

# MASTICATION, DEGLUTITION AND ITS ADAPTATIONS IN FACIAL PERIPHERAL PARALYSIS

## *Mastigação, deglutição e suas adaptações na paralisia facial periférica*

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### ABSTRACT

**Purpose:** to describe mastication, swallowing oral phase and possible functional adaptations observed in Facial Peripheral Paralysis subjects. **Method:** there were 30 subjects with grade IV Facial Peripheral Paralysis, with at the most 30 days paralysis history and no etiology differentiation. They were separated in three groups, 1 to 10 days paralysis, 11 to 20 days and 21 to 30 days. Mastication and swallowing oral phase functions were assessed with both solid food and water. Participants answered questions related to the difficulties right after the paralysis. Data were statistically analyzed using the Likelihood Ratio Test and Fisher Exact Test. **Results:** changes were observed in mastication and swallowing oral phase due to the lowering of lips tonus, orbicular muscle and buccinator muscle that allows the escaping of food and liquid by decreasing intra-oral pressure. To the speech therapist's observation "spill liquid while drinking" presented statistically significant data ( $p=0,003$ ) in the three observed groups. Variable "accumulate food between teeth and gums" was statistically significant in groups of 11 to 20 days ( $p= 0,002$ ). **Conclusion:** sample subjects chew with difficulty in the paralyzed side, showing slow and inconsistent mastication cycles. There is an increased tongue movements for cleaning the residues kept in oral vestibule in the paralyzed side. This is the most annoying symptom according to the patients. They develop adaptation strategies to compensate their functional difficulties.

**KEYWORDS:** Facial Palsy; Mastication; Deglutition; Facial Muscles; Rehabilitation

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### ■ INTRODUCTION

The partial or total interruption of impulses sent by the Facial Nerve to the muscles innervated by it results in the abolishment of facial mimic <sup>1-6</sup>.

The maxilla, mandible, temporomandibular joints, teeth, muscles, ligaments, tongue and lips form the Stomatognathic System (SS), which, controlled by the Central Nervous System is responsible by suction, mastication, deglutition and speech<sup>7</sup>.

Mastication is the act of biting and crushing food, transforming it into smaller particles which, bonded by the mixing action of saliva, make up the bolus

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which is ready to be swallowed<sup>7,8</sup>. The learned function depends of the neural pathways and synaptic connections established and commanded by the cerebral cortex<sup>9</sup>. Mastication contributes to the maintenance of the acquired tonus, and is considered the most important function of the SS<sup>10,11</sup>.

The bilateral pattern of mastication is the ideal condition for the functional harmony of the SS components, and is considered the model for normality<sup>3,7,11</sup>.

From a functional point of view, the facial and mastication muscles act synergically. During mastication, various muscle groups are coordinately contracted, with an obvious emphasis to the mastication muscles, followed by the tongue and facial muscles, specially the buccinator muscle and the orbicular muscle of the lips<sup>3,12</sup>. The morphofunctional harmony of the SS presupposes the balance among its basic physiological components and the performance of their functions with maximum efficiency. Any neuromuscular changes will lead to functional disruption of the system<sup>9, 13, 14</sup>.

Among individuals with Peripheral Facial Paralysis (PFP), the paralyzed hemiface leads to unilateral mastication, in the non-affected side<sup>13, 15</sup>. The containment of food between the dental arches is jeopardized by the inefficiency of the buccinator muscle and by the labial incompetence, which is a consequence of the flaccidity present in the affected hemiface<sup>3, 5, 12</sup>.

The lips, turned to the normal side and with little occlusion strength, determine the decrease of intra-oral pressure, altering the balance among the structures, lips, cheeks, palate and tongue<sup>15-17</sup>.

With the orofacial muscle tonus jeopardized, there will be extra-oral escape, difficulty in liquid ingestion and impairment of the masticatory function<sup>12-14, 17-20</sup>.

The patient develops individualized adaptations to feed<sup>13,19</sup>.

In this research, the characteristics of the mastication, oral phase of deglutition and possible functional adaptations used by patients with PFP to compensate for their limitations were studied.

## ■ METHOD

This is a transversal study, of a descriptive character, developed by the Cranium Base and Facial Paralysis Ambulatory of the Hospital das Clínicas from the Faculdade de Ciências Médicas in the Universidade Estadual de Campinas, UNICAMP.

Inclusion criteria:

- Individuals aged between 10 to 60 years, with House-Brackmann (HB) PFP IV.

- At most 30 days history, and etiology differentiation
  - Have all teeth in good conservation conditions.
- Exclusion criteria:
- Patients with neurological alterations related to deglutition.
  - Absence of dental elements.

30 individuals, who fulfilled the criteria for inclusion, were selected, and divided into three groups, according to time of paralysis onset: from 1 to 10 days, 11 to 20 days, 21 to 30 days.

After that, they were examined by the medical staff and classified as to the degree of paralysis according to the HB scale.

This research was made up by a clinical assessment and a questionnaire where the subjects could answer questions and where the examiner could observe the functional difficulties (Picture 1).

The questionnaire, based in complaints which were previously reported by patients treated in the Facial Paralysis Ambulatory from the Hospital das Clínicas in the Universidade Estadual de Campinas – UNICAMP was only given to the subjects after our assessment, thus avoiding that the patient be influenced by its questions and inhibit spontaneous behavior during the exam.

During the clinical assessment, the mastication function and the oral phase of deglutition were recorded and evaluated by the speech therapist, using solid food and natural water. The patients were instructed to chew normally, as they do at home. They were not oriented, neither received suggestions during the assessment, thus avoiding changes in their normal behavior.

The following protocol was used:

1. The patient was seated in a chair, with both feet fully touching the ground.
2. 1/5 of a cereal bar, weighing 25 grams was offered and the subject was oriented to eat normally.
3. The procedure was repeated.
4. After that, a glass of natural water was offered, to be drunk normally.
5. Assessment of the recorded material, focusing in the difficulties found and in the compensatory behaviors.

After that, the questionnaire was given, with questions related to the difficulties met by the patient to eat at home and at the moment of the clinical assessment.

This research was evaluated and approved by the Research Ethics Committee from the Faculdade de Ciências Médicas in UNICAMP, under number

	YES	NO
Chews on the paralyzed side?		
Slower mastication on the paralyzed side?		
Lack of strength to chew on the paralyzed side?		
Fatigue while chewing on the paralyzed side?		
Lips occluded during mastication?		
Accumulation of food between the teeth and gums on the paralyzed side?		
Chews on cheeks or lips?		
Difficulties to apprehend the glass between the lips?		
Spills liquid while drinking?		
Does not retain saliva?		
Other signs		

**Picture 1 – Protocol used with subjects with PFP related to the functional difficulties encountered to eat at home and during the clinical assessment**

291/2007, and was considered free of risks and a formal and informed consent was necessary.

In order to verify possible differences among the three groups when compared concomitantly as to the variables under study, the Likelihood Ratio Test was applied:

The level of significance was 5% (0.050), for the application of statistical tests, that is, when the calculated significance (p) was less than 5% (0.050), a difference or a statistically significant relation was observed. In order to check the level of association among the subjects and the speech therapist, for each of the variables under study, the Fisher Exact Test was applied. A the calculated significance value (p) equal or higher than 5% (0.050) represents a difference or a “statistically non-significant” relation. Thus, in this case, differences between the subject and the speech therapist will be found when  $p > 0.050$ .

■ **RESULTS**

The characterization of the sample containing the PFP onset time, age, gender, and etiology of the subjects who were studied are presented in Table 1.

The frequency distribution with its respective percentiles of functional alterations as reported by the subjects with PFP from the three groups is presented in Table 2. When the results from the three groups are compared, it was possible to note the existence of alterations, but according to the Ratio Likelihood test, time is not a relevant

factor, since the alterations remain the same in relation to it.

The distribution of frequency with its respective percentiles of functional alterations as was observed by the speech therapist in subjects with PFP from the three groups while they were eating are shown in table 3. According to the Likelihood Ratio test, there was a statistically significant alteration in variable “spill liquid while drinking” among the groups of 11 to 20 days and 21 to 30 days in the comparison of the observations made by the speech therapist for the three groups studied, among which, the subjects of the last group were the ones who presented the most difficulty in this item.

When comparing the answer of the subjects per groups and the observation of the speech therapist, there was a statistically significant difference in variable “accumulate food between teeth and gums on the paralyzed side” for the groups of 11 to 20 days, which was observed both by the speech therapist and the subjects.

In the comparison of functional alterations referred to by the subjects with PFP and the observation of the speech therapist per group, shown in table 4, there was no statistically significant relation in the following variables:

For the 11 to 20 days group, “chew on the paralyzed side”, “difficulty to apprehend the glass between lips” and “lips turn to the paralyzed side.”

For the 21 to 30 days groups, “accumulate food between teeth and gums on the paralyzed side” and “no retention of saliva”.

Table 1 – characterization of the population under study according to gender, age and etiology

Time of PFP onset	age (in years)	gender	etiology
01 to 10 d	11	F	BELL
	36	F	BELL
	54	F	BELL
	60	M	BELL
	19	M	TRAUMA
	23	F	BELL
	10	F	BELL
	28	M	BELL
	30	M	BELL
	34	M	BELL
11 to 20 d	56	F	BELL
	10	F	BELL
	11	M	BELL
	60	F	BELL
	13	F	BELL
	45	F	BELL
	34	F	TU
	45	F	ZOSTER
	58	M	TU
31	F	ZOSTER	
21 to 30 d	60	F	BELL
	33	M	TRAUMA
	29	F	BELL
	28	M	TU
	13	M	TRAUMA
	42	F	BELL
	44	F	TU
	17	F	BELL
	22	M	TRAUMA
	56	M	TRAUMA

Legend:

d: days

F: female

M: MALE

TU: Tumor extrinsic to facial nerve

**Table 2 – distribution of frequency (in %) with its respective percentiles of the functional alterations reported by the subjects with PFP in the three groups according to the categories analyzed**

<b>Time</b>	<b>n=10</b>	<b>n=10</b>	<b>n=10</b>	
<b>Alterations (%)</b>	<b>1 to 10d</b>	<b>11 to 20 d</b>	<b>21 to 30 d</b>	
Chews on the PS	40	50	70	0.384
Slower Mastication on the PS	80	80	80	0.999
Lack of strength to chew on the PS	20	60	40	0.178
Fatigue when chewing on PS	50	30	30	0.568
Lips are occluded during mastication	40	50	50	0.874
Lips are turned to the healthy side during mastication	50	50	60	0.874
Accumulation of food between the teeth and gums in the PS	80	90	70	0.523
Bites cheeks or lips	50	60	40	0.669
Difficulties to apprehend the glass between the lips	80	70	60	0.617
Spills liquid while drinking	70	70	70	0.999
Does not retain saliva	20	40	30	0.617
Other signs	20	20	10	0.773

Legend: PFP: peripheral facial paralysis

d: days

PS: paralyzed side

Statistical Test: Likelihood Ratio Test – Significance level of 5% (0.050).

(p) < 5% (0,050) = statistically significant difference.

**Table 3 – Distribution in frequency (in %) with its respective percentiles of the functional alterations as observed by the speech therapist in subjects with PFP in the three groups while they ate according to the categories analyzed**

<b>Time</b>	<b>n=10</b>	<b>n=10</b>	<b>n=10</b>	
<b>Alterations (%)</b>	<b>1 to 10d</b>	<b>11 to 20 d</b>	<b>21 to 30 d</b>	
Chews on the PS	60	70	40	0.384
Slower Mastication on the PS	80	40	40	0.104
Lack of strength to chew on the PS	30	10	10	0.404
Fatigue when chewing on PS	40	30	10	0.270
Lips are occluded during mastication	10	20	30	0.523
Lips are turned to the healthy side during mastication	70	70	60	0.862
Accumulation of food between the teeth and gums in the PS	70	90	80	0.523
Bites cheeks or lips	10	10	10	0.999
Difficulties to apprehend the glass between the lips	90	60	60	0.199
Spills liquid while drinking	20	00	60	0.003
Does not retain saliva	20	00	20	0.170
Other signs	00	00	00	0.999

Legend: PFP: peripheral facial paralysis

d: days

PS: paralyzed side

Statistical test: Likelihood Ratio Test – Significance level of 5% (0.050).

(p) < 5% (0,050) = statistically significant difference.

**Table 4 – Comparison among the functional alterations reported by the subjects with PFP and the speech therapist's observation – group study – p's significance**

	1 to 10d	11 to 20 d	21 to 30 d
Chews on the Paralyzed test	-----	0.083	-----
Accumulation of food between teeth and gum on the paralyzed side	-----	-----	0.067
Difficulty to apprehend the glass between the lips	-----	-----	0.067
	-----	0.083	-----

Application of Fisher Exact test, differences between the subject and the speech therapist, when  $p > 0.050$

## ■ DISCUSSION

People diagnosed with PFP are referred to Speech Therapy with the objective of maintaining the tonus and facilitating the function of the orofacial muscles.

Among the complaints presented, the difficulties related to feeding are constant and vary from patient to patient. In the literature consulted for this research, descriptions of the signs and symptoms of PFP and the therapeutic proposals are found, but few studies emphasize the difficulties to eat and drink.

In this research, the mastication difficulties during the oral phase of deglutition, and the adaptations developed to eat were studied.

Regardless of the severity of the paralysis, individuals with PFP present many functional problems immediately after the onset of the paralysis<sup>19</sup>.

It was possible to observe that in the first 10 days, subjects with PFP, still under the impact caused by the PFP in the impairment of facial expressions, do not notice or cannot be precise about the alterations related to feeding. The loss of voluntary movements and orofacial tonus causes difficulties in the feeding process<sup>12,17</sup>.

The majority of the subjects in this study (60%) does not spontaneously report chewing on the paralyzed side, saying that mastication is slower, with food accumulating in the lateral vestibule in the paralyzed side. The maintenance of food between the dental arches is jeopardized due to the flaccidity and to the non-participation of the buccinator muscle and as a consequence, it is difficult to chew on the paralyzed side<sup>11</sup>.

During the functional clinic assessment, in the same period, the same signs reported above by the subjects were observed.

The neuromuscular functional synergy of the mastication, facial, tongue and palate muscles, necessary for feeding, is disorganized in the PFP<sup>9,17</sup>. Mastication is done in slow and inconsistent cycles, probably due to the difficulty in the

coordinated contraction of the mandible, cheeks and lips movement.

Different from what was reported by the subjects, in the clinical assessment, 60% of them chewed on the paralyzed side, needing manual support to remove the residues which were retained together with increased tongue movement to clean the oral vestibule of the paralyzed side.

In the initial stage of PFP, with flaccid muscles on the side of the paralysis, the subjects cannot chew or avoid chewing in this side, because of the accumulation of food, due to a deficiency of the buccinator muscle<sup>13</sup>.

In the first 10 days, some subjects do not report or do not notice, during mastication, the lips slightly opened and turned to the non-paralyzed side, allowing the visualization of the bolus in the oral cavity, as was observed in the clinical assessment.

The duration and amplitude of the movements of the facial muscles are influenced by the mastication cycles and by the contact of the upper and lower lips<sup>3</sup>. The actions of the buccinator and orbicular muscles of the mouth are fundamental to the mastication efficiency. Therefore, in the cases with PHP, the mastication efficiency is impaired by the functional inadequacy of these muscles.

Studies show that patients with PFP prefer to chew on the healthy side. Electromyographic data demonstrate that the conditions of the mouth orbiculars is not a factor that influences the mastication preference. What does influence is the lack of activity in the buccinator muscle<sup>3</sup>.

The patients reported a difficulty in apprehending the glass between the lips, spilling liquid while they drank. The reduction of the labial occlusion strength implicates in the decrease of the intra-oral pressure, and, due to this, retention of liquids in the oral cavity<sup>2,16,17</sup>.

In the clinical assessment, the subjects supported the glass on the lip in the healthy side of the face, without spilling liquid, since they drank the liquid little by little, pausing between each drink.

This would already be an adaptation of the patient in relation to liquid ingestion.

The subjects with PFP from 11 to 20 days reported the same signs as the previous group, plus bites on the internal part of the cheeks during mastication and a lack of strength to chew. It is believed that trying to chew at the same pace as before the PFP increases the likelihood of biting the internal part of the cheeks, due to the absence of movement or little participation of the buccinator muscle during mastication.

Electromyographic studies during mastication, carried out in subjects with PFP, show that there is no statistically significant difference between the masseter muscles in the healthy side and in the side with PFP<sup>3</sup>. This way, the lack of strength seems to be related to the difficulty in maintaining the synergism between the mastication muscles and the facial muscles, which determines synchronized movements of the mandible and the maintenance of the food on the teeth for crushing.

This group with PFP from 11 to 20 days did not present statistically significant differences for the variables "chew on the paralyzed side", "lip deviation", "apprehension difficulty", coinciding the perception of the subjects with that of the speech therapist. It is understood that, because they have the face paralyzed for more than 10 days, they could identify more precisely the difficulties found for eating.

The subjects which presented PFP from 21 to 30 days, besides the symptoms reported by the previous groups, also reported chewing on the paralyzed side, but with slow mastication cycles. They notice the lips turning to the non-paralyzed side (60%), and that they are not sealed during mastication (50%). They report difficulties to apprehend the glass between the lips and reported having spilled liquid while they were drinking. This last item was a statistically significant datum in the comparison among the three groups in the clinical assessment.

The accumulation of food in the lateral vestibule and the non-retention of saliva did not present a statistically significant relation, and this was reported both by the patients as it was observed in the clinical assessment. In this group there were four cases of PFP due to trauma and four due to tumor extrinsic to the face nerve and a possible difference between

these patients and the patients with Bell's PFP may have determined stronger signs.

When comparing the three groups in relation to time, it was possible to notice that the signs and symptoms did not alter. Therefore, time is not a relevant factor. Initially bothered, the subjects progressively develop adaptations in order to be able to eat.

Even with difficulties, the subjects with PFP chew on the paralyzed side, and the sign which mostly bothers them is the retention of food in the vestibule, with or without biting the cheeks. The subjects are aware that they eat and drink slower. They develop adaptations such as decrease the quantity of food and ingest smaller portions, prefer foods of a creamy consistency and use manual support to remove residues. They drink supporting the glass on the non-affected side, drinking little by little or using a straw.

As in most cases of Bell's Paralysis a spontaneous recuperation occurs, it would be interesting to study the alterations in the orofacial muscles in the paralysis occurring from other etiologies. Since they remain a longer period in the flaccid stage, and due to a incomplete recovery in many cases, the best developed adaptations while eating could be observed.

In this research, the subjective examination of the speech therapist and the individual report of each subject with PFP were used. Maybe it could be interesting to go after objective examinations, such as the surface electromyography to characterize the oral motor disturbances in the alterations of the mastication, deglutition and speech in patients with facial paralysis<sup>3,17</sup>.

## ■ CONCLUSION

The subjects chew on the paralyzed side more difficultly, presenting slow and inconsistent mastication cycles, associated with movements of the tongue to remove residues in the oral vestibule. They find it difficult to drink in a continuous manner and search for individualized adaptations, aware or not that they try to compensate for their functional difficulties.

**RESUMO**

**Objetivo:** caracterizar mastigação, fase oral da deglutição e possíveis adaptações funcionais observadas nos portadores de Paralisia Facial Periférica. **Método:** participaram desta pesquisa 30 indivíduos com Paralisia Facial Periférica grau IV, com história de até 30 dias, sem distinção de etiologia e divididos em três grupos, os que apresentavam a paralisia em até 10 dias, de 11 a 20 e de 20 a 30 dias. As funções mastigação e fase oral da deglutição foram avaliadas tanto com alimento sólido e como com água natural. Os indivíduos responderam questões relacionadas às dificuldades imediatamente após a instalação da paralisia. Os dados foram analisados estatisticamente pelo Teste da Razão de Verossimilhança e pelo Teste Exato de Fisher. **Resultados:** foram constatadas alterações nas funções de mastigação e fase oral da deglutição pela diminuição do tônus no músculo orbicular dos lábios e do músculo bucinador, que diminuindo a pressão intra-oral, favorece o escape de alimento e líquido. À observação da Fonoaudióloga a variável “derrama líquido enquanto bebe” apresentou dados estatisticamente significante ( $p=0,003$ ) nos três grupos estudados. A variável “acúmulo de alimento entre os dentes e a gengiva no lado paralisado” foi estatisticamente significante nos grupos de 11 a 20 dias ( $p=0,002$ ). **Conclusão:** os indivíduos da amostra mastigam no lado paralisado com dificuldade, mediante ciclos mastigatórios lentos e inconsistentes. Ocorre um incremento nos movimentos de língua para limpeza de resíduos retidos no vestíbulo oral no lado paralisado. Este é o sintoma que mais incomoda o paciente. Apresentam dificuldade no beber de forma contínua. Desenvolvem adaptações para compensar suas dificuldades funcionais.

**DESCRITORES:** Paralisia Facial; Mastigação; Deglutição; Músculos Faciais; Reabilitação

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