

# Low level light therapy and peripheral facial paralysis: integrating literature review. Laser therapy and Bell palsy

Laserterapia de baixa potência e paralisia facial periférica: revisão integrativa da literatura. Terapia a laser e Paralisia de Bell

Laserterapia de baja potencia y paralisia facial periférica: revisión integral de la literatura. Terapia láser y parálisis de Bell

*Thales Vanderlei\**

*Rafael Nóbrega Bandeira\**

*Marisa Siqueira Brandão Canuto\**

*Giovan Anderson dos Santos Alves\**

## **Abstract**

**Introduction:** Peripheral facial palsy is an orofacial motor disorder that is responsible for bringing negative impacts in different settings in the life of individuals. Among the professionals involved in the treatment, the speech therapist is responsible for the important role of promoting the rehabilitation of the orofacial functions of the individual. Among the several resources that it can use, is the low intensity laser, still little investigated in the scientific literature. **Objective:** review the use and efficacy of low intensity laser as a therapeutic method for peripheral facial paralysis. Methods: (1) formulation of the guiding question of the study “What is the scientific evidence of efficacy of the use of low frequency laser in the treatment of peripheral facial paralysis? “; (2) Definition of descriptors, by DeCS and MeSH, combined through the Boolean operator AND: Low intensity light therapy; Laser therapy; Facial Paralysis

\* Universidade Estadual de Ciências da Saúde de Alagoas, Maceió, AL, Brazil

## **Authors' contributions**

TRVG data collection, tabulation, data analysis and writing of the manuscript; RNB, MSBC e GASA responsible for the study design and general orientation of the stages of execution and elaboration of the manuscript.

**Correspondence e-mail:** Thales Vanderlei - [thalesvanderlei@hotmail.com](mailto:thalesvanderlei@hotmail.com)

**Received:** 01/05/2019

**Accepted:** 20/11/2019

and Bell's Palsy; (3) PubMed and BIREME databases; (4) Delimitation of eligibility criteria and (5) collection and sorting of articles. Selection criteria: Using laser as a therapeutic resource and patients with facial paralysis in their methodology. **Results:** Ten studies enrolled in this revision found positive effects of laser therapy using laser dosages between 4 and 105 J/cm<sup>2</sup> and wavelengths between 670 and 1064 nm in a period between 4 and 20 sessions. **Conclusion:** the effects of low power laser are benefic in patients with peripheral facial paralysis and potencialized when associated with other therapeutic resources of speech therapy.

**Keywords:** Low-level light therapy; Laser therapy; Facial paralysis; Bell palsy; Face.

## Resumo

**Introdução:** A paralisia facial periférica é um distúrbio da motricidade orofacial responsável por trazer impactos negativos em diversos âmbitos na vida dos indivíduos. Entre os profissionais envolvidos no tratamento, o fonoaudiólogo é responsável pelo importante papel de promover a reabilitação das funções orofaciais do indivíduo. Dentre os diversos recursos que este pode utilizar, está o laser de baixa intensidade, ainda pouco investigado na literatura científica. **Objetivo:** realizar uma revisão integrativa da literatura acerca da utilização e o efeito do laser de baixa intensidade como método terapêutico das paralisias faciais periféricas. **Métodos:** (1) formulação da pergunta norteadora do estudo “Qual a evidência científica da eficácia, descrita na literatura científica, do uso do laser de baixa intensidade no tratamento da paralisia facial periférica?”; (2) Definição dos descritores, pelo DeCS e MeSH, combinados através do operador booleano AND: Terapia com luz de baixa intensidade; Terapia a laser; Paralisia facial e Paralisia de Bell; (3) Bases de dados PubMed e BIREME; (4) Delimitação dos critérios elegibilidade e (5) coleta e triagem dos artigos. Critérios de Seleção: Utilizar laser como recurso terapêutico e pacientes com paralisia facial em sua metodologia. **Resultados:** participaram desta revisão 10 artigos que encontraram efeitos positivos da laserterapia utilizando dosagens entre 4 e 105 J/cm<sup>2</sup> e comprimentos de onda entre 670 e 1064 nm em um período entre 4 e 20 sessões. **Conclusão:** os efeitos do laser de baixa potência são benéficos em pacientes acometidos por paralisia facial periférica e potencializam-se quando associados a outros recursos terapêuticos da Fonoaudiologia.

**Palavras-chave:** Terapia com luz de baixa intensidade; Terapia a laser; Paralisia facial, Paralisia de Bell, Face.

## Resumen

**Introducción:** La parálisis facial periférica es un trastorno de la motricidad orofacial responsable de traer impactos negativos en diversos ámbitos en la vida de los individuos. Entre los profesionales involucrados en el tratamiento, el fonoaudiólogo es responsable del importante papel de promover la rehabilitación de las funciones orofaciales del individuo. Entre los diversos recursos que éste puede utilizar, está el láser de baja intensidad, aún poco investigado en la literatura científica. **Objetivo :** realizar una revisión integrativa de la literatura acerca de la utilización y el efecto del láser de baja intensidad como método terapéutico de las parálisis faciales periféricas. **Metodos:** (1) la formulación de la pregunta guía del estudio “¿Cuál es la evidencia científica de su efectividad se describe en la literatura científica, el uso del láser de baja intensidad en el tratamiento de la parálisis facial periférica?”; (2) Definición de los descriptores, por el DeCS y MeSH, combinados a través del operador booleano AND: Terapia con luz de baja intensidad; Terapia láser; Parálisis facial y parálisis de Bell; (3) Bases de datos PubMed y BIREME; (4) Delimitación de los criterios elegibles y (5) recolección y clasificación de los artículos. Criterios de selección: Utilizar láser como recurso terapéutico y pacientes con parálisis facial en su metodología. **Resultados:** Diez estudios incluidos en esta revisión encontraron efectos positivos de la terapia con láser usando dosis de láser entre 4 y 105 J/cm<sup>2</sup> y longitudes de onda entre 670 y 1064 nm en un período de entre 4 y 20 sesiones. **Conclusión:** los efectos del láser de baja potencia son beneficiosos en pacientes con parálisis facial periférica y se potencian cuando se asocian con otros recursos terapéuticos de la terapia del habla.

**Palabras claves:** Terapia por Luz de Baja Intensidad ; Terapia por láser; Parálisis facial, Parálisis de Bell, Cara.

## Introduction

Peripheral facial paralysis (PFP) can be defined as a limitation or absence of muscle mobility on one side of the face due to facial nerve damage secondary to trauma, infections, tumors, toxicity, metabolic diseases, and idiopathic origin, among others<sup>1</sup>.

The musculature of the face has an important relationship with fundamental functions such as chewing, sucking, and swallowing, which may also be altered in these cases<sup>2</sup>. In addition, this musculature plays an essential role in nonverbal communication, allowing the exteriorization of human feelings. Changes in this function may represent a high restriction on the quality of life of these subjects<sup>3</sup>.

Patients affected by PFP may also have effects on psychological aspects. Because they have disorders related to verbal and nonverbal communication, it is possible that these individuals have social limitations and minor psychiatric disorders such as stress, anxiety, and depression<sup>4-5</sup>.

The treatment of peripheral facial paralysis should be performed by a multidisciplinary team involving otorhinolaryngologists, neurologists, psychologists, and speech therapists. The latter are responsible for the structural and functional rehabilitation of the muscles involved in the mimic and expressive movements of the face, functions involved in orofacial motricity and swallowing, which are the speech therapist's areas of activity<sup>6</sup>.

The speech therapy proposals range from guidelines on care during feeding to the use of manual maneuvers that induce the natural movement of the affected musculature, use of isotonic and isometric orofacial exercises to increase the relaxed muscle tone, stimulation of the motor points of the face, work with masticatory function, thermotherapy to increase blood supply to the region, cryotherapy to stimulate facial muscle contraction by reflex arc of the trigeminal nerve with the facial nerve, among others<sup>7-8</sup>.

With the increasingly frequent technological advances, healthcare has been benefiting from the implementation of new therapeutic techniques for the rehabilitation of the most diverse comorbidities<sup>9</sup>. In this context, speech therapy begins to adhere to methods such as surface electromyography, neuromuscular electrostimulation, and the use of low-

level laser, the latter being the most recent method studied by an increasing number of researchers.

Laser is a narrow beam of light originating from a source of electromagnetic radiation. Among other effects, low-level laser can be used to produce adenosine triphosphate (ATP) in cell mitochondria and increase protein synthesis. However, its application to peripheral facial paralysis is related to the effects of axon growth acceleration, myelination, post-injury regeneration, and maintenance of nerve functional activity, which translate into anti-inflammatory and regenerative effects<sup>10-11</sup>.

The use of low-level laser in speech therapy clinical practice is still discreet in Brazil mainly due to the lack of knowledge of professionals in the field, which may be the result of a low number of publications found in the literature on this subject.

Thus, the aim of this study is to perform an integrative literature review about the use and effects of low-level laser as a therapeutic method for peripheral facial paralysis. The results of this study can be used to spread knowledge about this method in clinical practice.

## Methods

This study is an integrative review of the scientific literature based on secondary data on the use of low-level laser as a therapeutic method for the treatment of peripheral facial paralysis. Data collection was performed from October to November 2017. Only studies from the last ten years were considered. It was elaborated based on the following steps: (1) formulation of the guiding question of the study, (2) definition and combination of descriptors, (3) databases for research studies, (4) delimitation of eligibility criteria, and (5) selection of studies.

This study sought to answer the guiding question: "What is the scientific evidence of the use and effects, described in the scientific literature, of low-level laser for the treatment of peripheral facial paralysis?" To select the descriptors used in the search in databases, queries were performed on the platforms Descriptors in Health Sciences (DeCS) and *Medical Subject Headings* (MeSH).

The following descriptors were selected: *Terapia com luz de baixa intensidade*, *Terapia a laser*, *Paralisia facial* and *Paralisia de Bell* in Portuguese and its respective English translations: *Low-level light therapy*, *Laser therapy*, *Facial paralysis* and *Bell's palsy*. The descriptors were combined using

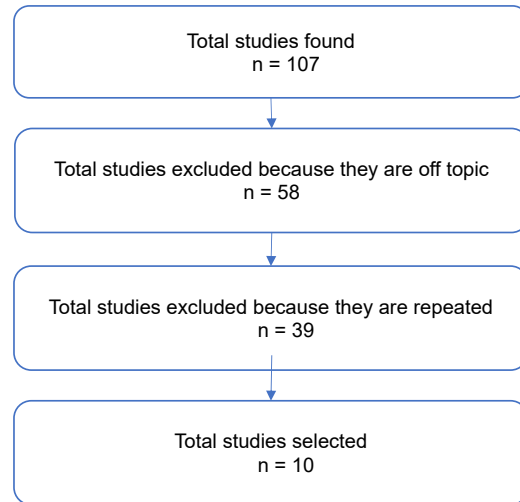
the Boolean operator AND, as follows: Terapia com luz de baixa intensidade AND Paralisia facial; Terapia com luz de baixa intensidade AND Paralisia de Bell; Terapia a laser AND Paralisia facial, and Terapia a laser AND Paralisia de Bell.

Such combinations were also performed in English in the PubMed and BIREME databases. To participate in this review, studies should meet the following eligibility criteria: address the use of low-level laser in the treatment of PFP and answer the guiding question; use laser as a therapeutic resource and patients with facial paralysis in its methodology; published in Portuguese, English or Spanish; full text available on the internet and not a literature review.

In addition to the eligibility criteria, the studies were analyzed and selected based on a form prepared by the author with the following variables: year of publication, study design, sample characteristics, objectives, therapeutic resources used, study results, Laser type, wave type, dosage, wave length, number of sessions, and number of sessions per week.

After inserting the combined descriptors in the chosen databases, reading the titles, abstracts or methodology of the studies and selecting studies based on the eligibility criteria, ten scientific

articles were included in this review, as described in Figure 1.



**Figure 1.** Flowchart of study selection results.

## Results

The methodology of the studies used in the review is described in Chart 1. Chart 2 shows the configuration of laser parameters made in this research.

**Chart 1.** Description of the studies found

Author	Year	Type of study	Sample	Objective	Resources Therapeutic Used	Laser type
ALFAYA et al	2012	Case study	1 individual	Description of the evaluation and intervention in patients with Bell's palsy and DTM.	Orthodontic plates, infrared laser, pharmacotherapy and speech therapy	Low-level laser (HeNe)
MACÍAS-HERNÁNDEZ et al	2012	Randomized clinical trial	21 individuals	Demonstrate the use of laser as an adjunctive treatment for nerve recovery.	Group 1 Laser + speech therapy. Group 2: Speech therapy + placebo laser	Low-level laser
CASTILLO et al	2012	Randomized clinical trial I	69 individuals	Evaluate the effectiveness of the magnetic field and laser compared to the conventional treatment and recovery. No myofunctional treatment.	Control group: conventional therapy; experimental group: Laser, magnetic field, massage, and facial exercises.	Low-level laser
FONTANA et al	2012	Case study	1 child	Observe low-level laser therapy in pediatric Bell's palsy.	Laser, medication	Low-level laser
ALAYAT et al	2013	Case study	51 individuals	Investigate and compare the effects of high-intensity laser therapy (HILT) and low-level laser therapy (LLLT) on the treatment of patients with Bell's palsy.	3 groups: HILT + orofacial exercises, LLLT + orofacial exercises; placebo laser + orofacial exercises.	High-Intensity Laser Therapy(HILT) And low-level laser therapy (LLLT)
FERREIRA et al	2013	Case study	1 individual	Observe the effects of acupuncture, laser and ear acupressure on a child with trismus.	Acupuncture, laser, acupressure.	Low-level laser gallium arsenide semiconductor.
RUBIS et al	2013	Case study	1 individual	Describe treatment of a Bell's palsy patient using LLLT and chiropractic manipulation	Low-level laser, chiropractic manipulation.	Low-level laser
BUCHAIM et al	2014	Randomized clinical trial	42 male mice	Compare two recovery techniques for an injured peripheral nerve: end-to-end epineural suture and fibrin patch; verify whether the use of low-level laser therapy assists in this regeneration process.	Epineural cult, fibrin patch, laser application, surgical procedure.	Aluminum Gallium Arsenide Laser
MONTEIRO et al	2014	Randomized clinical trial	44 members	Develop a therapeutic strategy to achieve an adequate quality of life for patients with Bell's palsy.	Therapeutic intervention, laser, acupuncture.	Low-level laser
ORDAHAN et al	2017	Randomized clinical trial	40 individuals	Evaluate the effects of laser therapy on Bell's palsy	Control group: orofacial exercises. Experimental group: Laser + orofacial exercises.	Low-level laser

**Chart 2.** Description of the laser used in the studies found

Author	Wave type	Dosage	Wavelength	Number of sessions	Number of sessions per week	Results
ALFAYA et al	Infra-red	4 J / in each of the 27 points	795 nm	13	N. R.	Complete reduction of pain, although no complete recovery of mobility.
ALAYAT et al	Infra-red	80 J per session on eight points. (Pulsed)	HILT 1,064 nm LLT830 nm	18	3	The HILT group had a more significant effect than the others did.
BUCHAIM et al	Infra-red	6 J / with 2, for 24 seconds at three points (Continuous)	830 nm	15	3	End-to-end epineural suture showed better results than fibrin patch; low-level laser therapy did not influence the regeneration process.
FERREIRA et al	Infra-red	105 J / cm <sup>2</sup> . 60 s at each point. (Continuous)	780 nm	10	Weekly	Mouth opening from 33.26 to 53.3 mm.
FONTANA et al	Infrared (4 sessions) Red (6 sessions)	17.5 J / cm <sup>2</sup> , 10 s per point. (Continuous)	780 nm/ 660 nm	11	4 per week (first 2) 3 weeks - 3 sessions.	After each session, overall improvement of different facial expressions
ORDAHAN et al	Infra-red	10 J / cm <sup>2</sup> , 8 points. (Continuous)	830 nm	18	3 times per week	Laser therapy has shown to be an effective treatment method for the recovery of Bell's palsy.
RUBIS et al	Infra-red	47.6 J / cm <sup>2</sup> 30 s per point (5)	910 nm	4	-----	Chiropractic and laser can be treatment methods to consider for patients with paralysis.
MACÍAS-HERNÁNDEZ et al	Infra-red and red	20 J / cm <sup>2</sup> (Pulsed)	830 nm 630 nm	15	All consecutive days	Perception of improvement of the patient. Laser group: 98.72%, Control group: 91.41%.
CASTILLO et al	Red	14 J / cm <sup>2</sup> 30 to 60 s progressive (Pulsed)	670 nm	20	5	36% of patients in the experimental group fully recovered facial mobility, compared to 17% in the control group.
MONTEIRO et al	N.R.	3 points, 6 minutes	N.C.	20	Alternate days.	Low-level laser is a noninvasive and effective modality for the treatment of people with facial paralysis.

Legenda :N.C - Não consta

## Discussion

Of the ten articles selected for the review, 50% (n = 5) presented a randomized clinical trial design and had from 21 to 61 subjects <sup>9,12-15</sup>. The other 50% were case studies with an experimental design <sup>16-20</sup>. Most studies were published in English (50%), 30% (n = 3) in Spanish, and 20% (n = 2) in Portuguese.

The interventions proposed to improve the clinical condition of subjects with PFP and evaluate treatment efficacy varied. Only three studies used exclusively myofunctional therapy associated with laser therapy in the experimental group <sup>9,13,16</sup>. Two studies have associated laser therapy with acupuncture <sup>15,18</sup>, two with pharmacotherapy with anti-inflammatory, B-complex vitamin and orthomolecular therapy <sup>17,19</sup>, one with orthodontic plaques <sup>17</sup>, one with chiropractic <sup>20</sup>, one with epi-

neural suture and fibrin patch <sup>12</sup>, and another study associated with magnetic field <sup>14</sup>.

The laser devices most commonly applied in low-level light therapy (LLLT) were Helium-Neon (He-Ne) and gallium aluminum arsenide (GaAlAs), according to the studies analyzed. The exception is the research by Alfaya et al. <sup>17</sup>, who, in addition to LLLT, used high-intensity light therapy.

The yttrium aluminum HILT laser has a longer wavelength (1,064 nm) compared to low-level laser, which ranged from 670 nm to 910 nm. Different wavelengths have a specificity of penetration and consequently different effects on tissues.

The study by Alfaya <sup>17</sup> found that the HILT group associated with orofacial motricity exercises had a more significant myofunctional effect than the others. The recovery was evaluated using scales that assessed the physical and social aspects of patients (chewing, swallowing, communication,



lip mobility, emotional changes, and social integration). The authors suggest future studies conducting electrophysiological analysis to point out the effectiveness of the method due to the scarcity of the subject in the literature.

The wavelength of the laser is also related to the light spectrum of the equipment. 80% (n = 8) of the researches used infrared laser, 10% (n = 1) red laser, and 10% (n = 1) did not describe wavelength. The literature indicates that the infrared laser penetrates deeper regions, being absorbed by the plasma membrane of cells, which justifies its application in PFP<sup>21</sup>. However, two studies<sup>13,19</sup> associated the use of infrared laser with red light with the end of treatment, with good results for increasing collagen and elastin synthesis<sup>21</sup>. The study using the red laser<sup>14</sup> resulted in a total recovery of facial mobility in 36% of the patients, but the laser was associated with a magnetic field, which may have influenced the result.

Dosage, laser contact application time, and irradiated points varied widely between studies. The study<sup>13</sup> points out that there is neither a standard laser dosage nor a single application technique. Therefore, results may vary when using different doses or application techniques.

Regarding laser emission methods, three studies used the pulsatile method<sup>13-14,16</sup>, four the continuous form<sup>9,12,18-19</sup>, and three did not mention the emission method<sup>15,17,20</sup>. The pulsed emission laser has an oscillating output power, which differs from the constant emission<sup>19</sup>. No studies were found evaluating both procedures in separate experimental groups for efficacy evaluation.

Two case studies<sup>17-18</sup> reported an association between PFP and temporomandibular disorders. Speech therapy follow-up in these cases is justified by the limitation of stomatognathic functions, with prescription of exercises and stretching of the orofacial muscles<sup>17</sup>. Such procedures are similar to those used in PFP patients at the sequelae stage. The laser with low-level light was used and a complete reduction in pain was observed, although there was no complete recovery of mobility perhaps because these patients are at the sequelae phase of peripheral facial paralysis.

## Conclusion

It is concluded that laser therapy is a noninvasive modality and benefits the treatment of PFP

as it contributes to the modification of clinical and functional parameters in a short period with better gains when associated with other therapies.

Low-level laser with a wavelength within the infrared light spectrum using the continuous method was the most widely used laser therapy procedure in the studies. There is no agreement in the literature as to the dosage, the time of laser contact application, and the irradiated points for procedures in peripheral facial paralysis.

## References

1. Atolini Junior N, Jorge Junior JJ, Gignon VF, Kitice AT, Prado LSA, Santos VGW. Facial nerve palsy: Incidence of different etiologies in a tertiary ambulatory. *Int. Arch. Otorhinolaryngol.* 2009; 13(2): 167-71.
2. Mory MR, Tessitore A, Pfeilsticker L, Couto Junior EB, Paschoal JR. Mastigação, deglutição e suas adaptações na paralisia facial periférica. *Rev. CEFAC.* 2013; 15(2): 402-10.
3. Santos RMM, Chiari BM, Guedes ZCF. Paralisia facial e qualidade de vida: revisão crítica de literatura no âmbito do trabalho interprofissional. *Rev. CEFAC.* 2016; 18(5): 1230-7.
4. Silva MFF, Cunha MC, Lazarini PR, Fouquet ML. Conteúdos psíquicos e efeitos sociais associados à paralisia facial periférica: abordagem fonoaudiológica. *Arq. Int. Otorrinolaringol.* 2011; 15(4): 450-60.
5. Silva MFF, Guedes ZCF, Cunha MC. Aspectos psicossociais associados à paralisia facial periférica na fase sequelae: estudo de caso clínico. *Rev. CEFAC.* 2013; 15(4): 1025-31.
6. Miranda VHM, Scarpel RD, Torres ACM, Agra IMG. Efetividade da fonoterapia em pacientes com paralisia facial pós-parotidectomia. *Rev. CEFAC.* 2015; 17(3): 984-95.
7. Tessitore A, Pfeilsticker LN, Paschoal JR. Aspectos neurofisiológicos da musculatura facial visando a reabilitação na paralisia facial. *Rev. CEFAC.* 2008; 10(1): 68-75.
8. Magalhães Junior HV. Fonoterapia na paralisia facial periférica: Uma abordagem miofuncional orofacial. *Rev. Bras. Promoç. Saúde.* 2009; 22(4): 259-63.
9. Ordahan B, Karahan AY. Role of low-level laser therapy added to facial expression exercises in patients with idiopathic facial (Bell's) palsy. Springer-Verlag London. Konya. 2017; 32(4): 931-6.
10. Rochkind S, Drory V, Alon M, Nissan M, Ouaknine GE. Laser phototherapy (780nm), a new modality in treatment of long-term incomplete peripheral nerve injury: a randomized double-blind placebo-controlled study. *Photomed Laser Surg.* 2007; 25(1): 436-42.
11. Rochkind S. Phototherapy in peripheral nerve regeneration: from basic science to clinical study. *Neurosurg Focus.* 2009; 26(8): 1-6.
12. Buchaim DV. Reparo do nervo facial com sutura epineural térmico-terminal e coaptação com adesivo de fibrina em ratos associado ou não a laserterapia. [Tese de doutorado]. Bauru: Universidade de São Paulo- Faculdade de Odontologia de Bauru; 2014.



13. Macías-Hernández SI, Lomelí-Rivas A, Baños T, Flores J, Sanches M, Miranda-Duarte A. Efectos del láser de baja potencia en el tratamiento de la parálisis facial periférica aguda. *Rehabilitación*. 2012; 46(3): 87-192.
14. Delgado MC, Sánchez del Rio M, Díaz AJG, Winter GP, Aguilera IG. Tratamiento combinado de campo magnético, láser, masaje y ejercicio en la parálisis facial periférica idiopática. *Elsevier España*. 2012; 34(3) :99-104.
15. Montero TF, Zayas MSH, andino IRC, Correoso VC. Evaluación clínica y funcional de pacientes con parálisis de Bell tratados con láser. *medisan*. 2015; 19(12): 1459 - 65.
16. Alayat MMS, Elsodany AM. Efficacy of high and low level laser therapy in the treatment of Bell's palsy: A randomized double blind placebo controlled trial. *Lasers Med Sci*. 2014; 29:335-42.
17. Alfaya TA, Nivoloni TP, Castro DE, Uemoto L, Barcelos R, Gouvêa CVD. Associação entre paralisia facial de Bell e disfunção temporomandibular: manejo clínico. *RFO UPF*. 2012; 17(2): 222-7.
18. Ferreira DCA, De Rossi A, Torres CP, Galo R, Paula-Silva FWG, Queiroz AM. Effect of laser acupuncture and auricular acupressure in a child with trismus as a sequela of medulloblastoma. *Acupunct Med* 2014; 32: 190-3.
19. Fontana RC, Bagnato VS. Low-Level Laser Therapy in Pediatric Bell's Palsy: Case Report in a 3-Year Old Child. *The Journal of Alternative and Complementary Medicine*. 2012; 18(0): 1-7.
20. Rubis LM. Chiropractic management of Bell's palsy with low level laser and manipulation: a case report. *J Chiropr Med*. 2013; 12(4): 288-91.
21. Barbosa RI, Marcolino AM, de Jesus Guirro RR, Mazzer N, Barbieri CH, de Cássia Registro FM. Comparative effects of wavelengths of low-power laser in regeneration of sciatic nerve in rats following crushing lesion. *Lasers Med Sc*. 2010; 25(3): 423-30.

