Literature Review

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Orofacial rehabilitation in head and neck burns: a systematic review of the literature

Reabilitação motora orofacial em queimaduras em cabeça e pescoço: uma revisão sistemática de literatura

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ABSTRACT

Purpose: Analyze studies addressing the treatment of head and neck burns in different fields of health care, especially treatments that involve the functional rehabilitation of the head and neck muscles. **Research strategy:** This qualitative review of the literature analyzed international scientific publications in the PubMed database that used the following keywords: "burn and face and speech-language pathology", "burn and face and speech language", "burn and face and rehabilitation", "burn and face and myofunctional rehabilitation", "burn and face and myofunctional therapy", "nonsurgical and scar and management", "burn and face and nonsurgical", and "burn and face and scar and management". **Selection criteria:** Scientific publications on treatment strategies for head and neck burns associated to functional rehabilitation of the head and neck muscles using muscle exercises and/or manual therapy were included in this study. **Results:** Overall, most of the treatments described in the investigated studies presented positive outcomes for patients with head and neck burns. The studies showed wide variability in terms of treatment proposals and methodologies used to verify treatment efficacy. **Conclusion:** Although a growing number of publications on the rehabilitation of head and neck burns were observed, the best therapeutic technique and its real benefits remain unclear. There is a wide range of treatment protocols, and very few focus on the functional treatment of the orofacial myofunctional system. Most of the studies propose isolated motor activities to improve the mandibular range of movements.

Keywords: Burns; Head; Neck; Speech, Language and hearing sciences; Rehabilitation; Review

RESUMO

Objetivos: Investigar estudos sobre o tratamento das queimaduras em cabeça e pescoço, nas diversas áreas da saúde envolvidas na assistência a queimados (médica, enfermagem, fonoaudiologia, fisioterapia e terapia ocupacional), avaliando a eficácia das técnicas empregadas, principalmente no que se refere à reabilitação da funcionalidade da musculatura em cabeça e pescoço. **Estratégia de pesquisa:** Os artigos foram selecionados por meio da base de dados PubMed, utilizando os descritores "*burn and face and speech-language pathology*", "*burn and face and speech language*", "*burn and face and rehabilitation*", "*burn and face and myofunctional rehabilitation*", "*burn and face and myofunctional therapy*", "*nonsurgical and scar and management*", "*burn and face and nonsurgical*" e "*burn and face and scar and management*". **Critérios de seleção:** Foram incluídos artigos que investigaram os tratamentos das queimaduras em cabeça e pescoço, associados à reabilitação da funcionalidade da musculatura em cabeça e pescoço, utilizando exercícios musculares e/ou terapias manuais. **Resultados:** A maioria dos tratamentos descritos apresentou efeitos benéficos para pacientes com queimaduras. Foi observada grande variabilidade da metodologia adotada para a aplicação e verificação dos efeitos dos tratamentos. **Conclusão:** Apesar do crescente número de pesquisas, ainda não existe consenso quanto à melhor técnica terapêutica e ao real benefício de cada uma delas. Existe uma grande diversidade nos protocolos de tratamento, sendo que um número pequeno de estudos de tratamento visa a funcionalidade do sistema miofuncional orofacial. A maioria dos estudos tem, como foco, atividades motoras isoladas, que visam à mobilidade mandibular.

Palavras-chave: Queimaduras; Cabeça; Pescoço; Fonoaudiologia; Reabilitação; Revisão

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INTRODUCTION

According to the literature, burns are defined as lesions to organic tissues caused by traumas of different origins. These traumas can be thermal (exposure to flames, hot or cold liquids, and combustion), solid (by friction), electrical, chemical (sulfuric acid, caustic soda, nitric acid, and anhydrous ammonia), or by radiation (uranium, radium, plutonium, and the radiation produced by X-ray and radiotherapy devices), compromising the integrity of the skin and soft tissues[1-3].

Epidemiological data show that burns account for over 300,000 deaths/year, and nearly 11 million people worldwide require burn-related medical assistance[1,4]. Statistics from the United States indicate that more than one million burns occur each year, with five thousand of these injuries being fatal, placing burns as the fourth leading cause of death from unintentional injuries[4,5].

Brazil ranks fifth in the world for this occurrence, both by geographical area and population. For this reason, the incidence rate of burns tends to vary considerably in the literature, and reports are usually limited to a single Burn Treatment Center (BTC)[1,4]. Burns are also a significant public health concern[1,4], representing the second cause of death in children in Brazil[4]. The National Health Surveillance Agency (Anvisa) reports that there are approximately 300,000 new cases of child burns per year[6]. A literature review published in 2012 showed that over 4% of all public hospital admissions in the Country are a result of burns. Prevalence rates for head and neck burns also vary considerably, with estimates of 6-60% of all burns recorded in the Country[7].

In general, burns are classified with respect to their depth, according to involvement of the constituent layers of the skin. First-degree burns affect only the epidermis and the hair follicles. Second-degree burns may be superficial or deep: the superficial ones affect the whole epidermis and a portion of the dermis, whereas the deep ones cause the destruction of practically the entire dermis. Third-degree burns, however, destroy all layers of the skin, and can reach subcutaneous and other deeper tissues such as muscles, tendons, bones, and the digestive and respiratory tracts[1,8].

Hypertrophic scars are hard, raised, red, pruritic, tender, and contracted[8,9]. Several methods for measuring scar severity and response to treatment have already been described, such as clinical observation, the Vancouver Scar Scale, scar volume, photography, vascularity, flexibility, and ultrasound thickness; however, none of these methods has been accepted as standard[10,11]. Keloids and hypertrophic scars are characterized by excess collagen accumulation in the wound and are examples of fibroproliferative disorders[12,13].

The head and neck regions are exposed to various lesions. The contractile forces of the neck can also cause facial deformities and adversely affect the maturation of facial scars[14,15]. Burns in the head and neck region are prone to develop hypertrophic scars and contractures that may cause incomplete oral occlusion, impairments in articulation and feeding, difficulties in intubation, oromaxillofacial skeletal deformities, oral/dental hygiene difficulties, esthetic deformity, and facial expression and vocal changes[1,16-18]. Third-degree burns in the orofacial region are described as complex and difficult to treat[16].

Most studies addressing burn treatments described in the literature refer to surgical evaluations and procedures performed in the acute phase of burn, as this is the most critical period for patient survival. However, many patients evolve with functional and esthetic sequelae, which can directly impact their quality of life[1,19,20].

PURPOSE

Given the scarcity of data on functional treatments of head and neck burns, the purpose of this literature review was to verify possible treatments for these conditions in the various health care areas, assessing the efficacy of the techniques used, mainly with respect to rehabilitation of the head and neck musculature mobility and of the orofacial myofunctional functions, such as breathing, chewing, and swallowing.

RESEARCH STRATEGY

Research methodology followed the precepts of the Cochrane Handbook for Systematic Reviews of Interventions[21]. The articles included in this study were selected at the PubMed database using the following keywords: “burn and face and speech-language pathology”, “burn and face and speech language”, burn and face and rehabilitation”, burn and face and myofunctional rehabilitation, “burn and face and myofunctional therapy”, “nonsurgical and scar and management”, “burn and face and nonsurgical”, and “burn and face and scar and management”; the search was limited to studies published in Portuguese and English between January 2008 and January 2018.

Search for articles in the database was performed independently (at different times, and without contact between the referees) by three researchers aiming to minimize possible citation losses. Only texts closely related to the study proposal were analyzed. All stages of the research, namely, database search and exclusion of texts in language other than Portuguese and English, repeated due to overlapping of keywords, with limited access, and lacking description of treatments, were conducted independently by the researchers.

SELECTION CRITERIA

Articles addressing treatments of head and neck burns associated with functional rehabilitation using muscle exercises and/or manual therapies were included in this review. Articles published in languages other than Portuguese and English were excluded, as well as those to which access to full text was limited and/or were in duplicate due to overlapping of keywords. Of the complete texts obtained, literature reviews, letters to the editor, and texts not directly associated with the study theme were excluded from this review. In case of disagreement between the researchers (they did not classify the text compatible with the investigated theme), only the texts on which a final consensus was reached were included in this literature review.

DATA ANALYSIS

All selected texts were analyzed with respect to the following variables: study sample, age and gender of participants, burned body surface area (BBSA), study objective, techniques used, and results/conclusion.

RESULTS

Of the 181 articles selected, 14 were considered for analysis according to the inclusion criteria of the study. Of these, two were not available, thus 12 studies were included in the final review (Figure 1).

For analysis purposes, the articles were divided into and presented in two charts: Chart 1 – containing articles addressing burn treatment; Chart 2 – including case reports on treatment of burned individuals.

DISCUSSION

Analysis of all selected articles, from all health areas, showed prevalence of males among the investigated patients, and that none of the studies used gender as a variable of research. Although the prevalence of burns in males is not well understood, the literature indicates that this finding can be explained by the behavior of this population, which is characterized by marked ability to explore the environment, excessive motor activity, and less caution, representing an increased risk for this type of accidents[2-5,22].

A wide age range was observed in the samples of the selected articles, varying from 1 to 80 years, and including children, adolescents, adults and the elderly[16,17,23-33]. Although no statistics on burns by age group are available, in the United States, it is estimated that between 500,000 and 2 million burns occur per year, with burns in children accounting for 440,000/year; of these, 11,000 children are hospitalized and 7,800 evolve to death. In Brazil, 1 million burns occur each year, with children as the most affected[34-36].

According to the literature, severity of burn injuries is normally determined by calculating the BBSA, which can be assessed using the Lund-Browder chart[37]. Although determination of burn severity is essential to define procedures and treatments to be adopted, this literature review showed that only six articles used this measure to characterize the sample, hindering generalization of the results[16,17,24,26,27]. The literature shows that BBSA >20% is considered severe, requiring specific care such as volume replacement[36].

Sample size of the reviewed articles varied considerably, with only two studies conducted with more than 100 participants[16,17]. Of the 12 articles included in this literature review, four studies used a control group, two of them in the Speech-language Pathology (SLP) area, which had control groups matched for age of the participants[16,17,25,27]. Presence of a control group allows greater possibility of analysis and accuracy of results[28].

Of the articles in the medical area, only one performed evaluation with pre- and post-treatment objective exams[23]; the other two medical articles employed assessment methods published in the literature and widely used in the area, such as mandibular range of movement and mouth opening measurements, scar and speech intelligibility (auditory-perceptual evaluation) scales, and pressure sensibility sensation assessment[24,25]. The following treatment techniques were reported in these medical studies: surgical (face transplantation, debridement, and grafting); massage and compression mask and use pharmaceuticals (pentoxifylline). All the articles showed positive results after the treatment used, and only one study reported use of myofunctional rehabilitation[23-25].

Still in the medical area, orofacial myofunctional rehabilitation techniques were reported but not detailed, that is, no description of the types of massage and exercise performed was provided and the frequency at which the techniques were used was not mentioned[23]. Results of the study that assessed speech intelligibility and facial sensibility[23] demonstrated improvement in smell, breath, eat, speak, grimace and facial sensation, but the results regarding the evaluation of eat, breath and grimace were registered based on the patients' reports, and not by means of objective pre- and post-treatment assessments. According to the literature, self-assessments are considered subjective, because there may be difficulty understanding the questions, in the cases of patients with low schooling, and direct influence of the individual's psychological state at the time of evaluation. Despite being considered inaccurate, this type of evaluation is widely used in the literature[38].

Studies selected in the SLP area were conducted by the same research team and in the same treatment center[16,17]. Both studies analyzed the effect of orofacial myofunctional rehabilitation: one conducted with patients with second-degree burns[16] and the other with individuals with third-degree burns[17]. Both studies used control groups matched for age, with evaluation measures

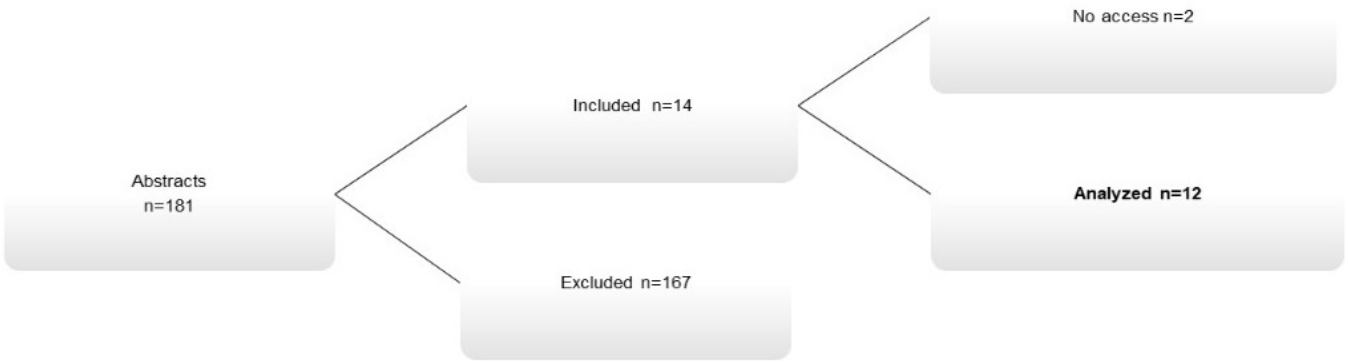

Figure 1. Selection of the articles included in the literature review
Subtitle: n = number of articles

Chart 1. Burn treatment

Reference	Article title	Area of professional action	Study sample	Age	Gender	BBSA	Study objectives	Techniques used	Results/Conclusion
Fischer et al.[23]	Functional Outcomes of face transplantation	Medicine	Face transplantation recipients of the institution n=5 Face transplantation recipients of other institutions n=29	19-59 years	Both	Not mentioned	Provide a compilation of functional impairments before and improvements after face transplantation.	Treatment for patients of the institution: data collection, physical examination, computed tomography and laryngoscopy; auditory-perceptual assessment of speech intelligibility; facial sensibility assessed by the Semmes-Weisntein test. Treatment for patients from other institutions: literature review.	Patients showed improvement in smell, breath, eat, speak, grimace and facial sensation. Standardized outcome evaluation is inevitable to enlarge the field of application.
Philp et al.[24]	Late outcomes after grafting of the severely burned face: A quality improvement initiative	Medicine	Patients with facial grafts n=35 Post-graft patients for late follow-up n=14	43 (±16) years	Not mentioned	Total BBSA 23% (± 21%)	Perform a detailed evaluation of the late outcomes in adult patients who have undergone grafting using a standardized surgical and rehabilitation approach for facial burns.	Evaluations used for treatment: Vancouver scar scale, pressure sensibility sensation, Semmes-Weinstein monofilaments, and esthetic and functional measures. Treatments performed: surgical (tangential burn wound debridement and grafting), massage, and compression mask.	Outcomes showed the scalp as a preferred donor site, pressure preference at the graft edges around the mouth and chin, scalp use for hairlines such as eyebrows, use of grafts of varying thicknesses, and orientation to the patient regarding the probability of changes in sensitivity.
Isaac et al.[25]	Intralesional pentoxifylline as an adjuvant treatment for perioral post-burn hypertrophic scars	Medicine	Case group treated with pentoxifylline n= 10 Control group n= 8	12-45 years	Both	Not mentioned	Determine whether the use of pentoxifylline intradermally would improve the elasticity of hypertrophic scars in the peribuccal area in burned patients.	Case group: Measurements of mouth opening (lip-to-lip and tooth-to-tooth distances in mm) were taken using a digital caliper, before and after five therapeutic sessions with pentoxifylline with weekly intervals; application of patient satisfaction scale and a quantitative analogue pain rating scale. Control group: No treatment performed.	Significant improvement in the opening of the mouth, in vermilion distance as much as the dental distance in the case group compared with the control group.

Subtitle: BBSA = burned body surface area; n = number of participants; % = percentage

Chart 1. Continued...

Reference	Article title	Area of professional action	Study sample	Age	Gender	BBSA	Study objectives	Techniques used	Results/Conclusion
Clayton et al.[16]	Orofacial contracture management outcomes following partial thickness facial burns	Speech-language Pathology	Patients with partial-thickness orofacial burn n=229 Control group n=120	Patients with burn: aged 16-79 (±15.7) years Control patients: aged 16-80 years	Both Patients with burn: Males=183 Females=46 Control patients: Males=60 Females=60	11.7% (1-71%) (±12.1%)	Analyze clinical outcomes following non-surgical exercise for contracture management post partial-thickness orofacial burn in a cohort of patients.	Pre- and post-treatment assessments were performed through vertical and horizontal mouth opening/lip-to-lip measurements in patients with orofacial burn. The treatment combined exercise and stretching performed 10 times each, 5 times a day. For patients (n=4) who had prolonged healing over 21 days, a mouth splint was used 1 hour per day (Free Access II Cheek Reatractor®). Treatment completion was defined with closure of the wounds and functional objectives achieved. Stabilization of treatment was monitored for additional 4 weeks and referred to the medical staff of origin; if regression was observed, the patient returned to the previous level of treatment. For the control group, the same measures were performed only once and no treatment was offered.	For the group of patients, significant differences (p□0.001) were observed regarding vertical and horizontal mouth opening compared with the control group. Treatment duration was, 30.7 days on average. After treatment significant improvement (p<0.001) was found for vertical and horizontal opening. At treatment conclusion, a significant (p<0.01) difference remained between the burns cohort and control group for vertical mouth opening. Study results support positive outcomes following orofacial contracture management for patients with partial-thickness orofacial burn; however, some functional loss remained with patients demonstrating persistent reduced vertical mouth opening at conclusion of treatment compared with the control group.

Subtitle: BBSA = burned body surface area; n = number of participants; % = percentage

Chart 1. Continued...

Reference	Article title	Area of professional action	Study sample	Age	Gender	BBSA	Study objectives	Techniques used	Results/Conclusion
Clayton et al.[17]	Full-thickness facial burns: Outcomes following orofacial rehabilitation	Speech-language Pathology	Patients with orofacial burn n=12 Control group n=120	Patients with orofacial burn aged 17-61 years Control group aged 16-80 years	Both Patients with orofacial burn Males=4 Females=8 Control group Males=60 Females=60	8-80%	Measure length extension after full-thickness facial burn and describe results associated with orofacial rehabilitation in a cohort of prospectively studied patients with full-thickness facial burn.	Pre- and post-treatment assessments were performed through vertical and horizontal mouth opening/lip-to-lip measurements in patients with orofacial burn. The treatment combined exercise and stretching performed 10 times each, 5 times a day and the use of Cheek Retrator® for 1 hour, twice a day. For some patients (n=9) additional stretching was required and the TheraBite® or OraStretch® were used with 5 sustained stretches of 30 s for 3 times. After reaching mouth opening greater ≥35 mm, patients were followed-up every 3 months and, if regression of results was observed, they returned to the previous level of treatment. For the control patients, the same measures were performed only once and no treatment was offered. .	Participants had significantly (p<0.001) reduced vertical and horizontal mouth opening range compared with controls. Average duration of orofacial contracture management was 550.25 days, with 33% of patients demanding 1 year of treatment, half requiring >2 years rehabilitation, and 175 needing more than 2 years rehabilitation. After treatment, significant (p<0.01) positive improvement in vertical and horizontal mouth opening had been achieved, however measures had returned to lower limits of normal function and remained significantly (p<0.05) reduced compared to the control group. This study demonstrates that although positive gains can be achieved through non-surgical exercise after full thickness burn, some degree of long term loss in functional mouth opening remains. Methods to optimize results, especially for vertical mouth measures, need to be examined.

Subtitle: BBSA = burned body surface area; n = number of participants; % = percentage

Chart 1. Continued...

Reference	Article title	Area of professional action	Study sample	Age	Gender	BBSA	Study objectives	Techniques used	Results/Conclusion
Parry et al.[26]	Nonsurgical scar management of the face: does early versus late intervention affect outcomes?	Physical therapy	n=82	Mean age of 5.4 (± 4.5) years	Both Males=62% Females=38%	Mean of 35.2% (± 22.5%)	Assess the timing of common noninvasive scar management interventions after facial skin grafting in children with facial burns.	General data from the medical records were analyzed and the modified Vancouver scar scale was used to monitor the evolution of patients after the use of non-invasive treatment techniques for facial burns, such as massage, exercise, pressure therapy and earlier application of silicone.	Earlier use of silicone for the face is associated with a better score in the modified Vancouver scar scale, specifically in the subscales of vascularity and pigmentation. It was also possible to observe an improvement in vascularity after pressure therapy and facial exercise.
Parlak Gürol et al.[27]	Itching, pain, and anxiety levels are reduced with massage therapy in burned adolescents	Nursing	Massage group n=32 Control group n=31	Aged 12-18 years Mean of 14.07 (±1.78) years	Both	Between 11 and 20%	Examine whether the effects of massage therapy reduced burned adolescents' pain, itching, and anxiety levels.	Assessments of itching and pain were performed through visual analogue scales and a Likert scale composed of 20 questions was applied for the evaluation of anxiety. Pre- and post-massage therapy assessments were performed. Patients in the massage treatment group received 15-min massages twice weekly for 5 weeks.	Massage therapy was effective because it reduced the itching, pain, and anxiety levels of the treated patients compared with those in the control group.

Subtitle: BBSA = burned body surface area; n = number of participants; % = percentage

Chart 2. Burn Treatment - Case Reports

Reference	Article title	Area of professional action	Study sample	Age	Gender	BBSA	Study objectives	Techniques used	Results/Conclusion
Wei et al.[29]	3D-printed transparent facemasks in the treatment of facial hypertrophic scars of young children with burns	Not mentioned	n=2	Aged 1-6 years	Male	Not mentioned	Test the efficacy of 3D-printed transparent facemasks on two children with facial burns resulting hypertrophic scars.	Facial features were scanned using a portable 3D scanner to produce the customized printable facemasks printed out on the transparent biocompatible material followed by adding the medical grade silicone gel to provide extra pressure on the scar site. The facemasks were fitted to the patients with elastic straps. The scar thickness was measured through ultrasound and a second layer of silicone was added to the sites where the scar thickness was in relief to increase pressure. Both children and family were instructed to wear the facemask for at least 20 h per day and they were assessed before treatment, one month and three months after treatment on the facial scar conditions.	The 3D-printed transparent facemask is convenient and efficient to fabricate, and is suitable for treating pediatric facial hypertrophic scars after burn.
Pontini et al.[30]	Multidisciplinary care in severe pediatric electrical oral burn	Medicine, Odontology, and Speech-language Pathology	n=1	Aged 16 months	Female	Not mentioned	Describe a multispecialist team approach that ensures satisfactory outcome by reconstructive surgery, careful progressive evaluation of dental and soft tissue healing, and speech recovery.	Reconstructive surgeries, long-term x-ray evaluation, and SLP rehabilitation.	The multidisciplinary care involving the treatment of soft tissues, teeth, and rehabilitation of speech articulation results in satisfactory long-term recovery.
Sadiq et al.[31]	The role of free flap reconstruction in pediatric caustic burns	Odontology and Physical Therapy	n=2	Aged 21-36 months	Both	Not mentioned	Describe cases of caustic soda scarring with free flap reconstruction in children.	Free flap reconstruction surgery and physical therapy rehabilitation with exercises and use of TheraBite® in 1 of the 2 reported cases.	Free flap surgery is complex and demanding, but if done at an early age may reduce the need for repeated operations and the growth and development of the facial skeleton.

Subtitle: BBSA = burned body surface area; n = number of participants; % = percentage; FOIS = Functional oral intake scale; POSAS = Patient and Observer Scar Assessment Scale; AusTOMS = Australian Therapy Outcome Measure; FEES = Fiberoptic Endoscopic Evaluation of Swallowing

Chart 2. Continued...

Reference	Article title	Area of professional action	Study sample	Age	Gender	BBSA	Study objectives	Techniques used	Results/Conclusion
Clayton et al.[32]	Intensive swallowing and orofacial contracture rehabilitation after severe burn: A pilot study and literature review	Speech-language Pathology	n=2	Aged 18-54 years	Male	53% and 76%	Outline the development of principles/basic elements that should be adopted for the rehabilitation of dysphagia and orofacial contracture in this specific population.	Pre- and post-treatment assessments were conducted using horizontal and vertical range of movement and the Vancouver, POSAS, FOIS, AusTOMS, FEES protocols, and the laryngeal penetration/pharyngeal aspiration, pharyngeal residue severity rating, Marianjoy secretion, and Patterson edema scales. Treatment for orofacial contracture was performed through stretching (10 times each, 5 times a day) and with the use of OraStretch® (5 times, for 30 s, 3 times a day) and Free Access II Cheek Retractor® (for 1 h, twice a day). Dysphagia rehabilitation included base of tongue (Masako Manoeuver) and pharyngeal strengthening (Effortful Swallow) exercises performed 10 times each, 5 times a day.	Active rehabilitation achieved full functional outcomes for swallowing and orofacial range of movement. A long-lasting therapy can be anticipated in this complex population.

Subtitle: BBSA = burned body surface area; n = number of participants; % = percentage; FOIS = Functional oral intake scale; POSAS = Patient and Observer Scar Assessment Scale; AusTOMS = Australian Therapy Outcome Measure; FEES = Fiberoptic Endoscopic Evaluation of Swallowing

Chart 2. Continued...

Reference	Article title	Area of professional action	Study sample	Age	Gender	BBSA	Study objectives	Techniques used	Results/Conclusion
Clayton et al.[33]	Rehabilitation of speech and swallowing after burns reconstructive surgery of the lips and nose	Speech-language Pathology	n=1	Aged 62 years	Male	Not mentioned	Describe the physical rehabilitation of a patient with full-thickness burns to the nose, lips, mouth, and chin following electrical burn injury.	Surgical reconstructive procedures, rehabilitation of swallowing, articulation and speech intelligibility, and exercises were performed aiming to minimize the development of contractures, such as reduction of the vertical opening of the mouth. Exercises included puffing up the lips and cheeks (each exercise was performed for 3s and repeated 10 times, 5 times a day) and a passive range of stretching techniques, such as horizontal and vertical stretching (each stretching was performed for 30 s and repeated 5 times per session). Splinting was conducted using the Free Access II Cheek Retractor® (for 1 h, twice daily) and the Therabite® (5 repetitions held for 15-20 s per session, twice daily).	In the multidisciplinary work involving surgical planning and post-surgical rehabilitation, the patient presented an ideal result, both esthetic and functional, with good speech quality and swallowing, and with ability to maintain functional oral movement. Rehabilitation of speech and swallowing is an essential factor to consider when planning postburn reconstructive procedures.

Subtitle: BBSA = burned body surface area; n = number of participants; % = percentage; FOIS = Functional oral intake scale; POSAS = Patient and Observer Scar Assessment Scale; AusTOMS = Australian Therapy Outcome Measure; FEES = Fiberoptic Endoscopic Evaluation of Swallowing

taken at a single time for the control groups and pre-and post-treatment for the case groups. The same evaluation and treatment techniques were used in both studies[16,17]. For assessment, measures of horizontal (commissure to commissure) and vertical (lip to lip) mouth opening were taken. The treatment used was also the same, and both studies mentioned that exercises and stretching were performed (ten times each, five times a day). The following motion rehabilitation instruments were used for sustained stretching five times for 30 s, three times daily: Therabite®, Cheek Retractor® or OraStrech®. Both studies presented a description of the orofacial myofunctional therapy adopted and described the frequency of each treatment stage; however, neither mentioned which muscles were stretched and which exercises was performed[16,17]. The resources applied for sustained stretching require the use of these devices, which are not available in the therapeutic routine of BTCs in Brazil[39]. The articles analyzed in the SLP area reported positive outcomes after treatment, aiming to improve mouth opening, and the need for long-term follow-up of the results obtained[16,17].

In the area of Physical Therapy, only one article was selected[26]. Patient assessment was conducted using the Vancouver Scar Scale[10], and non-invasive therapeutic techniques such as massage, exercises, compression mask, and earlier use of silicone gel were employed. This study also did not provide a detailed description of the techniques applied with respect to the types of massage and exercises, their frequency, and the pressure used. The study groups were divided according to the technique used (massage, exercises, compression mask, and earlier use of silicone); however, there was no standardization regarding the number of participants in each group and the application time of the rehabilitation strategies[26]. Concerning the results associated with efficacy of the techniques proposed in the area of Physical Therapy, earlier use of compression mask and exercises were related to improvement of vascularity ratings on the Vancouver Scar Scale, whereas earlier application of silicone gel and use of compression mask and exercises were associated with scar improvement and shorter scar maturation time. The authors did not detail which exercises were performed and the pressure used in the facemasks[26].

Only one article was selected in the Nursing area[27]. It aimed to analyze whether massage could reduce pain, pruritus and anxiety in adolescent patients with burn injuries. Although the purpose of this study was not directly related to myofunctional rehabilitation, a choice was made for keeping it in this literature review because it is understood that pain negatively influences myofunctional rehabilitation, considering that it can cause muscular adaptations that evolve to impairments of orofacial myofunctional functions[40-51]. Pre- and post-assessments were performed using a quantitative analogue pain rating scale. A Likert scale with 20 questions was applied to evaluate the level of anxiety. Both evaluations were subjective, that is, depended on the patient's reported opinion. This type of assessment is controversial, since patients do not follow pre-established theoretical and technical standards to fill the scales, and end up responding to the questions according to how they feel at the time of their application[27,29-37].

The other analyzed articles were clinical case reports involving participants of both genders[29-33]. Results of these studies showed the effects of surgeries, scar improvement, and myofunctional rehabilitation[29-33]. In all of these case reports, the patients benefited from the treatments, showing improved motor signs and symptoms.

Overall, lack of consensus was observed regarding the techniques used for myofunctional rehabilitation in patients with burns in the four health areas included in this literature review. Scar scales and mouth opening measurements were the most commonly used assessment methods[16,17,24-26,32,33]. Although scar assessment scales are extensively reported in the literature, no correlation between scar rating and head and neck motor rehabilitation has been found to date. This type of evaluation also showed variability, with some studies using the Vancouver Scar Scale[10] and others using the Patient and Observer Scar Assessment Scale (POSAS)[11]. Mouth opening measurements are also widely reported in the literature, mainly with the aim of evaluating temporomandibular joint (TMJ) integrity. An article conducted with burned patients published in 2015 identified that reduced mandibular range of movement is considered a risk for the development of TMJ dysfunction (TMD)[1]. Although improvement in the quality of life (QoL) of patients with burns was a concern of the studies, only one of the analyzed articles used a QoL assessment scale - the Australian Therapy Outcome Measures (AusTOMS)[52]. QoL evaluation is important for the better understanding of physical, psychological and social impacts on victims of burns, as well as for discussion on possible interventions and treatments[52-54].

Variability was also observed as for credibility of the studies and quality of research methodology: most of the selected articles did not present validated, published assessment protocols, but the clinical trials that used control groups[16,17,25,27] showed more detailed methodologies, enabling their replication and verification of result reproducibility. As for the results achieved through the treatments, regardless of the area, most of the analyzed studies prioritized improvement of scar and motor function. Few studies assessed changes associated with orofacial functions[16,17,32,33]. Only the studies in the SLP area referred to the importance of rehabilitation of orofacial functions and orofacial myofunctional balance[16,17,32,33].

Ordinance GM/MW nº. 1.273 of November 2000 of the Brazilian Ministry of Health considers, among other aspects, the need to ensure assistance to these patients at various levels of complexity, by multiprofessional teams, using specific techniques; however, speech-language pathologists are not included in these teams[55]. In 2011, the European Burns Association published the European Practice Guidelines for Burn Care (Minimum Level of Burn Care Provision in Europe). In this manual, speech-language therapists are included in the multidisciplinary team for the care of burned patients[56]. Currently, although not mandatory, some BTCs in Brazil have a speech-language therapist as a member of the multidisciplinary team to assist patients with head and neck burns[38], with the objective of evaluating and rehabilitating orofacial myofunctional impairments as in breathing, chewing, swallowing, speech and voice, as well as vocal disorders caused by head and neck burns and by sequelae, such as contractures resulting from pathological cicatrization[1,16,17,32,33,38,57].

CONCLUSION

Despite the growing number of studies addressing face burn treatments, there is still no consensus as to the best therapeutic technique to be adopted, and little is known about the real benefit of each of these techniques. Speech-language Pathology emphasizes reduction of the orofacial contracture and the need for rehabilitation of the orofacial functions. There is great

diversity of treatment protocols, and each of them presents some benefit. A small number of studies on treatment of head and neck burns aim at the functionality of the orofacial myofunctional system, and most of them are concerned with isolated motor activities such as mandibular mobility. Nevertheless, protocols with combined techniques, such as surgeries, massage, exercise therapy, compression mask, or association with the earlier use of silicone gel, show better results than the isolated treatments. These combinations foster improvements both associated with aspects of mandibular mobility and with enhanced functionality of the orofacial myofunctional system.

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