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Case Report

Concomitant use of autologous exosomes and Nd:YAG laser in post-reconstructive treatment of Bell's palsy: A case report

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ABSTRACT

Background: Bell's palsy is the most common paralysis of the seventh cranial nerve. Recently, regenerative procedures have been proven to improve facial nerve function, reduce neuronal damage, enhance natural healing potential, and improve muscle function. Among these procedures, exosomes can be used as an effective regenerative therapeutic tool. This case presents a 49-year-old woman diagnosed with Bell's palsy grade IV with a ten-year history of left-side facial dysmorphia after facial nerve neuralgia and failed treatments.

Methods: The patient was treated with a combination of injected autologous exosomes released from preconditioned platelet-rich plasma (PRP) with the MCT System and Nd:YAG laser pulses. The treatment included three sessions, three months in between, and a follow-up visit one year after the first treatment (three months after the third treatment).

Results: The patient showed significant facial improvement one year after the first treatment. The paralysis degree, according to the House-Brackmann facial nerve grading scale, varied from stage IV to stage II. Changes observed were an increase in facial muscle strength, an improvement in eye closure, and an increase in smile symmetry.

Conclusions: The protocol applied, combining injected preconditioned autologous platelet-rich plasma and Nd:YAG pulses, was safe

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and well tolerated, and the results showed significant restoration of facial appearance and resolution of Bell's palsy symptoms.

Introduction

Bell's palsy is the most common idiopathic and unilateral paralysis of the seventh cranial nerve. Bell's palsy is usually transient due to a trauma or an inflammation of the seventh cranial nerve or facial nerve. However, in some cases, it becomes a long-term paresis leading to facial dysmorphia.[1]

In the early stages, steroid or antiviral therapy may improve symptoms. In severe cases, nerve decompression and plastic surgery procedures are used.[2] Sometimes, signs of paralysis persist, so developing effective regenerative therapies is a priority.[1] Regenerative procedures aim to improve facial nerve function, reduce neuronal damage, enhance natural healing potential, and improve muscle function. Exosomes can regenerate tendons, skeletal muscles, and peripheral nerves, promoting myogenesis, increasing tenocyte differentiation, enhancing neurite outgrowth, and Schwann cell proliferation.[3]

Based on the regenerative properties of exosomes and lasers, the case reported was treated with injected autologous exosomes released from preconditioned platelet-rich plasma (PRP) and Nd:YAG laser pulses combination.

Case presentation

This case presents a 49-year-old woman with a ten-year history of left-side facial dysmorphia diagnosed as Bell's palsy grade IV after facial nerve neuralgia with failed treatments. The patient presented facial muscle disfiguring weakness, inability to lift the left eyebrow with incomplete eye closure and mouth corner asymmetry, and severe muscle synkinesis. The treatment started three years after face paralysis and a failed restorative surgery. The treatment included three sessions with injected autologous exosomes combined with Nd:YAG laser pulses.

Previous treatments

During the acute phase of facial nerve inflammation, when free radicals, oxidative stress, tissue destruction, apoptosis, and accumulation of inflammatory response rise, the patient was under vitamin B supplementation and a short course of higher doses of oral corticosteroid therapy (Prednisolone) without significant improvement of paralysis signs or deepening of paresis (Figure 1a). The patient did not receive additional laser light or physical therapies. Two years later, the patient underwent surgical treatment to tighten the muscles from the paresis facial side through the transposition of the temporalis muscle and to form a new nasolabial fold underlying the projection of the surgical nasolabial scar (Figure 1b). The results were not satisfactory, and the signs of paralysis persisted (Figure 1c).

Treatment procedures

After surgery, since the desired results were not obtained, the patient was treated concomitantly with two regenerative procedures, performed in the same treatment session, including subdermal injections of autologous exosomes released from preconditioned PRP and superlong neodymium: yttrium-aluminum-garnet (Nd:YAG) laser pulses. The treatment included three sessions, three months in between, and a follow-up visit one year after the first treatment (three months after the third treatment). The variations in severity were assessed using the House-Brackmann facial nerve grading scale.[4]

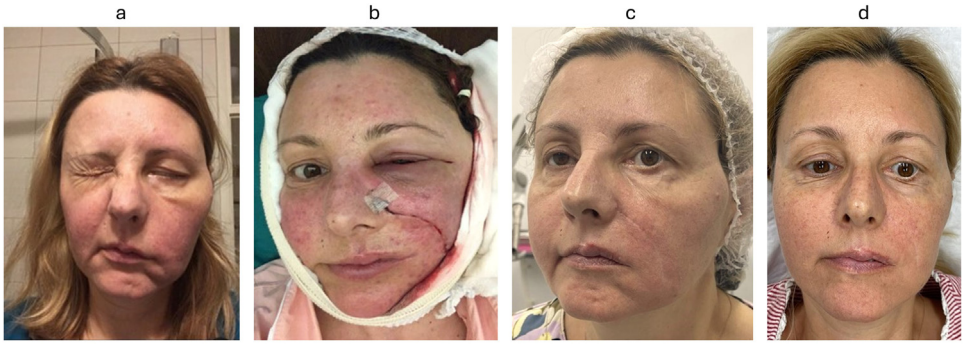

Figure 1. a) Patient in the acute phase of Bell's palsy; b) After reconstructive surgery; c) At day 0, before the first treatment session; d) One year after the first treatment session with MCT Exosomes and Nd:YAG pulses.

- *Treatment with autologous exosomes*

The autologous exosomes were obtained from preconditioned PRP with photothermal biomodulation (PTBM) through the MCT System® (Meta Cell Technology®, Sant Cugat, Spain). MCT is a novel device with specific presets that employs different energy, wavelength, and time combinations for priming platelets and promoting the release of platelet-derived exosomes (from now on, "MCT Exosomes"). The system includes the MCT Unit® and the MCT Kit®, a disposable medical device classified as class IIa.

Eight mL of peripheral blood was collected from each patient using a 10 mL Luer-lock syringe (Nipro, Bridgewater, US) and placed in one 9 mL citrated DPRP PlasmoLifting tube (PlasmoLifting, Berlin, Germany). The tube was centrifuged at 3200 rpm for five minutes with a DLAB DM0408 centrifuge (DLAB Scientific Co., Ltd, Beijing, China), yielding approximately 4 mL of PRP for each treatment session. Following the manufacturer's instructions, 2 mL of PRP was transferred into a sterile, single-use MCT Kit® and inserted into the MCT Unit®. This action was done twice per treatment session. The Exosomes preset was selected to precondition the platelets and promote exosome release. In this mode, the sample was exposed for 10 min to a light intensity of 2 J/cm^2 (wavelength of 467 nm) and a temperature of 37 °C.

Before MCT Exosomes administration, the skin was cleansed with Octenisept® (Schülke & Mayr GmbH, Norderstedt, Germany. MCT Exosomes were administered deep intradermal and subdermal, below the scar, with a 30G x 1/2'' needle at intervals of 8–10 mm and an approximate inclination angle of 15°, 45 for the scarring area, along the left side, between the zygomatic arch and the mandibula. A 0.05–0.10 mL of MCT Exosomes was administered in each puncture. Each treatment session lasted approximately five minutes.

- *Nd:YAG laser protocol*

The laser device employed for the treatment was a solid-state free-running-pulse 1064 nm Nd:YAG (Dynamis SP, manufactured by Fotona; Ljubljana, Slovenia) laser with a power of 80W/35W and an energy of 50J. Each Nd:YAG procedure was performed with a laser spot diameter of 9 mm and a pulse fluence of 90 J/cm^2 for 10 min of irradiation along the left side of the face, with circular irradiation movements on the marked area.

Treatment outcomes and safety

One year after the first treatment (one hundred and twenty days after the last treatment session), the patient showed significant facial improvement (Figure 1d). The degree of paralysis, according to the House-Brackmann facial nerve grading scale, varied from stage IV to stage II. The changes observed were an increase in facial muscle strength with only slight remanent weakness, almost complete eye closure, and an almost symmetric smile with barely noticeable synkinesis.

The treatment was well-tolerated. No complications or adverse effects were reported from the exosome or laser treatments—only post-treatment expected transitory side effects associated with fractional laser treatment, as erythema associated with non-ablative laser heating. After the first two sessions, the patient felt enhanced laxity in the buccal area, spontaneously resolved two weeks later.

Discussion

Exosomes released by PRP help to stimulate fibroblast proliferation and collagen deposition.[5] PRP preconditioned with PTBM promotes regeneration and increases the release of exosomes from platelets. Nd:YAG laser 1064 nm wavelength causes mild vasodilation, enhancing the uptake of exosomes and their distribution within tissues, and could increase collagen production, prevent degradation, and activate the Erk1/2 and JNK-MAPK pathways.[6] The treatment does not lead to redness or prolonged erythema, and the tissue effects of both techniques encompass anti-inflammatory and biomodulatory properties with a robust anti-inflammatory response.

This case showed an evident recovery in facial appearance, including an almost complete eye closure and increased facial muscle strength. The treatment was well-tolerated without technical complications or side effects. Preclinical studies have evidenced that PRP promotes facial nerve regeneration.[7] A Systematic review suggested that laser therapy can effectively improve facial nerve function and reduce the severity of symptoms in patients with facial palsy.[8] Other studies with regenerative therapies for Bell's palsy included uncultured umbilical cord-derived mesenchymal stem cells (MSC)[9] or allogenic extracellular vesicles derived from bone marrow MSCs[10] with favorable recoveries.

Case limitations included the absence of a control group or similar studies to compare our results, which limited the case robustness, as this could be the first case combining two complementary techniques with regenerative purposes for Bell's palsy treatment.

Conclusion

This case could be the first to combine two regenerative procedures, injected preconditioned autologous PRP and Nd:YAG pulses, to treat Bell's palsy. The protocol was well tolerated, significantly restoring the patient's facial appearance and reducing Bell's palsy symptoms.

Statement for patient consent

The author obtained written consent from the patient for her photographs and medical information to be published in print and online with the understanding that this information may be publicly available. The patient consent form was not provided to the journal but is retained by the author.

Ethical approval

The patient was treated according to the Declaration of Helsinki and Good Clinical Practice, and she consented prior to any procedure. An Institutional Review Board did not review the case.

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Declaration of competing interest

J.K. declares that Meta Cell Technology S.L. paid the article processing charges, but she did not receive any personal fees for conducting the study.

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