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Regenerative Peripheral Nerve Interfaces (RPNIs) in animal models and their applications: a systematic review

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Abstract-

Regenerative Peripheral Nerve Interfaces (RPNIs) encompass neurotized muscle grafts employed for the purpose of amplifying peripheral nerve electrical signaling. The aim of this investigation was to undertake an analysis of the extant literature concerning animal models utilized in the context of RPNIs. A systematic review of the literature of RPNI techniques in animal models was performed in line with the PRISMA statement using the MEDLINE/PubMed and Embase databases from January 1970 to September 2023. Within the compilation of one hundred and four articles employing the RPNI technique, a subset of thirty-five were conducted using animal models across six distinct institutions. The majority (91%) of these studies were performed on murine models, while the remaining (9%) were conducted employing macaque models. The most frequently employed anatomical components in the construction of the RPNIs were the common peroneal nerve and the extensor digitorum longus (EDL) muscle. Through various histological techniques, robust neoangiogenesis and axonal regeneration were evidenced. Functionally, the RPNIs demonstrated the capability to discern, record, and amplify action potentials, a competence that exhibited commendable long-term stability. Different RPNI animal models have been replicated across different studies. Histological, neurophysiological, and functional analyses are summarized to be used in future studies.

Index Terms- Regenerative Peripheral Nerve Interfaces (RPNIs); animal models; Inlay-RPNI; Burrito-RPNI; neuroma prevention; myoelectric prostheses; systematic review

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