Effect of neural-induced mesenchymal stem cells and platelet rich plasma on facial nerve regeneration in an acute nerve injury model

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ABSTRACT

The facial nerve plays an important role in various functions, to the facial nerve in conjunction, functional, aesthetic, and psychological problems for the patient. Despite advancements in understanding of the surgical management of facial nerve injuries, functional recovery is often poor, especially after a complete transection. This study evaluated the effectiveness of neural-induced human MSCs and platelet rich plasma (PRP) in the functional recovery of the facial nerve following acute injury as an experimental animal model. Based on the histologic evaluation, the presence of regular and circular nerve fibers was observed in all groups. The control group was the slowest group to demonstrate favorable outcomes; however, the remaining groups showed a significant improvement in nerve regeneration. This study provides evidence for the usefulness of PRP and MSCs on axonal regeneration from a facial nerve axotomy injury in a guinea pig model.

INTRODUCTION

The facial nerve plays an important role in various functions, to the facial nerve in conjunction, functional, aesthetic, and psychological problems for the patient. Despite advancements in understanding of the surgical management of facial nerve injuries, functional recovery is often poor, especially after a complete transection. This study evaluated the effectiveness of neural-induced human MSCs and platelet rich plasma (PRP) in the functional recovery of the facial nerve following acute injury as an experimental animal model. Based on the histologic evaluation, the presence of regular and circular nerve fibers was observed in all groups. The control group was the slowest group to demonstrate favorable outcomes; however, the remaining groups showed a significant improvement in nerve regeneration. This study provides evidence for the usefulness of PRP and MSCs on axonal regeneration from a facial nerve axotomy injury in a guinea pig model.

RESULTS

Fig. 1. The anatomy of the right facial nerve in a guinea pig.

Subjects and Methods

Animals

Four female guinea pigs, weighing 250–350 g, were used in the present study. Animal care complied with institutional guidelines.

Experimental Methods (Fig. 1.)

The animals were randomly divided into 4 groups of 6 animals each, as follows: group I, 2 peripheral 10-0 microsuture only; group II, 2 peripheral 10-0 microsuture with PRP (group II), and group III, 2 peripheral 10-0 microsuture with neural-induced human MSCs (1 x 10^6 cells in 5 μl) application; group II, 2 peripheral 10-0 microsuture with PRP (group II) and neural-induced human MSCs (1 x 10^6 cells in 5 μl) application.

Electrophysiological evaluation

Three weeks later, there were significantly better performance in groups II and III compared with group I in the amplitude (p<0.05) and there was a significant better performance in groups II, III, and IV when compared with group I in the excitation area of the MAP (p<0.05). Thus, there was a significantly better performance in groups II, III, and IV when compared with group I in the amplitude and the excitation area of the MAP (p<0.05); group IV had the best performance (Fig. 3).

Fig. 2. Vibration and eye closure movement after touching the cornea.

CONCLUSIONS

In the present study, we observed markedly increased expression of neurotrophic factors, including NGF, BDNF, GDNF, and NT-3, which have been reported to support cell survival, axonal regeneration, and nerve sprouting. All 3 groups showed a significant increase in NT-3 protein expression. In the functional evaluation, PRP and MSCs had a significant beneficial effect and there was a trend to the control group 4 weeks after surgery (p<0.05).

In the histological evaluation, immunohistochemical staining and histochemical analysis revealed that group IV had similar results to those described in previous studies. The results of this study indicate that PRP and MSCs may be useful for the treatment of peripheral nerve injuries, and that other methods of nerve repair should be considered in the future.

Fig. 3. Histological appearance of the facial nerve stained with toluidine blue in each group 6 weeks after surgery.

REFERENCES


