

## Exploration of chewing: The functional masticating angles of planas FMAPs

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### Abstract

The most important aspect in the exploration of mastication is the possibility that the patient can easily move the mandible to both sides. The chewing capacity must be the same on both sides. Although this laterality movement is not functional in itself, it is nevertheless the one that best imitates the masticatory functional situation.

The key element of the study of mastication is the examination of the functional masticatory angles of Planas (FMAPs).

We compared the results of this examination in 15 patients with the results of electromyographic recording of the activity of the masseter and anterior temporal muscles during food chewing in order to assess the reliability of FMAPs in the exploration of chewing function.

We found that the electromyographic activity of the above-named muscles is higher on the side of the smallest FMAP or on the side usually used by the patient for chewing, thus confirming the reliability of Planas FMAPs.

**Keywords:** Function of mastication; Functional masticatory angles of Planas (FMAPs); Electromyographic recording

### 1. Introduction

The purpose of chewing is to crush, triturate food and mix it with saliva so that, through swallowing, it can be transported through the digestive tract.

Many authors <sup>1,2,3,4,5</sup> recognize the important role played by chewing in craniofacial development.

The experiences on animals <sup>6,7,8,9,10</sup> and numerous clinical studies have shown that the forces delivered by the masticatory muscles during masticatory function stimulate bone apposition and sutural growth in the jaws and alveolar processes

Any functional deficit (decreased masticatory capacity) can have repercussions on the growth of the jaws and be the cause of the appearance of certain malocclusions.

Several studies <sup>11,12,13,14,15,16,17</sup> have been carried out to compare masticatory performance in subjects with balanced occlusion and others with class I and class II malocclusions. It emerged that children with normal occlusion had better masticatory performance than children with class I and class II malocclusions. These studies have also shown an alteration of masticatory cycles.

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Assessing the quality of occlusal balance and mastication is a crucial part of the orthodontic examination. In other words, our intellectual approach when caring for a patient must take into account:

- The morphogenic influence of mastication which leads to linking the shape of the arch and the occlusal organization to the function.
- The meaning of the results found during the exploration of mastication.

Different means are used to study masticatory movements, direct observation of the incisal point or the chin, graphic records <sup>4, 18</sup>, photographic <sup>19</sup>, radiographic, electronic and electromagnetic. More recently, cinefluorography and videofluorography <sup>20</sup> have made it possible to better understand lingual movements during mastication.

These recording methods require equipment that is not always available, moreover they are relatively time-consuming, and often difficult to implement in young children.

This is why we have chosen the exploration method of Pedro Planas <sup>1, 19, 21</sup> which does not require any particular instrumentation and which is quick to perform.

The latter had the great merit of having observed and studied human mastication, of having described its semiology and of having observed the existence of biological constants.

Occlusal and masticatory function can be studied by observing dental contacts in right and left laterality movements (functional masticatory angles of Planas or FMAPs).

In this work we propose to explain the method of exploration of mastication of Planas and to compare the results with those obtained with the examination of the bioelectric activity of the masseter and anterior temporal muscles during mastication. This is in order to show the reliability of FMAPs in the exploration of mastication function.

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## 2. Material and methods

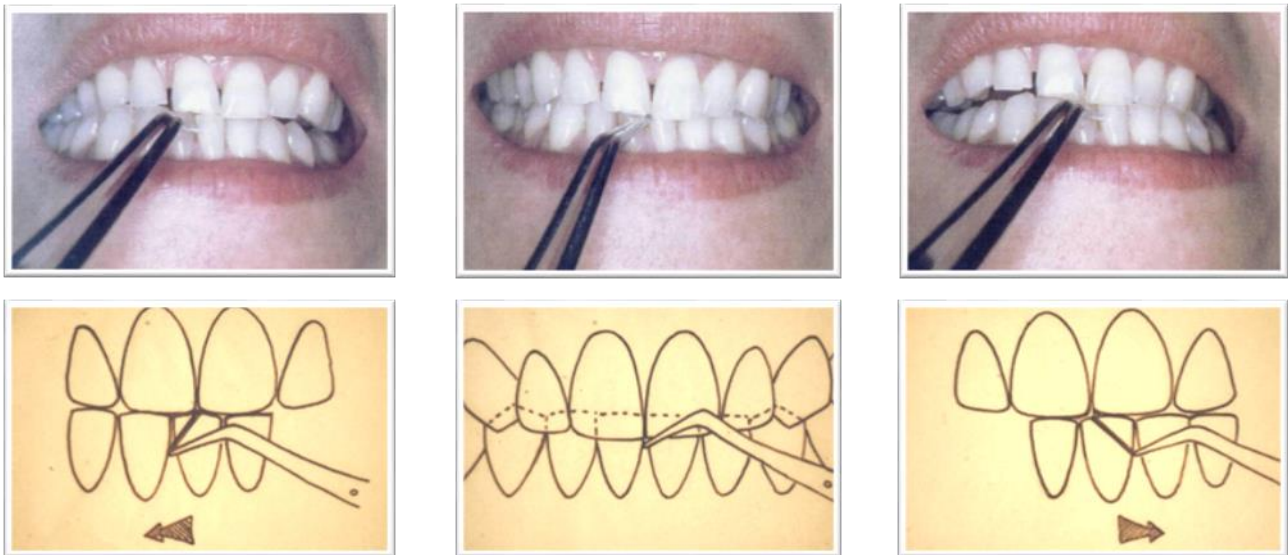
Fifteen patients were selected from the orthodontic department of the Blida University Hospital. All had malocclusions and masticatory problems. A complete orthodontic assessment was established for each patient. The informed consents duly signed by the legal guardians were retrieved.

The masticatory capacity of these subjects was assessed before orthodontic treatment.

The semiology <sup>21</sup> of the chewing function is based on the examination of the functional masticatory angles of Planas (FMAPs). Starting from the position of maximum intercuspitation, the FMAP is the angle formed, in the frontal plane, by the horizontal and the line, more or less oblique, materializing the displacement of the lower inter-incisal point during mandibular laterality movements.

Although various devices have been devised to facilitate the precise determination of FMAP, in the clinic, one can proceed quite simply as follows:

- The subject being in occlusion, use the point of a pair of tweezers to locate the lower inter-incisor point at its junction with the line of the free edge of the upper incisors.
- Without letting go of the tweezers, carefully observe the path described by this point when the patient performs lateral movements to the right and then to the left.
- By holding the tweezers allows us to “feel” the trajectory. Indeed, the fingers will eventually feel, through the tweezers, jumps which are in fact the witness of possible occlusal interferences.
- It is also necessary to observe whether the path is straight or, on the contrary, whether it makes a series of curves, another indicator of interference during the laterality movement.



**Figure 1** Visualization of FMAPs using tweezers <sup>21</sup>

This simple but fairly detailed clinical examination requires training that the practitioner must carry out from his own experience.

Carefully carried out, this exploration provides us with precise and valuable information on the ability and masticatory capacity of our patients.

The value of these FMAP makes it possible to determine whether there is, for example, a preferred side of chewing or, on the contrary, the patient chews alternately on both sides.

Normally, in the case of balanced and alternating mastication, the FMAPs are equal and decrease together with time with the physiological abrasion of the teeth.

A difference between the right and left FMAP indicates dominant unilateral mastication on the side of the smallest angle.

Planas explains the prevalence of cycles on the side of the smallest AFMP by what he calls the law of minimum vertical dimension which favors chewing on the side where the lowering of the mandible is less when gripping the food bolus by the mandible.

We carried out the examination of the AFMPs as we have just described it, in the 15 selected patients.

Once the AFMPs examination was performed, the same patients have benefited from an electromyographic examination to observe the activity of the masseters and the anterior temporals, on each side, during masticatory movements.

The electromyogram <sup>22,23,24</sup>, also called electroneuromyogram, aims to analyze nerve impulses in motor nerves, sensory nerves and muscles. It is a test that assesses the functioning of the nerves and muscles.

In practice, the examination consists of recording the electrical activity of the nerves as well as the contraction of a muscle by sticking an electrode on the skin.

The electromyogram used for this work is a bipolar neuro EMG with:

- Two dynamic recording channels and a frequency response of 20 khz during a sweep of 100 milliseconds;
- Integrated acoustic and visual stimulators;
- A microcomputer including all the necessary software, hardware and accessories.



**Figure. 2** A bipolar neuro EMG

The examination is carried out at the hospital, in the neurology department of the university hospital center of Blida, Algeria. The examination, without risk, lasts 30 min.

The graphic recording of the masseter and anterior temporal muscles, on both sides for each patient, was obtained by means of self-adhesive electrodes attached to the skin covering the muscles concerned, following the direction of the muscle fibers detected by palpation.

The impedance to the passage of the current was reduced by scrupulous cleaning of the skin part used, with alcohol at 90°.

To obtain these recordings, each patient was invited to bite into an apple and chew on the right then on the left until the food bolus was swallowed.

The sensors glued to the skin record the electrical activity of the muscle and transcribe it in the form of a graph on the screen.

For all the recordings made, the patient was in a seated position, the Frankfurt plane being practically parallel to the ground. In addition, an effort has been made to create an atmosphere of tranquility and silence.

All recordings were made by the same neurologist.

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### 3. Results

The clinical appreciation of the FMAPs allowed us to study the mastication of each patient. Seven patients showed preferential chewing on the right (fig.3), the other eight showed dominant chewing on the left. None of the 15 patients had symmetrical FMAPs

For the electromyographic examination, the computer makes it possible to obtain a qualitative recording of the frequency spectrum produced by the patient's muscles.

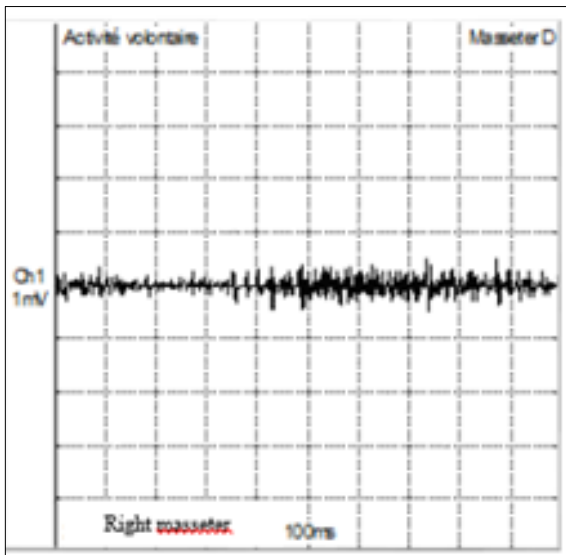
The recording obtained corresponds to the maximum power developed by the muscular system.

In each patient who chewed, a moderate increase in activity was observed for all recorded muscle groups.

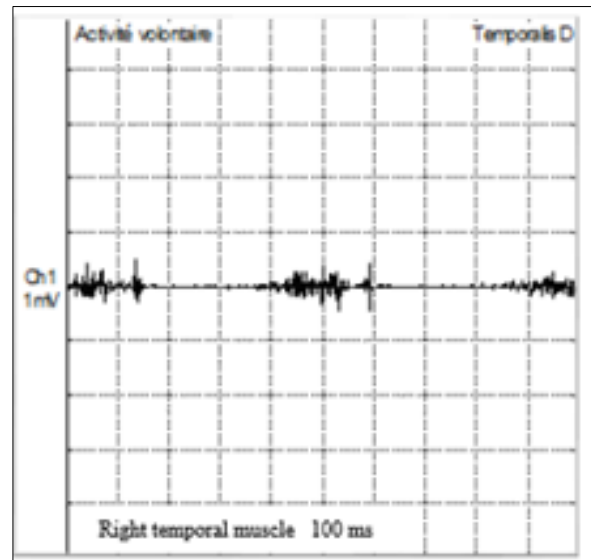
It was also found that the electromyographic activity of these same muscle groups is higher on the side where the FMAP is smaller, in all the subjects examined.



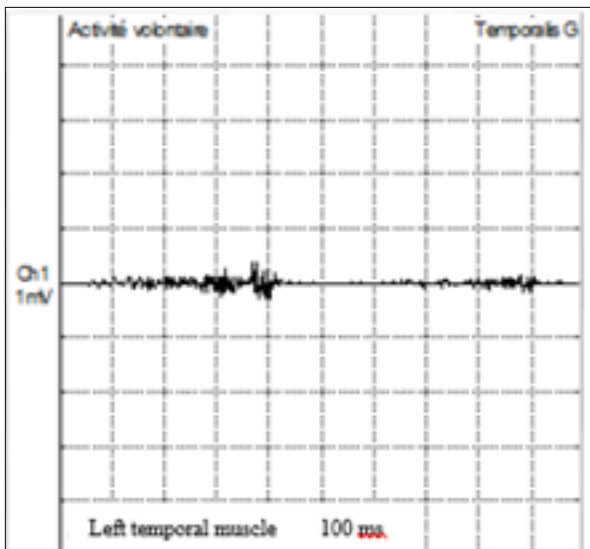
**Figure 3** Yanis, a 10-year-old child with unequal FMAPs and preferential chewing on the right (right FMAP < left FMAP)



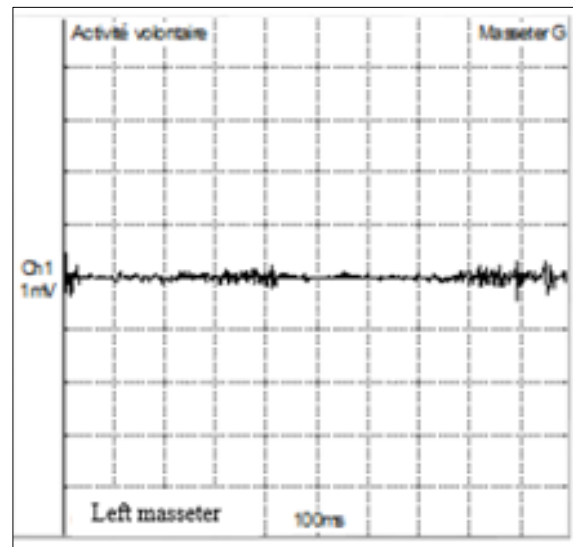
**Figure 4** Graphic recording of the right temporal muscle of Yanis



**Figure 5** Graphic recording of the right masseter of Yanis



**Figure 6** Graphic recording of the left temporal muscle of Yanis.



**Figure 7** Graphic recording of the left masseter muscle of Yanis

#### **4. Discussion**

The aim of our work is to show the reliability of FMAPs in the exploration of mastication function. For this, we compared the results of the method of exploration of the mastication function of Planas (FMAP) with those obtained with the examination of the bioelectric activity of the masseter and anterior temporal muscles during the chewing of a food (apple).

The selected patients all having malocclusion and masticatory dysfunction, none presented symmetrical FMAPs and therefore physiological, unilateral and alternate mastication. They all presented with unequal FMAPs with preferential right or left chewing.

An electromyographic examination of the anterior temporal muscles and the masseter muscles was undertaken in a second time, in all the patients of our study.

Electromyography is the recording of muscle action currents. Indeed, muscle contraction is accompanied by an electrical phenomenon that can be recorded.

When the muscle fibers receive a nerve impulse from the motor neuron with sufficient intensity, a number of electrical changes take place.

This sudden change in polarization determines the action current that is recorded and is reflected on an electromyographic tracing.

When the contraction is mild, it is accompanied by the activity of a limited number of motor units (neuron and muscle fibers to which the terminal arborizations of that neuron are distributed), and EMG recording is relatively straightforward.

The contraction increases with the intensity of the stimulus by recruiting new motor units.

The currents of action are more and more numerous, they overlap and the amplitude of the tracing increases.

In this work, stimulation was induced by chewing a food (apple). Recording of muscle activity was performed on both sides, for each patient.

An increase in bioelectric activity is observed for all recorded muscle groups. This activity is higher on the side of the smallest FMAP, in all the subjects examined, i.e. on the side usually used by the patient for chewing.

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#### **5. Conclusion**

Our study consisted in comparing the results of the exploration of the chewing function by the method described by Planas (FMAP) with those obtained by the electromyographic examination of the anterior masseter and temporal muscles during the chewing function.

The results obtained confirm the reliability of the FMAP examination for the exploration of mastication.

The methods of examining the function of mastication are multiple (as we said previously) but require equipment that is not always available, moreover they are relatively time-consuming, and often difficult to apply in young children.

This is why we offer the clinical observation of Planas which does not require any particular instrumentation, which is quick to perform, reliable and reproducible.

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#### **Compliance with ethical standards**

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*Disclosure of conflict of interest*

I declare that there is no conflict of interest regarding this article

*Statement of ethical approval*

For this study, we used the electromyographic recording made in the hospital as part of complementary examinations.

*Statement of informed consent*

A complete orthodontic assessment was established for each patient. The informed consents duly signed by the legal guardians were retrieved.

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