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Rehabilitation in the Management of People with Persistent Peripheral Facial Paralysis

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Abstract

Objective: Assess the methodological quality of articles treating persistent facial palsy (FP) thanks to Cochrane tools assessment and a critical mind. To position ourselves on the relevance of physiotherapeutic care for people with persistent peripheral facial palsy, describe this care.

Recent findings: Peripheral FP has a high incidence and a strong impact on the quality of life of those affected. Numerous studies of low methodological quality have allowed reviews to be carried out in an attempt to justify physiotherapy management. The clustering of studies with individuals who had peripheral FP for more than 3 months and who have received physiotherapy intervention has not yet been carried out.

Data sources: A literature search was performed in PubMed and Google Scholar using all the declinations found for the terms "sequelae" and "a peripheral facial paralysis" or "bell's palsy" and "physiotherapy" owing to keywords, MeSH Terms and HeTOP terms.

Results: The 160 studies selected, 25 were analysed. The majority of the studies have serious suspicions of bias (13 of the 25 retained), 7 have a critical risk, 4 a moderate and only one low. Other methodological problems were found. Studies tend to show an improvement in intra-group markers in pre- and post-physiotherapy.

Conclusion: There is a correlation between the completion of physiotherapy and improvement in markers of persistent FP. Physiotherapy may be effective in persistent facial paralysis, but the quality of the studies prevents us from making a judgment on causality.

Keywords: Physiotherapy; Facial nerve; Rehabilitation; Facial exercises; Facial paralysis; Facial nerve injuries

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Introduction

Persistent facial paralysis

Any facial paralysis that started more than three months ago, with a functional or aesthetic recovery that does not satisfy the person, or with visible sequelae such as hemispasms, syncinesis, myokimia, crocodile tear syndrome or asymmetry of the face, at rest or during movement. Thus, we include in this definition: paralysis that has not recovered spontaneously (between 3 months and 2 years) and paralysis with an uncertain prognosis of recovery via a decrease in the regenerative potential of the facial nerve (> 2 years).

BP has an incidence reported by studies ranging from 11 to 53 cases per 100,000 people per year [1,2]. FP from all causes is often estimated to be around 50 cases per 100,000 people per year; however, we often find the proportion of 70-80% of FPs out of the total number of FPs [3]. Between 9% and 20% have after-effects [4,5]. Facial paralysis is a pathology that seriously reduces the quality of life, on the one hand because of the dysfunctions, and on the other hand because of the alteration of social relations [6]. The management of this pathology is therefore a public health problem. Several treatments are possible, they are not

all equivalent in terms of cost and adverse effects, the balance seems to tip in favor of physiotherapy: this method of non-invasive treatment also has the advantage of providing follow-up of individuals and individualized management. Numerous studies of low methodological quality have allowed reviews to be carried out in an attempt to justify physiotherapy management. The clustering of studies with persistent FP has not yet been carried out. These observations lead us to a central question:

How do the studies on maxillofacial rehabilitation in the management of people with persistent peripheral facial paralysis support its relevance or not?

The answer to this question will then allow us to determine: What is the role of maxillofacial rehabilitation in the management of people with persistent peripheral FP? That's why we will analyze studies in people with persistent peripheral FP who have received physiotherapy, ideally compared to people who have not, and assess the results of FP markers.

Literature Search

Protocol

The detailed protocol can be consulted in our study paper "Place of maxillofacial rehabilitation in the management of people with persistent peripheral facial paralysis: review of the literature" 2021

1. **Eligibility criteria:** Explained in **Table 1.**
2. **Sources of information**

A search was performed in the following databases: PubMed and Google Scholar using all the declinations found for the terms "sequelae" and "a peripheral facial paralysis" or "bell's palsy" and "physiotherapy". Declinations were found via keywords, MeSH Terms and HeTOP term. We also went through the bibliographies of the included studies, and an author sent us a complementary study **(Figure 1).**

Results and Discussion

Methodological quality

Numerous studies are in favor of physiotherapy in cases of persistent facial paralysis. The authors almost always report an improvement in FP markers in pre- and post-physiotherapy. We see that the methodological quality of the studies does not make it possible to define a causal link between the practice of rehabilitation and the improvement of the condition of the individuals. However, the studies reviewed allow us to affirm a correlation between physiotherapy practice and improvement in FP markers **(Tables 2 and 3).**

The discussion will allow us to present the different rehabilitation techniques found. Thus, we will be able to compare the studies that followed the same treatment method, in view of the results and the methodological analysis. This will allow clinicians to learn how to treat persistent FP, while being aware of the quality of the studies.

Mime therapy is investigated by the 4 reports of the same study by Beurskens et al. This re-education technique seems to have globally proved its value with a strong effect on the short term and also on the long term, after about ten sessions. When we look at the stability of the benefits, the emphasis is on the importance of automation. Indeed, the treated person must first have understood, then learned, then automated the emotional exercises in social situations. The role of the environment (of repeated stimulation) is therefore a determining factor in the success of the therapy. The study by Beurskens et al. [5] reports the same information with an increase of at least 2 grades of HB for 26% of the people, 68% of one grade, 6% without change and no person having deteriorated it with an intra-group comparison.

Gelder's study with the intra-group comparison by t-matched test informs us of no improvement with $p<0.05$ on facial symmetry and personal judgement, but improvements with $p<0.01$ when judges assessed facial symmetry. This study is part of a corpus that found positive results on the same people with different judging criteria.

What's Mime therapy?

It includes education, self-massages, relaxation and breathing exercises, coordination, inhibition of syncinesis, exercises in expressing emotions, closing of lips, eyes and pronunciation of letters and words. The BFB of a mirror is used at the beginning of therapy, then gradually abandoned in favour of internal sensations. Approximately 10 sessions of 45 minutes, once a week or less, a follow-up between 3 and 6 months, self-rehabilitation is daily and assisted by a book.

The use of Botulinum Toxin (BTX) in conjunction with physiotherapy is found in Azuma's study, where a single dose of

Table 1 Eligibility criteria.

Nature	Inclusion	Non-inclusion
Age	All	None
Pathology	Peripheral FP unilateral > 3 months, acquired, all etiologies	FP Central, congenital, bilateral (>10%) FP <3 months
Treatment	Physiotherapy	No physiotherapy, new drug
Measurement	Measurement of the impact of FP	No measurement of the impact of FP
Date	1955 - 26/04/2020	>26/04/2020
Language	English / French	Other
Species	Human	Other
Type of Study	Test on person	No New Experimentation

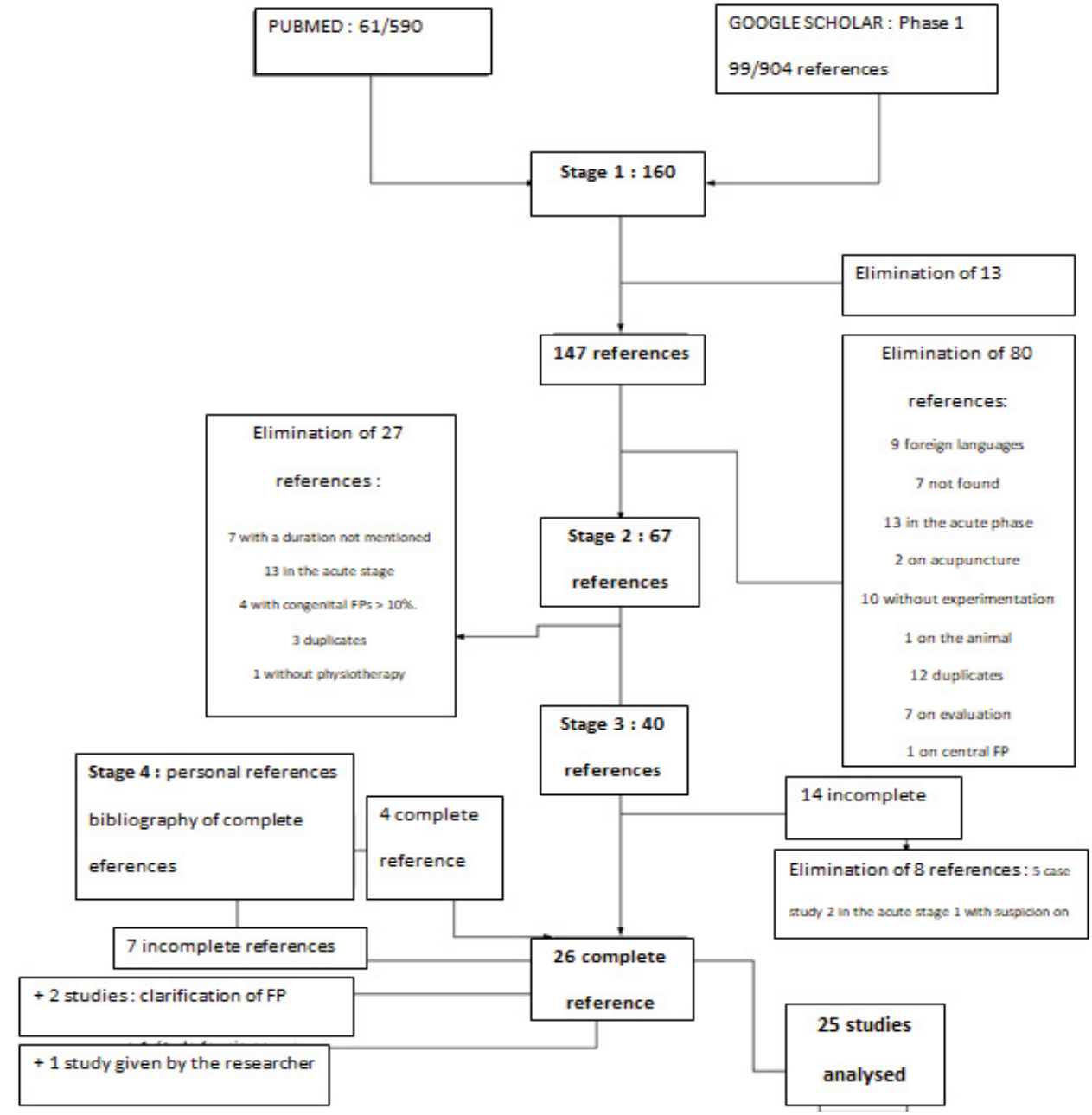


Figure 1 Flow chart showing the bibliographies of the included studies.

BTX-A is followed by a self-rehabilitation of about ten months (30 min/d of BFB with mirror, focusing on syncinesis: keeping the eye open during mouth movements, which corresponds to the study's evaluation criteria) : The function seems to be improved because the judgment criteria increase statistically significantly after 10 months (normally no p-value is used when doing non-parametric statistics with the Wilcoxon test).

Looking at the details, the authors report a deterioration of the evaluation criterion of up to 2 months, which probably corresponds to the gradual disappearance of the effect of BTX. Then, the evaluation criterion improves for up to 4 months, which probably corresponds to the effect of the therapy. The evaluation criterion then reaches a plate at 4 months, which is maintained up to 10. There is a slight degradation of the criterion between the BTX injection and the final evaluation at 10 months. We have no information on the maintenance of the score beyond 10 months.

According to them, rehabilitation has no effect on syncinesis already present (that's why persons need botulinum toxin). This assertion is contradicted by other studies in the review, where assessments of syncinesis are improved after physiotherapy only.

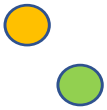
There were no side effects of botulinum toxin in the Azuma or Pourmomeny study. In Lee's study, 4 of 17 people experienced an adverse event (hematoma, ptosis or diplopia) but none persisted for more than 6 weeks.

Table 2 Application of the Cochrane ROBIN-tool.

Name of the Study	Bias due to confounding factors	Bias in selection of study participants	Bias in classification of interventions	Bias due to deviations from planned interventions	Bias due to missing data	Bias in the measurement of results	Bias in the selection of reported results	General bias	Rather in favor.
Cronin et al. Otolaryngology– Head and Neck Surgery 2003						EMG : Other :			Of the intervention
VanSweariingen et al. Plast. Reconstr. Surg, 2003									Of the intervention
Kasahara et al. Neuroscience and Biomedical Engineering, 2016						Pain : Imagery			Of the intervention
Lindsay et al.									Of the interven
PT, 2010									tion
Hyva¨rinen et al. American Journal of Physical Medicine & Rehabilitation, 2008						HB-FGS : CMAP			Of the intervention
Targan et al. Oto-laryngology- Head and Neck Surger, 2000						HB/item : CMAP			Of the intervention
Karp et alOtology & Neuro-tology 2019									Of the intervention
Brach et al. Plastic and Recons-truction Surgery 1997									Of the intervention
Beurskens et al. Otology & Neurotology 2006 [2]									Of the intervention
Gelder et				Mime :		Questionn			
PT, 2010									tion
Hyva¨rinen et al. American Journal of Physical Medicine & Rehabilitation, 2008						HB-FGS : CMAP			Of the intervention
Targan et al. Oto-laryngology- Head and Neck Surger, 2000						HB/item : CMAP			Of the intervention
Karp et alOtology & Neuro-tology 2019									Of the intervention
Brach et al. Plastic and Recons-truction Surgery 1997									Of the intervention
Beurskens et al. Otology & Neurotology 2006 [2]									Of the intervention
Gelder et				Mime :		Questionn			
logy–Head and Neck Surgery (2006)						FDI :			
Beurskens et al. American Journal of Otol-aryngology 2004 [3]									Of the intervention

Note: Low Risk of bias; Moderate; Serious; Critical; Not enough information; Not applicable

Table 3 Application of the Cochrane RoB2-tool.

Name of the study	Bias from the randomization process	Bias due to deviations in interventions	Bias due to missing data	Bias in outcome measurement	ias in selection of reported outcomes	Overall bias	Rather in favor
Monini et al. Acta Oto-Laryngo-logica, 2011							Of the intervention
Beurskens et al. The Australian Journal of Physiotherapy, 2006 [1]							Of the intervention
Otology & Neurotology 2003 [3]							Of the intervention
The Nijmegen Mime Therapy Study (Psychosocial Sequelae) 2003 [4]							Of the intervention
Ross et al. Laryngo-scope 1991							
Pourmo-meny et al. Iran J Otorhi-nolaryngol. 2015							
Marotta et al. Medicine, 2020							

Note: Low Risk of bias; Some concerns; High risk

In this study, the number of injections was 3, separated by 6 to 8 months, and rehabilitation was carried out for 2 years after the first injection. Rehabilitation here includes a new technique, the "half mirror BFB". To be carried out, the person is photographed during various expressions. She comes to place the photography of the hemi-face without FP to occult one side of the mirror; this will be a static objective to achieve. This makes it possible to work by seeking the symmetrization of the two hemi-faces. However, it only realizes movements from the homolateral (HL) side to the FP side. This allows her to concentrate only on this side. The results reported are improvements in the Facial Grading System (FGS) score but minor surgical procedures were performed and the judging criterion was not mesured after the effect of the BTX was over. The movement pattern on the controlateral (CL) side may also be altered in persistent FP due to the disruption in receiving information from the HL side to the FP. Thus, this technique should not be used alone but in combination with full face BFB.

For Monini, the BTX allows a window of action during which people have better control of facial movements, with a decrease in syncinetic movements. This was evidenced by the 20 subjects, 10 of whom were performing NMR only for 3 months and 10 were performing NMR after BTX injection. Both groups in the intra-group comparison improved their syncinesis scores ($p<0.001$) but the BTX group improved more ($p<0.001$).

For Pourmomeny et al. they did not show any difference ($p>0.05$) between those who receive and those who do not receive BTX on the FGS, while both groups progressed when they received physiotherapy with Biofeedback (BFB) by electromyogram (EMG) ($p<0.05$).

Venables et al. have applied another method: physical therapy is provided, and if syncinesis persists after 12 months of BFB EMG or Neuromuscular (NMR) rehabilitation and the person has reached a plate in their rehabilitation, then they offer BTX. The therapy provided in the trial is individualized and includes trigger point release maneuvers; so-called isotonic and isometric exercises; and mirror therapy. Mirror therapy was not found to be more detailed in the studies. Its principles could be transposable in the case of flaccid FP. In the case of FP with syncinesis, we assume that its use is dangerous as it can maintain syncinesis due to a lack of feedback. All the indicators used showed an improvement $p<0.05$ in intra-group comparison on non-parametric statistics: chewing problems diagnosed with IPREDD dropped from 74 to 43%, the most frequent residual problem being food residues in the affected cheek.

Many studies report the use of BFB with a mirror, this is the case of Azuma, Brach, (n=14) and we find it in mime therapy (Beurskens, Gelder). The use of BFB with a mirror is very frequent, either in sessions or in self-rehabilitation.

The use of BFB by EMG is valued in the Cronin study (n=30). The advantage of the device is its sensitivity to movement. Detection during BFB allows targets of the order of 10-20 microvolt/s; whether they are targets of increasing the action potential during voluntary movement or of inhibition during synckinetic movements. Intra-group results suggest that the device is effective. The authors support learning via central nervous system plasticity. In view of the precision of the device, they recommend highly controlled exercises to avoid the development of abnormal movements. Time, effort and concentration are required to achieve the finest possible movements. They encourage us to be wary of the fatigue that people develop during exercise.

Ross's study comparing two groups performing BFB with a mirror, but one of the group also has BFB by EMG. Both groups have an improvement $p<0.01$ on voluntary movement when compared to a 3rd control group consisting of those living far from the center, but the difference between these two active interventions is not found in the study ($p>0.05$). The compound motor action potential (CMAP) was not changed in a statistically significant way.

Watson et al. mention another way of getting BFB, this time non-visual, which is the placement of a tap. The tap is place for 3 h/d, it gives tactile afferences on the movements of the muscles. The quality of facial discrimination being high, this technique is a good compromise. Indeed, it is not possible to practice expressions in front of a mirror or with an EMG for 3 hours a day. However, learning to recognize the tactile sensation provided by a symmetrical and asymmetrical expression and then trying to think about it during the day seems more feasible. People are treated in combination with other physiotherapy techniques until they reach a recovery plateau, then they are left or referred to another department (surgery). The measurement of the evolution of the FGS shows an improvement of 24 points, in intra-group $p<0.001$, knowing that some people have received BTX.

The technique of Neuro-muscular rehabilitation is close to that of mime therapy in its description. What differs is the use of emotional exercises in mime therapy. The special attention paid to syncinesis is present in both treatments. Van Swearingen's study aims to describe the outcomes following NMR therapy, but overall the principles of NMR are found in the majority of the therapies investigated in the review. The authors report interest in voluntary movement (59 of 66 patients improved it) and syncinesis (54/66 decreased it). These data allow them to define a correlation between the reduction of syncinesis and the increase in voluntary movement during the trial. This correlation allows them to draw a clinical trial. If it is not possible to make a movement without any syncinesis, focusing on the movement by letting the syncinesis appear initially may be relevant; then focusing on its inhibition after recovery of the movement.

Coulson (n=10) brings the application of motor imagery and conscious motor learning to therapy via "self-modeling" videos. These consist of a film of about 1min with a replay of the best smiles (the most symmetrical, without syncinesis, with the highest degree of voluntary movement). People watch this video 3x/day for 2 weeks. Then they learn their Prepared Smiles. These are smiles adapted, planned for each situation (when, where, with whom). They perform mental repetitions of the desired activity in advance. This helps to develop the pattern related to this activity. The quality of the smile, the control of movement

and symmetry, the Facial Disability Index (FDI) were in intra-group better after the intervention ($p<0.05$).

In addition, the speed of the smile being useful to ensure that it is used at the appropriate time, the set-up time was measured. Asymmetrical smiles occurred more slowly after the procedure (allowing time for the person to inhibit them), while symmetrical smiles occurred more quickly (allowing time for the person to respond appropriately). People report an 85% increase in the use of their smile within 2 weeks after treatment. These results suggest automation, thanks to the choice of very well-defined moments to use the smile.

Electrical stimulation is investigated in Hyvârinen's studies. This technique is very controversial and is no longer used in clinical practice, but studies continue to be conducted on it. However, therapists consider it to be an aberration when it triggers contractions. Indeed, these massive contractions will increase the tonicity of the muscle fibres. However, FP is already a complication of hypertonia. Thus, pathophysiology tends to have reservations about this technique.

In Hyvârinen's study, this stimulation is carried out at the sub-motor and under-sensitivity stage. Stimulation of the facial nerve is done gradually up to 6 hours per day, on 3 sites (Fz = 20 hz, t = 100 microsec). Depending on therapeutic adherence, the 10 participants performed between 400 and 800 hours of stimulation. The intra-group measurements show us a faster CMAP on the upper branch in post-treatment, and an improvement of subparts of the HB. The subjective experience of the person is recognized as better for 9 out of 10 patients and some people report a decrease in FP complications (dry eyes, eye closure). Authors conclude that there is a treatment clue for unresolved FPs

Ten of the twenty subjects in Marotta's study received electrical stimulation with visible contraction (NMES) associated with shortwave diathermy (SWD); while the remaining 10 received a sham procedure. These procedures were given 30min, 5x/week, for 4 weeks. All subjects received a mime therapy type rehabilitation. In an intergroup comparison with Wilcoxon's test, no FGS parameter gave a clinically relevant result. Although the voluntary movement sub-score and secondary judgement criterion, which is the symmetry of zygomatic movement, have a $p<0.05$. In our opinion, this study encourages us not to incorporate electrical stimulation generating contraction, even though diathermy is supposed to protect against the muscular hypertonicity. According to the authors, there is a possibility of associating NMES and SWD to avoid after-effects.

The 17 people in Targan's study received electrical stimulation up to 6h/d, for 6 months, this time at an under-motor but over-sensory intensity, and they noted improvements ($p<0.05$) on a clinical (HB) and electrical (CMAP) score.

Intra-oral massages are practiced in Kasahara's study, these are given as self-massage 3x/day for 10 min. Due to an improvement of the intra-group stiffness score of 2.5 pts in the 5 subjects, the authors report a stiffness of the HL cheek, initially more rigid, comparable to the CL cheek in post-treatment. The sono-elastography technique was used to visualize the structural changes, and they are visible after 4 weeks of treatement. A decrease of 5.4 EVA points was also observed on average. The explanation is that conventional massage stretches the skin, while intra-oral massage is deep enough to stretch the muscles in relation to the different planes. This justification is put in danger by the anatomy of the facial muscles, which are skin muscles.

Conclusion

The therapeutic education of the person is a primordial element found in the majority of studies: Advice to protect the eye (artificial tears, Vit A, sunglasses, strip), the face (shawl for wind and cold); how to chew and clean the mouth after eating (residues on insensitive areas have to be removed with the tongue); vigilance against cheek biting, salivary discharge, false routes; ear protection; stimulation of salivary production; sleeping on the affected side. The clinician's therapeutic arsenal has been tested in different studies. These studies do not assure the effectiveness of the therapy, although they suppose it and describe how to manage people with persistent FP.

Key Clinical Messages

- A person wishing to improve facial function or quality of life during persistent FP can be referred to a physiotherapist but the effectiveness of the therapy has not been clearly demonstrated.
- A person with persistent facial paralysis who is reluctant to have surgery may try to receive rehabilitation to improve their situation.
- A Failure, a plate in rehabilitation may involve the addition of botulinum toxin injection to the treatment.

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