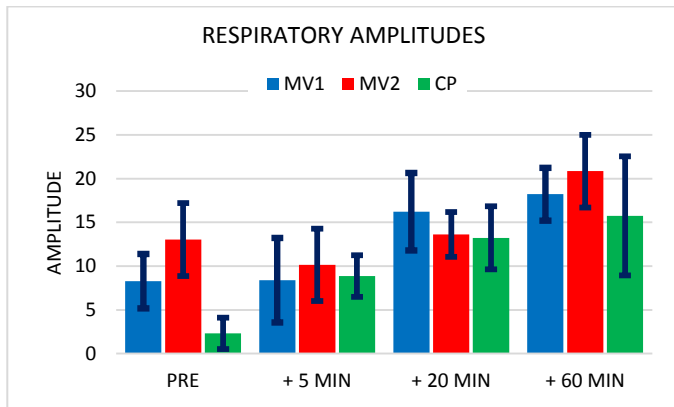


Figure 6: Results main graphs. Error bar on the left side graphs have the $\pm 1\sigma$ value

Table 1: Respiratory performances across the experiment

	AMPLITUDES		INTERVALS		FREQUENCIES
	Mean	Std Dev	Mean	Std Dev	/min
PRE	8,29	3,12	1,33	0,23	22,50
+ 5 MIN	8,40	4,82	1,40	0,49	21,50
+ 20 MIN	16,21	4,44	2,13	0,21	14,09
+ 60 MIN	18,21	3,01	1,69	0,49	17,71

Discussion

It seems to be remarked the great benefit observed in the parameters of the subject CP. The respiration frequency immediately slowed down while the depth of the respiratory act did progressively increase across the experiment. Overall, it should be remarked the rather rapid settlement of the beneficial effect within some 20 minutes from the treatment. Interestingly enough a re-organization phase of the respiratory activity is noticed immediately after the treatment. It can perhaps be a confirmation of the acupunctural effects on autonomic functions.

Conclusion

The test on three healthy subjects was undoubtedly showing a remarkable effect. It seems reasonable that an even greater result would be observed in post Covid rehabilitation. In fact, a recording made with the very same MIRA device on a SARS-2 patient (Figure 7) shows the presence of many respiratory anomalies – mainly spasms - that we have observed to disappear almost immediately after the LU7 LieQue stimulation.

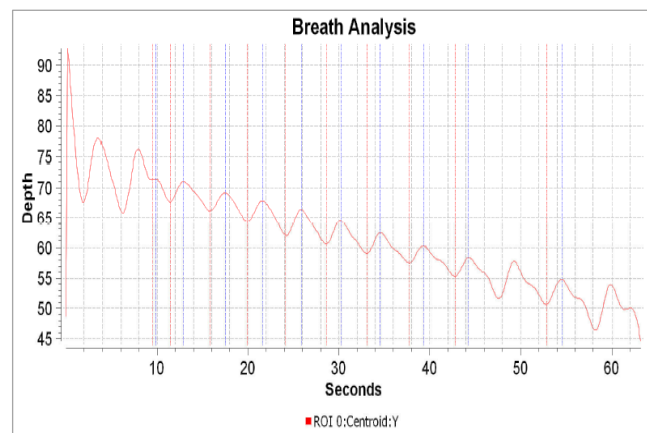


Figure 6: MIRA recorded respiratory activity of a SARS-2 affected patient. Please note the high number of functional respiratory anomalies

This test is somehow contributing a further confirmation of the acupuncture-like effect of Libralux stimulation. How the pulsating tiny flow of 650 nm photons can start stimulation along the Meridian channels is something worth further exploration but it could add some information to scientists studying the physiological action mechanisms of acupuncture [25-29].

Getting back to clinical applications we believe that, taking also into account the almost negligible contra-indications to the kind of stimulation given by Libralux (Patients affected by neoplasia, pregnant women, subjects at risk of epileptic discharges, bearers of implanted electromedical devices of any kind) it could be worth performing a double-blind trial on post Covid-19 patients and on a control group of healthy, age matched, individuals, applying either Libralux or a sham laser stimulation. The

application of the most usual respiratory tests (E.g. Borg scale on exhaustion [30]) that can be performed only in a clinical environment, would certainly provide further elements of evaluation.

On the other hand, expert acupuncturist could suggest a combination with other points such as, for ex-ample, BL 12 Fengmen and/or BL13 Feishu that are both known to be effective in pathologies of the lungs or ST36 Zusanli and LI4 Hegu that are known to be effective in the promotion of muscle relax.

Ethics approval and consent to participate

The three volunteers subscribed their written consent MV, lent and operated the Libralux belonging to Oculistica Viva Eye clinic

Conflicts of Interest

Marzio Vanzini and Daniele Gullà declare the absence of any conflict of interests.

Michele Gallamini is a minority shareholder (<1%) of Fremslife Srl producing Libralux.

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No funding was received

Authors' contributions

MV conceived and executed the experiment supporting MG in the conception of the manuscript. DG assisted as MIRA Camera operator and provided the recordings. MG drafted the manuscript and the figures. All authors read and approved the final manuscript.

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DG, CEO and founder of Hyperspectral Imaging Co lent and operated the Mira device providing its output data.

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