Irish Society for Disabilities in Oral Health

CHEWING FUNCTION AND HEALTHY EATING

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Irish Society for Disabilities in Oral Health

Ingestion functions according to ICF

Functions of chewing

Teeth and mastication

Teeth and feeding behaviour

Mastication in patients with obesity

International Classification of Functioning,Disability and Health

b510 Ingestion functions

B5101 Sucking Functions of drawing into the mouth by a suction force produced by movements of the cheeks, lips and tongue.

B5101 Biting Functions of cutting into, piercing or tearing of food with the front teeth

B5102 Chewing Functions of crushing, grinding and masticating food with the back teeth (e.g molars)

B5103 Manipulation of food in the mouth

Functions of moving food around the mouth with the teeth and tongue

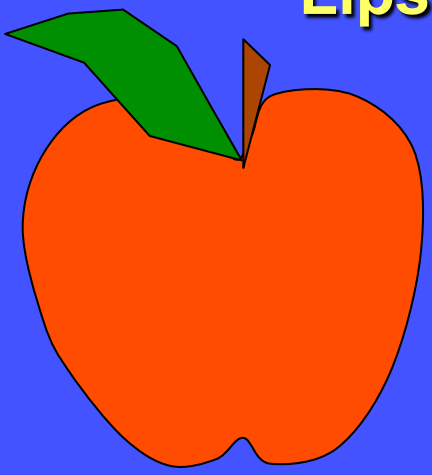
B5104 Salivation Functions of the production of saliva within the mouth

B5105 Swallowing Functions of clearing the food and drink though the oral cavity, pharynx and oesophagus into the stomach at an appropriate rate and speed.

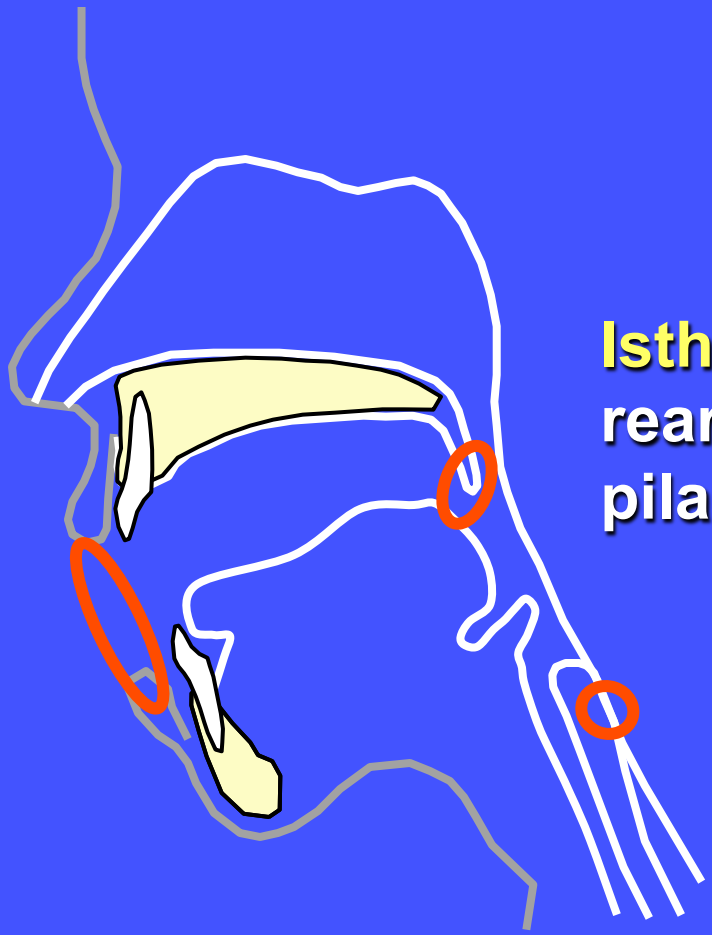
B5105 Regurgitation and vomiting

Functions of moving food or liquid in the reverse direction to ingestion, from stomach to oesophagus to mouth and out.

The food oral process is controlled by 3 sphyncters

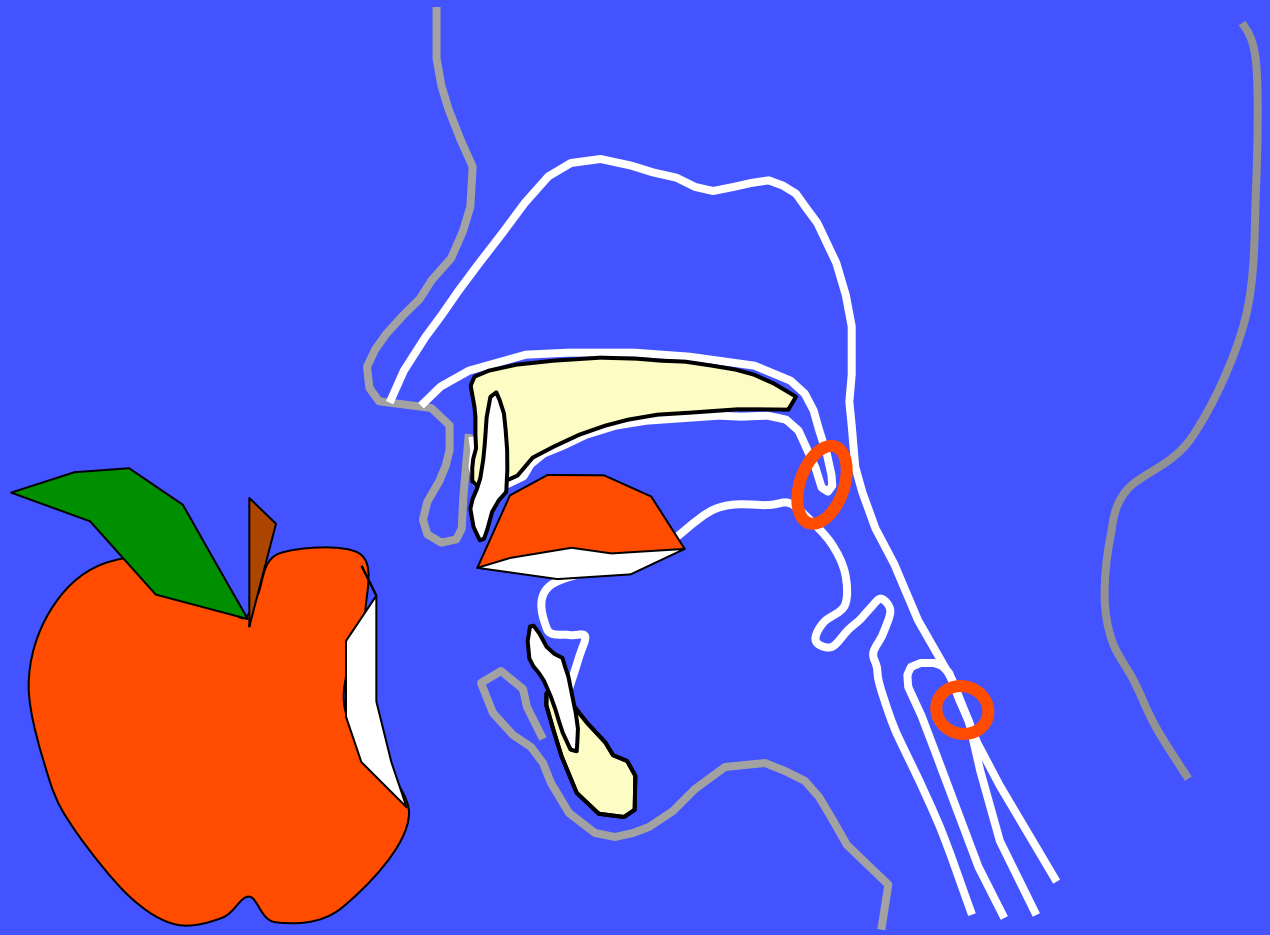


Lips

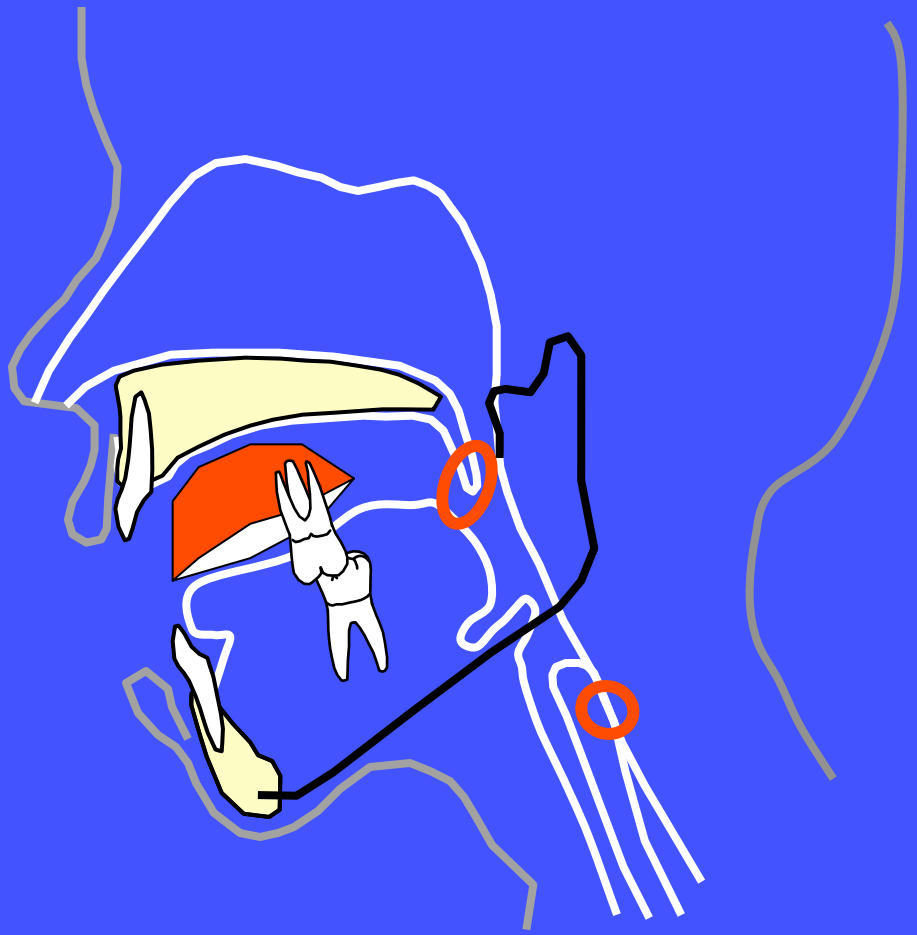


Isthmus (soft palate, rear tongue, lateral pilars of amygdalus)

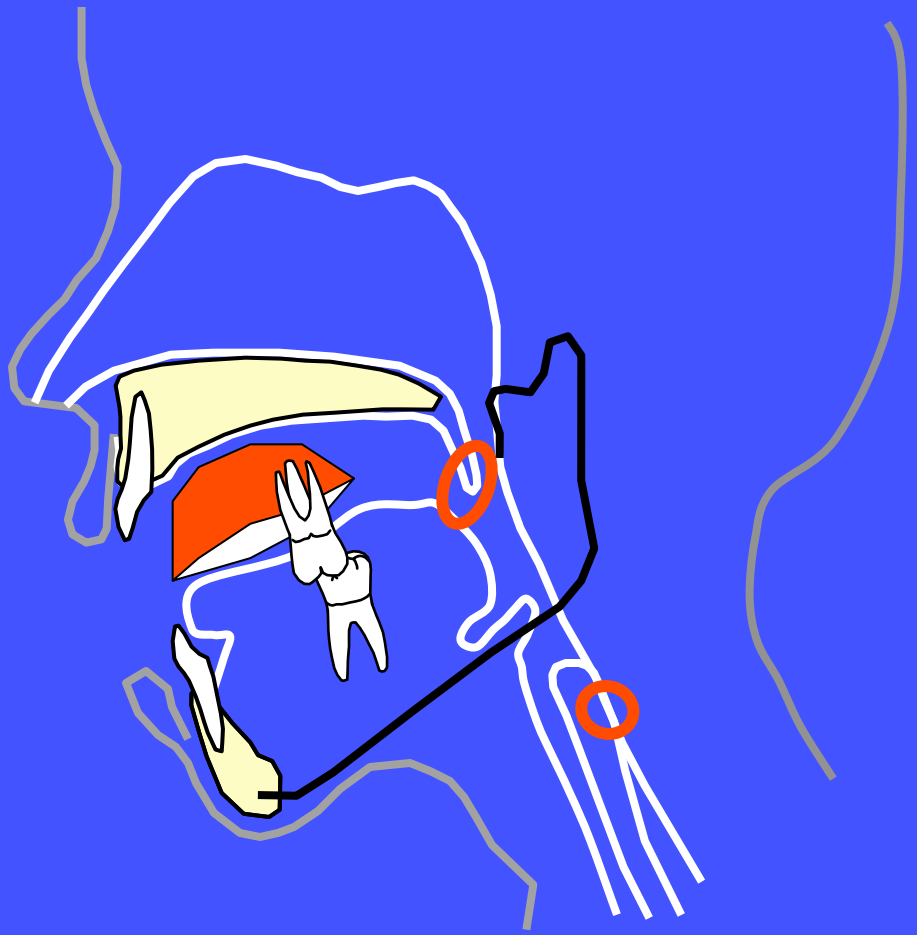
Superior oesophagus sphyncter



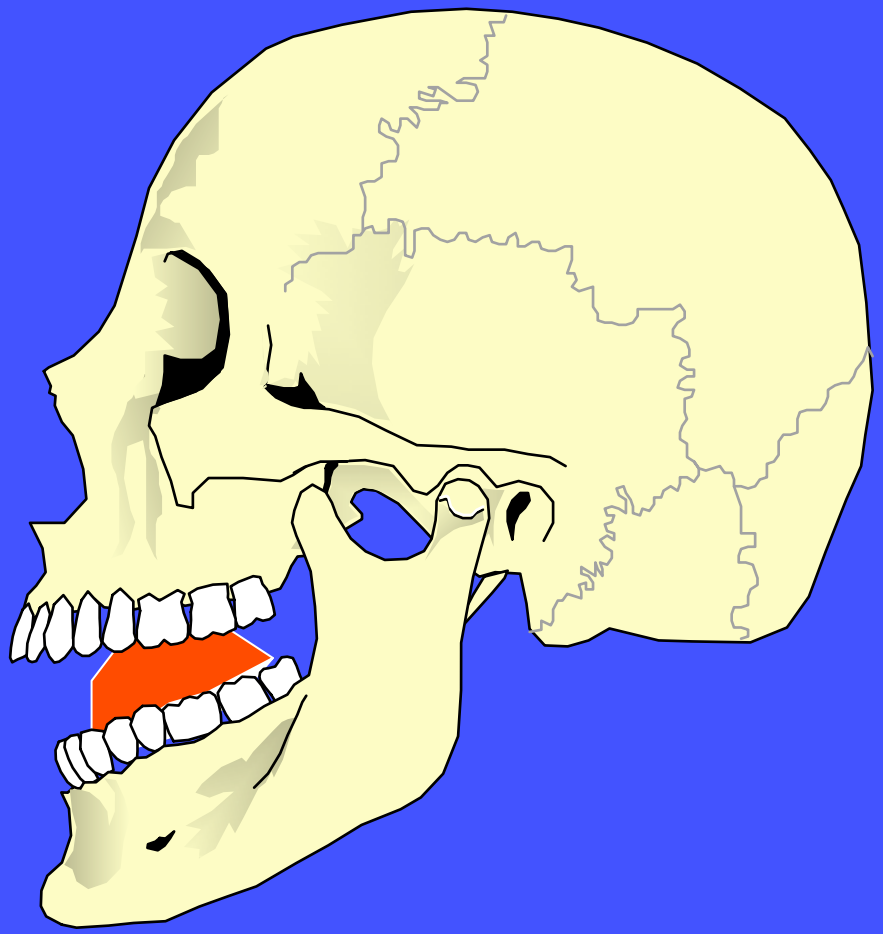
Preparing chewing (positionning the food between the arches , the tongue and the jaw)



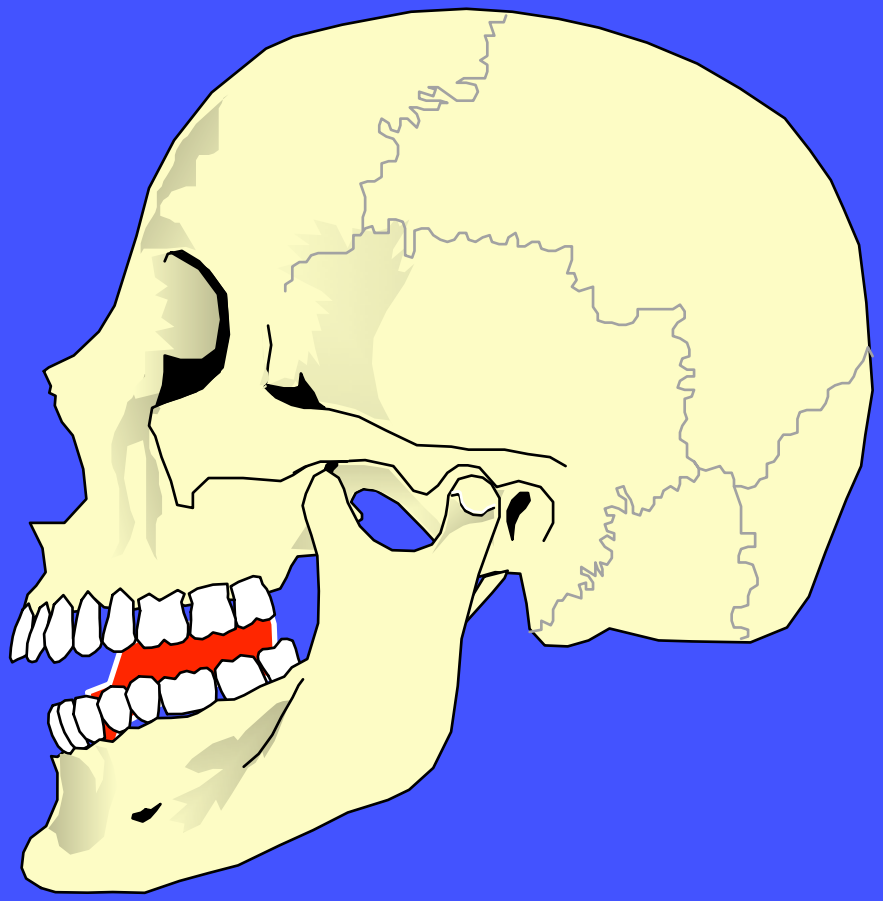
Chewing



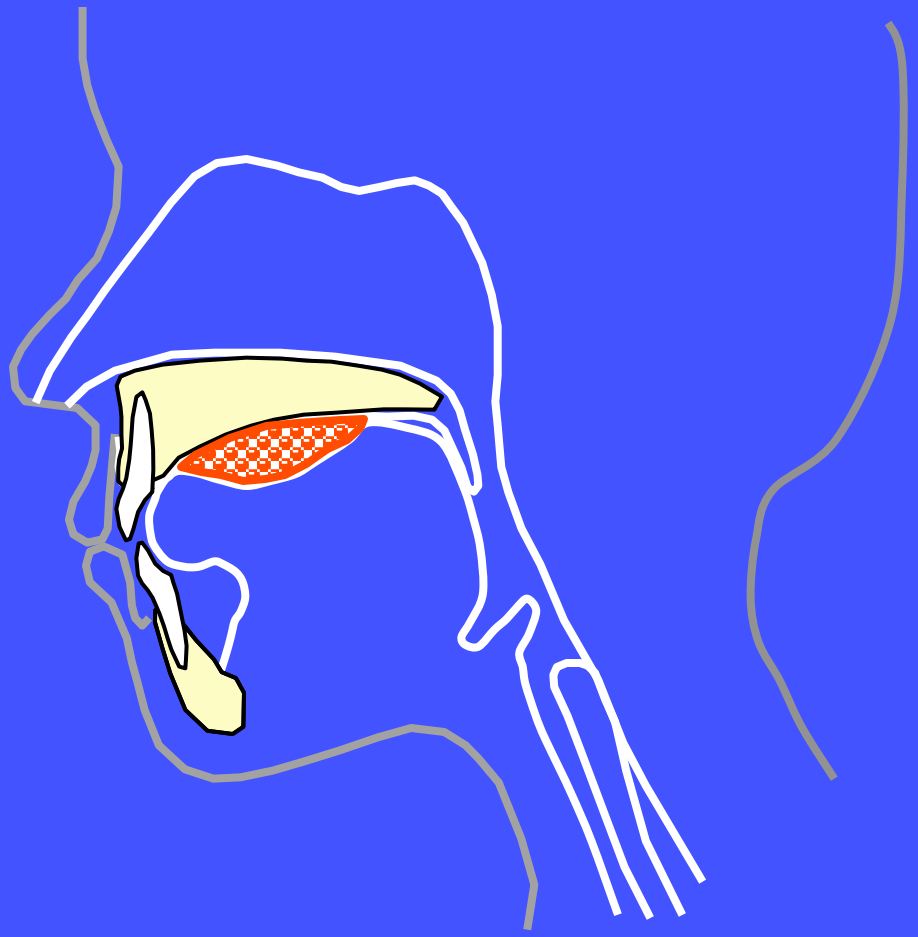
Chewing



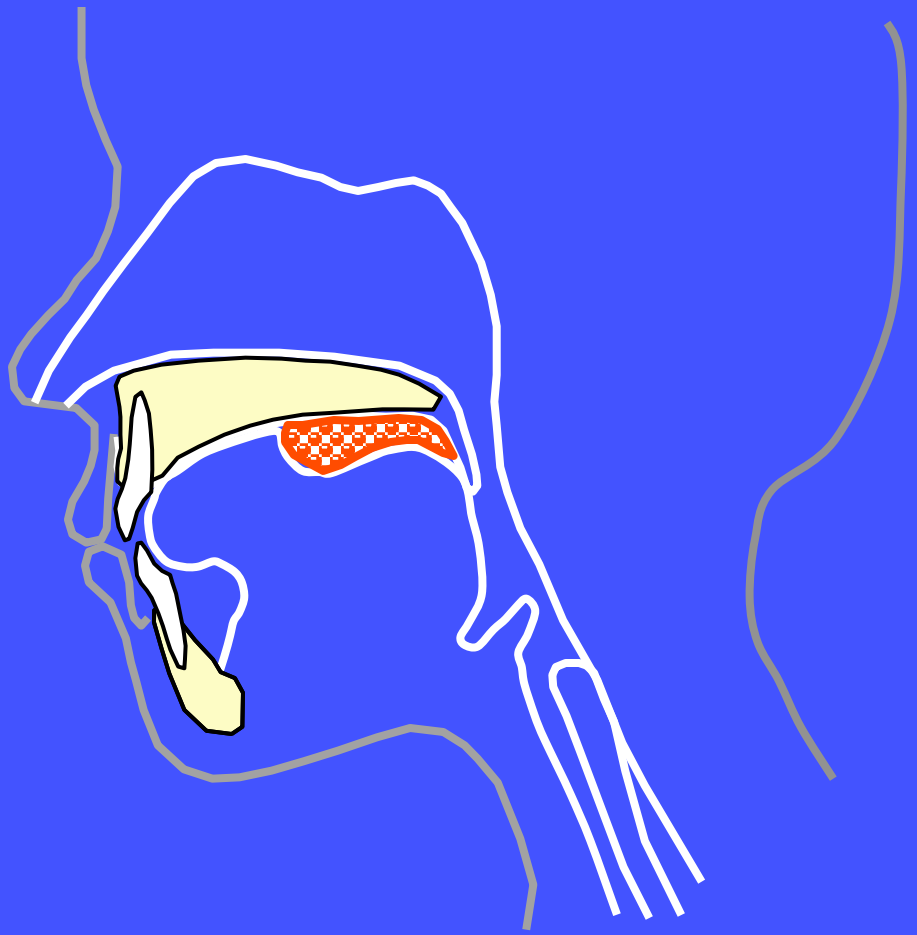
Chewing



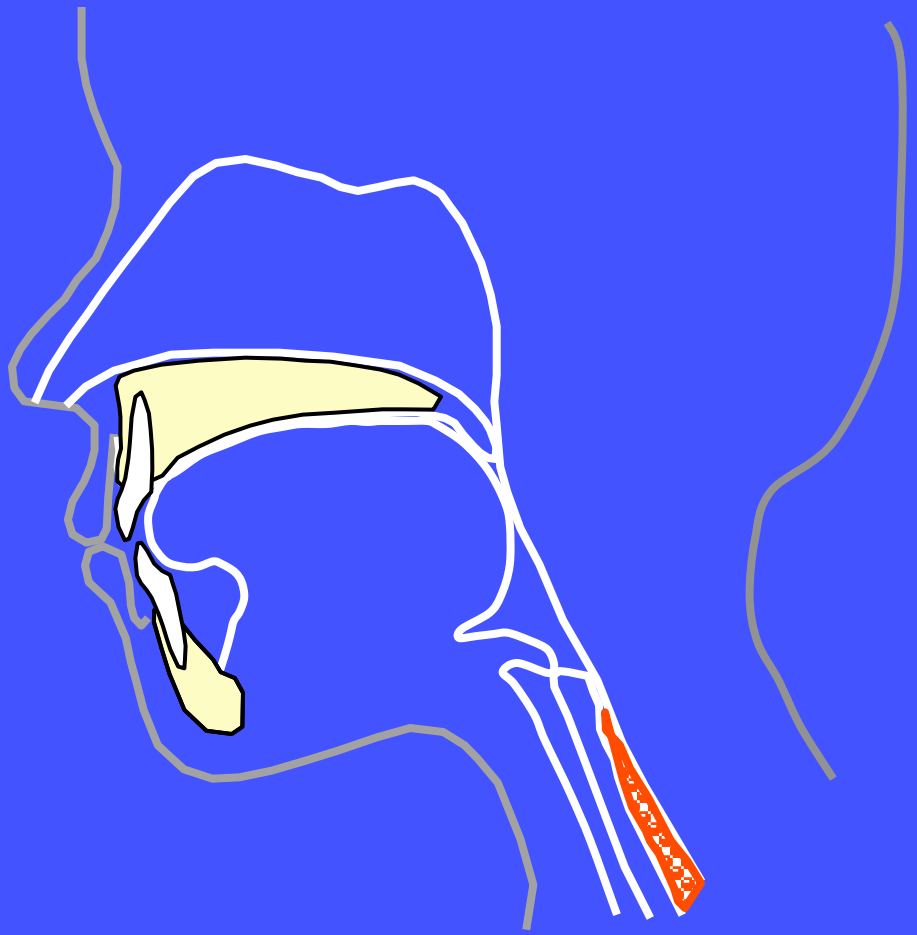
Chewing



Preparing swallowing



Ideal plasticity and cohesivity



Ideal plasticity and cohesivity

Mastication transforms the food into a swallowable bolus, that should have the ideal plasticity and cohesivity to be swallowed safely.

During mastication, the tactal, gustative, or olfactive receptors send sensorial inputs to inform the brain on the food texture and the expected safety of swallowing.

The food can be swallowed, or rejected, or vomited. After a first negative experience, the food would be rejected before being tested in mouth.

Thus all the ingestion functions are inter-dependant

These relationships control the biodisponibility of the nutriments, their absorption and their assimilation

Mastication has direct and indirect metabolic consequences on the digestive process by :

1) reducing the food to small particles

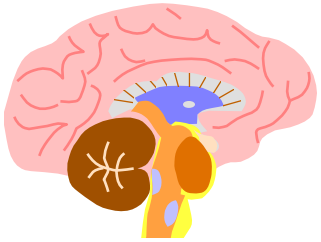
2) stimulating saliva production,

3) mixing saliva and the food to produce a bolus easy to swallow

4) activating the cephalic phase of digestion that is related to the physiological, endocrinal and autonomous reactions of the digestive system and result from the stimulation of the sensory system of the oropharyngeal cavity.

Initiation of the digestive process

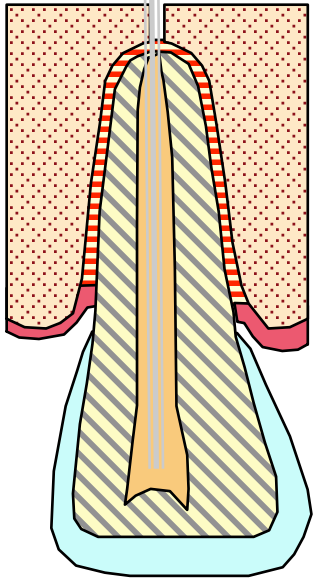
Chemo sensory stimulations



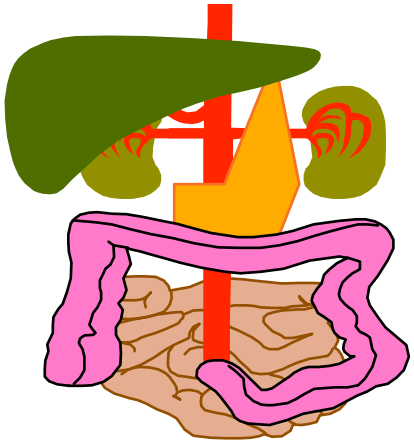
Brain

Anticipatory physiological answers

Periodontal receptors



Digestive system



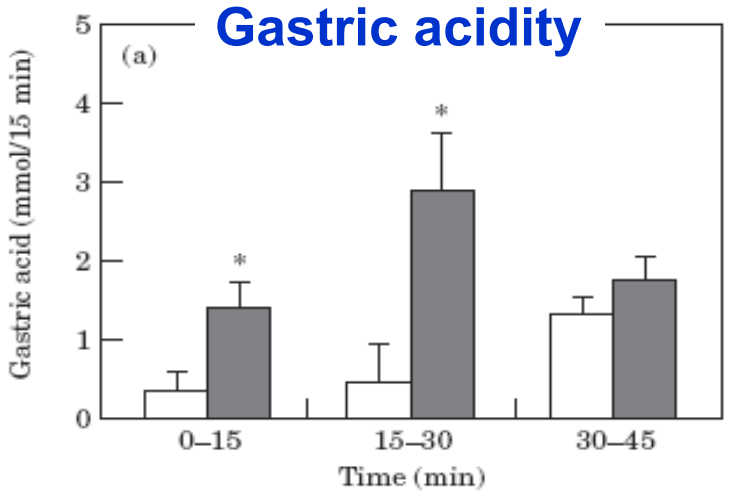
Metabolic activations

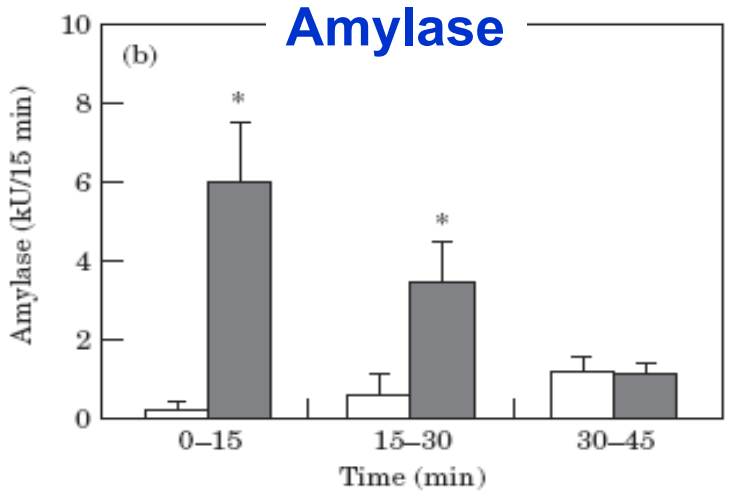
(cephalic phase of the post prandial thermogenesis: 30-40 mn after exposition to food)

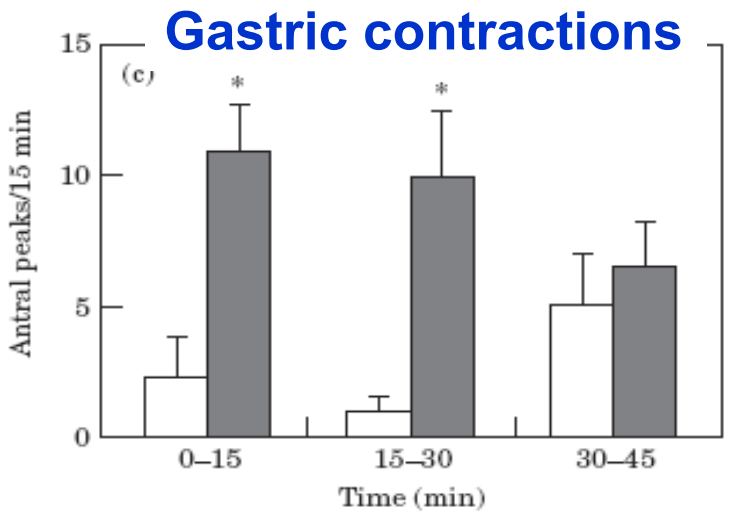
Examples of cephalic phase

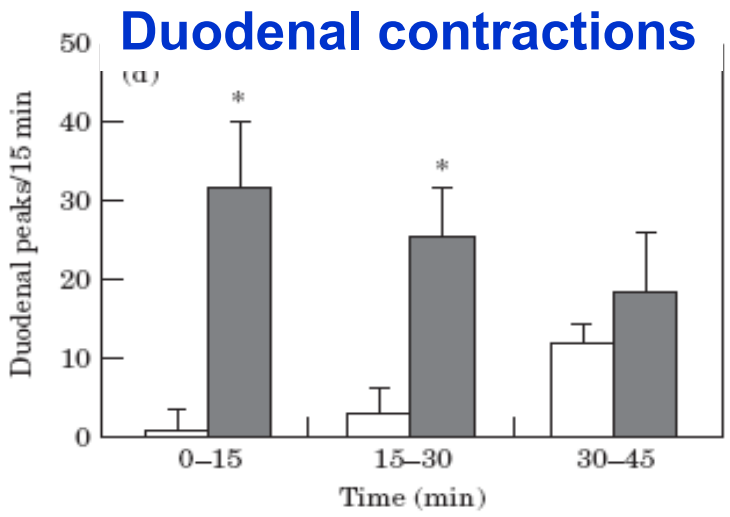
Rest, without sham feeding

sham feeding (meat)







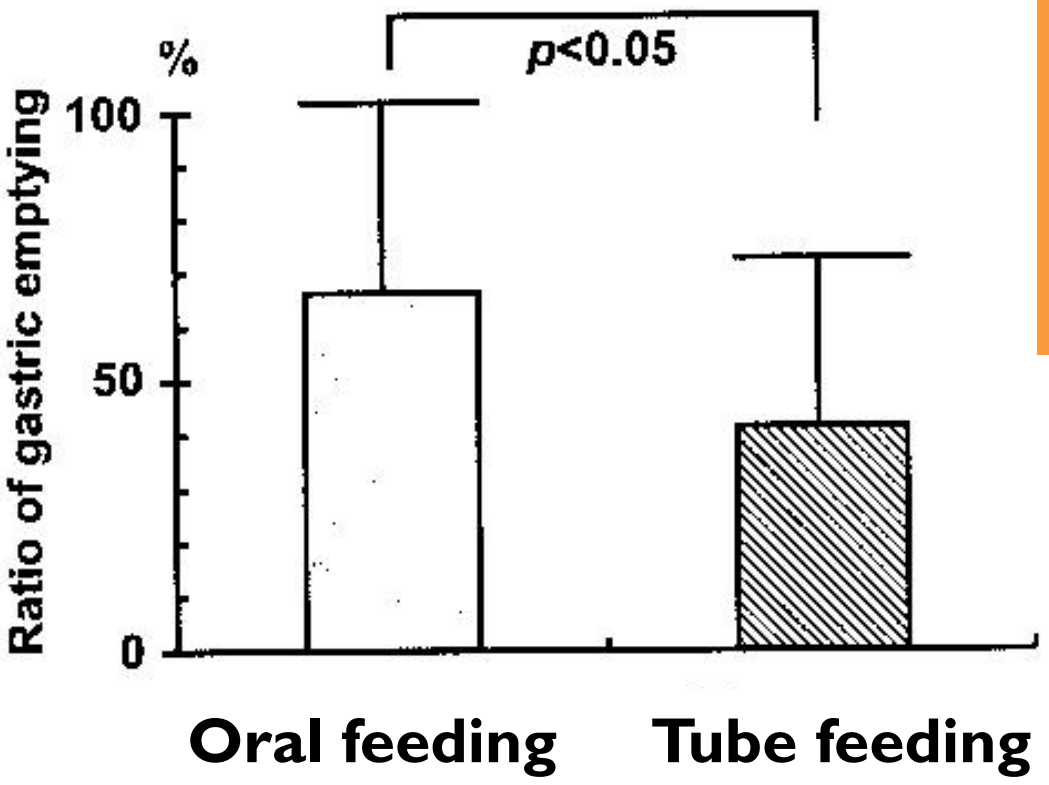


Katschinski et al, 2000

Examples of cephalic phase

Gastric emptying (motility)

The post-meal gastric emptying increased when the meal is ingested orally, compared to the same meal ingested via a tube

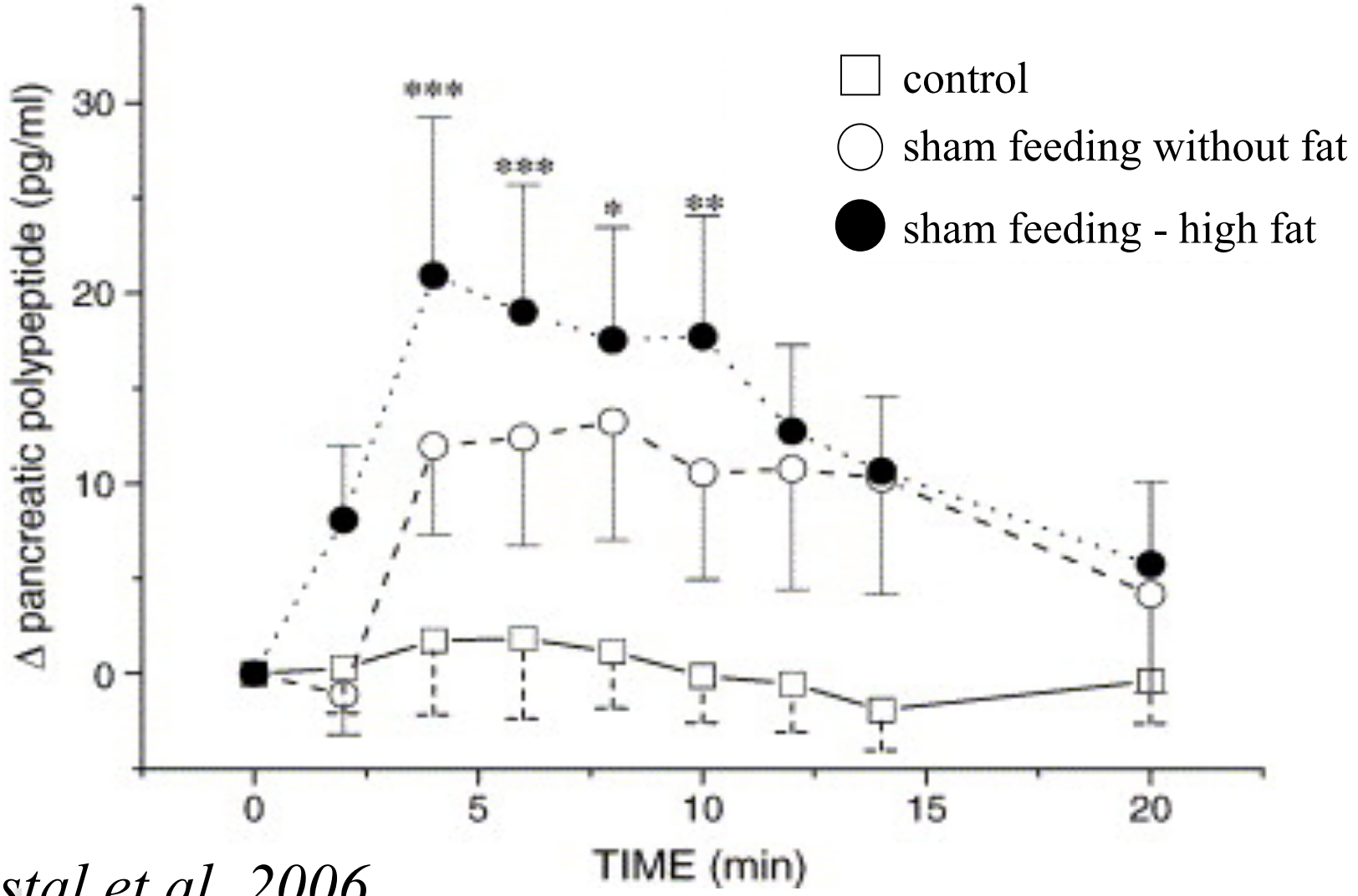


- Same meal in both groups
- Measure of gastric emptying during 30 minutes

Kimura et al, 2006

Examples of cephalic phase

Secretion of the pancreatic polypeptide after sham-feeding



Crystal et al, 2006

Teeth and mastication

During mastication, teeth are not simple tools that mechanically reduce the food to particles and mix saliva with the food to produce a bolus, easy to swallow.

They participate to the food oral process that initiate the digestion process before the bolus has left the mouth.

They also are essential to the neuromotor control of food ingestion, through the periodontal sensory receptors.

Teeth and mastication

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They participate to trigger the cephalic phase that initiate the digestion process before the bolus has left the mouth and .

They also are essential to the neuromotor control of food ingestion, through the periodontal and pulpal sensory receptors.

Moreover the motricity induced during mastication activates the centre of satiety.

Teeth and feeding behaviour

- Masticatory disability modifies the eating behaviour by restriction of the type of foods : individuals choose the easy to chew foods (soft or already fractionated foods), among their usual choice.

There is a conditionning process following a single unexpected negative experience during mastication (aspiration).

Teeth and eating behaviour

Denture wearers

Avoidance of:
- foods with fibres (meats)
- dried foods (bread)
- vegetables and fruits with fibres

Decreased of ingested food amounts
- carbon-hydrate
- animal proteins

Calcium and iron deficiency

Decrease in the caloric portion (BMI ↗ or ↘)

Preference for soft foods with high levels of cholesterol and saturated fat acids

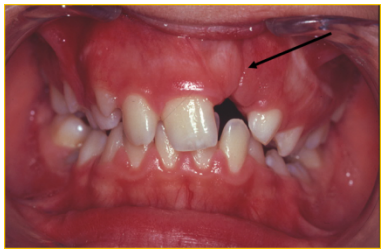
Increased blood concentration of cholesterol and saturated fat acids

Enhanced risk for cardio-vascular diseases

Any dental disease that affects the number, the structure or the position of the teeth is supposed to have an impact on chewing and, in turn, on nutrition.

Oral diseases





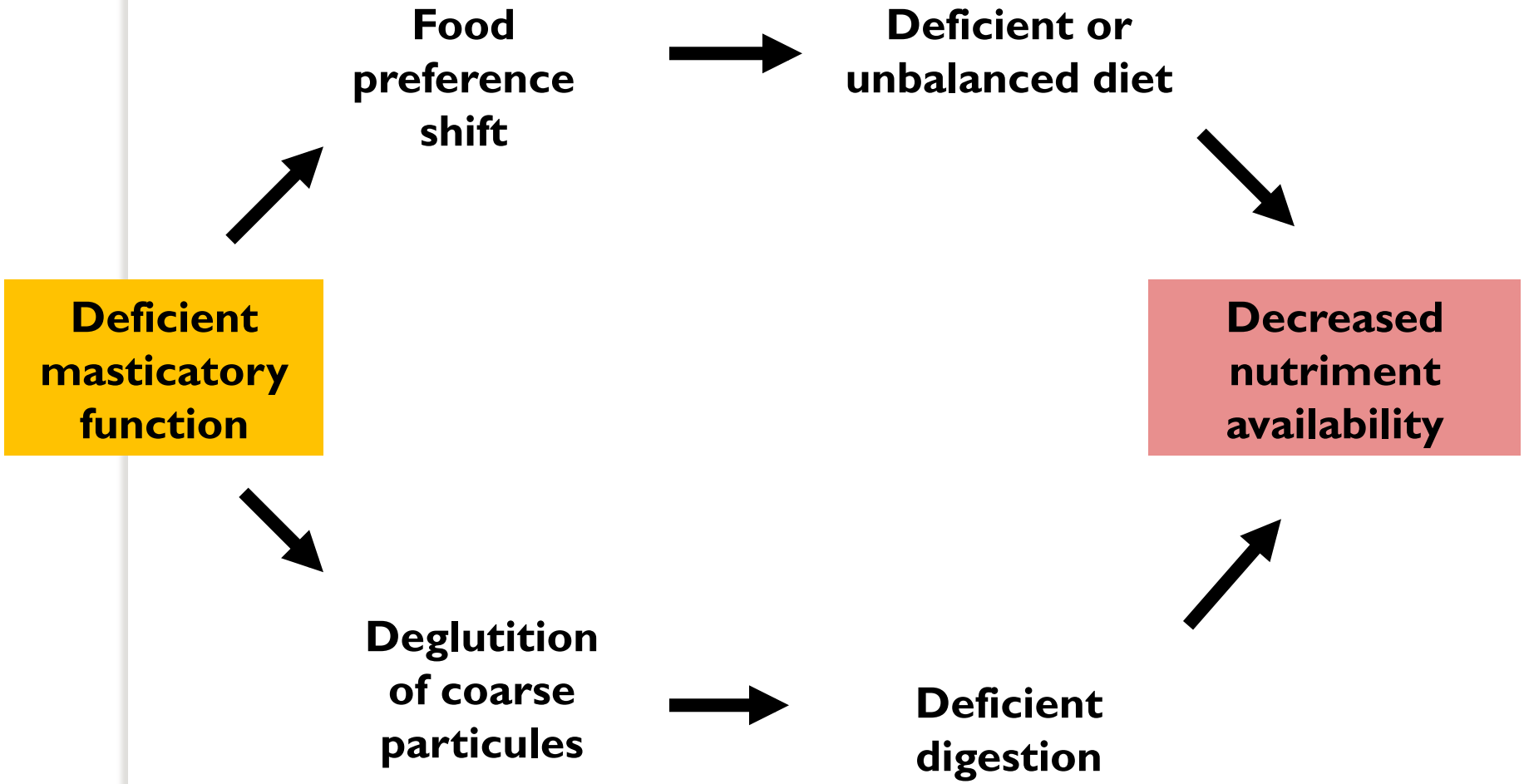
chewing

Restrictive feeding behaviour

Cardiovascular diseases

Metabollic diseases

Thus, a physiological approach is necessary to measure the extent to which the dental status of an individual affects the chewing function.



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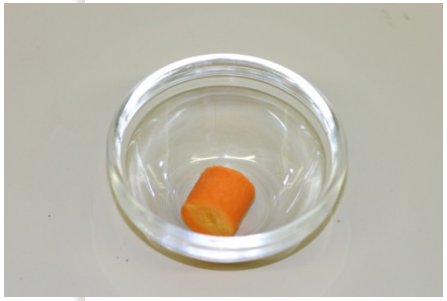
Concepts/tested hypothesis

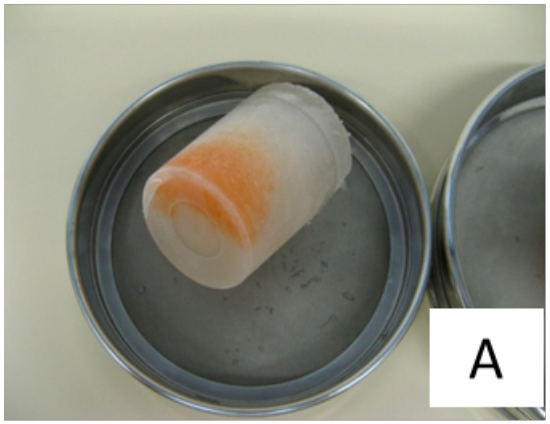
1. Food bolus mean particle size before swallowing is constant.
   During mastication, food bolus granulometry decreases until reaching a value compatible with a safe swallow (plasticity and cohesion). This value depend on the food type (=4000µm for carrot).

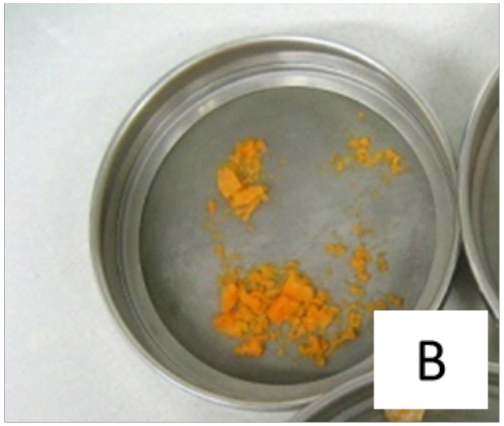
2 Mastication frequency is constant .
   When food hardness increases, an healthy individual increases the number of cycles and the duration of the sequence but does not change his chewing frequency.

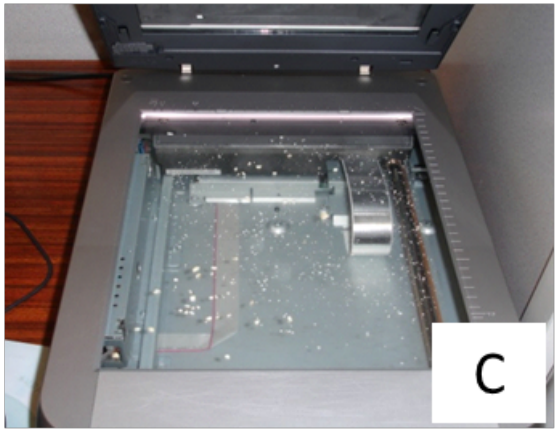
Woda A, et al J Dent Res. 2010

Carrot bolus granulometry









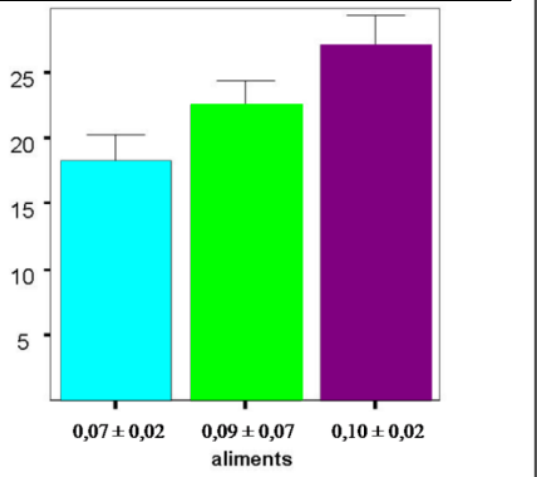
Chewing cinematics

*Resistancy to compression for 50% of deformation

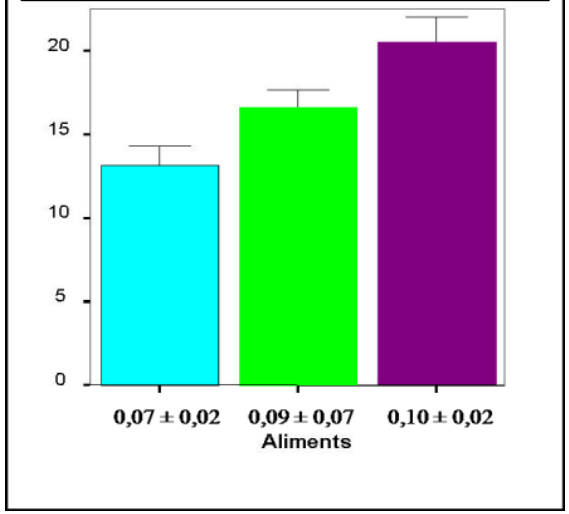
	N	Moyenne* (MPa)	SD
Turquoise	76	0,07	0,02
Vert	75	0,09	0,07
Violet	80	0,10	0,02

N=48 (16 subjects, 3 répétitions)

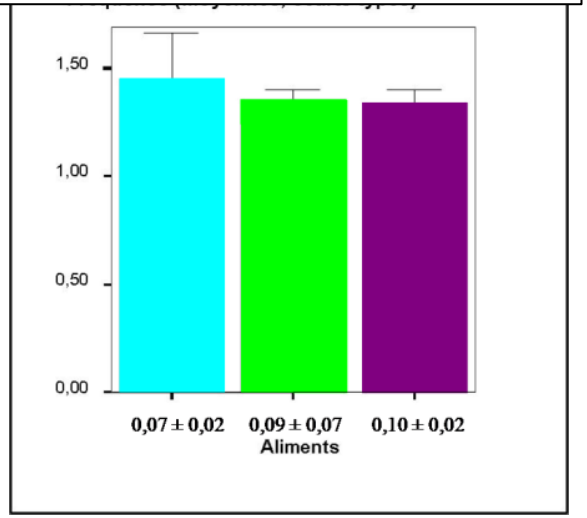
Number of cycles



Chewing time



Chewing frequency(s^{-1})



Chewing abilities in persons with obesity

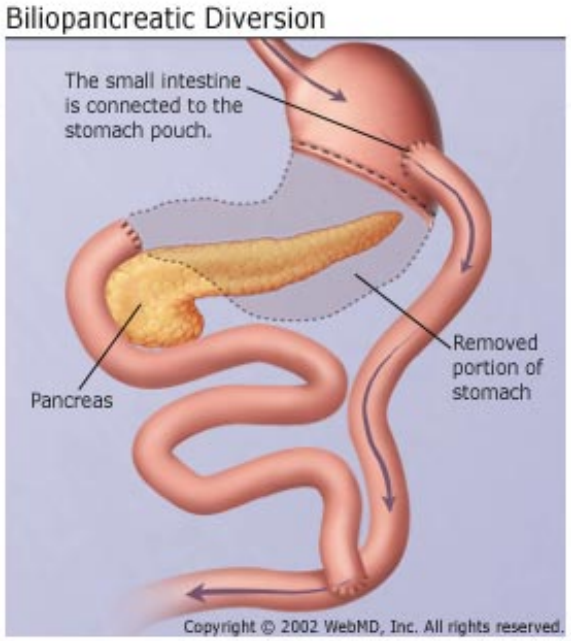
Chewing ability in persons with obesity could affect links between nutrition and feeding behaviour.

Previous studies on feeding attitudes demonstrated that obese subjects eat faster than their lean peers and suggested that a lack of oral stimulations could be related to energetic metabolism .

It has been suggested that low activity of the autonomous nervous system explains a decrease in the thermogenic response to food in individuals with obesity.

It was also shown that the palatability of the meal had an effect on the cephalic phase of dietary thermogenesis and that this effect is significantly decreased in obese subjects compared with non-obese ones .

Chewing abilities in persons with obesity scheduled for bariatric surgery



International guidelines generally suggest that patient criteria for elective surgery for BS should :

•firstly, include the control of feeding behaviour in order to eat less and more slowly

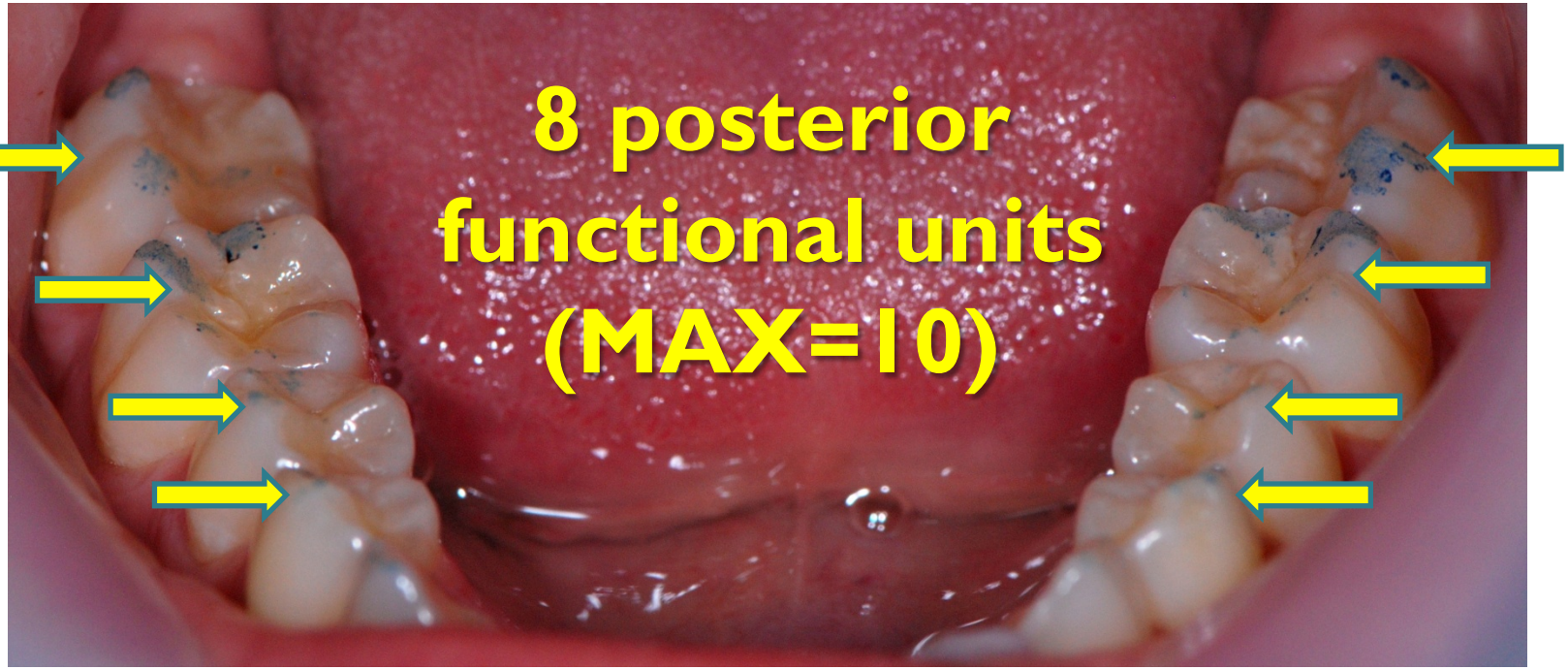
•secondly, a functional dental status providing good chewing function.

This set of conditions was assumed to reduce the prevalence of vomiting, diarrhoea, pain or dumping syndrome.

A cohort of 46 obese women provided three groups: FD group: fully dentate (7-10 functional dental units [FU]); PD group: partially dentate (4-6 FU) without partial dentures; DW group: partial and complete denture wearers.

Distribution of patients included in the study according to dental status, age, BMI, and proportionate variation in BMI at three months post-surgery.

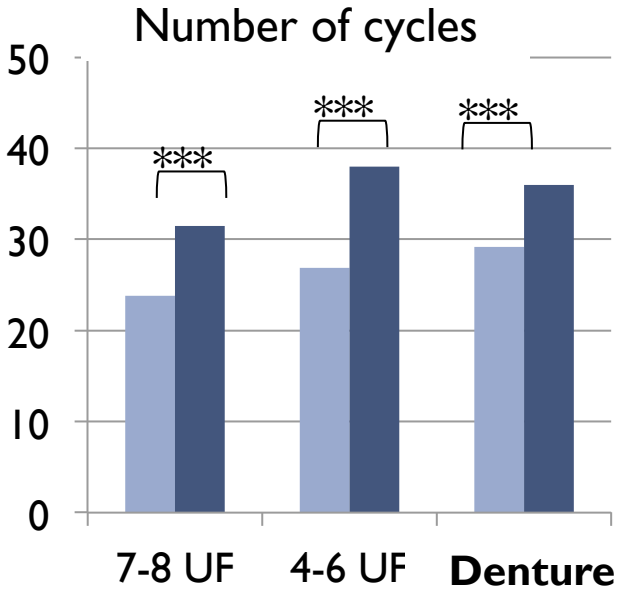
Group	Number of subjects	AGE (years)		Mean BMI before surgery		Mean BMI at 3 months post-surgery		**Mean % of BMI variation**	
		Mean	±SD	Mean	±SD	Mean	±SD	**Mean**	**±SD**
FD group (7-8 FU)	23	39.8	11.8	46.3	5.3	37.6	5.6	**-18.9%**	**6.9**
PD group (4-6 FU)	15	44.3	11.9	48.6	9.7	39.6	9.7	**-19.8%**	**6.8**
DW group (O-3FU and Denture)	8	46.3	11.0	49.8	12.1	41.4	8.7	**-16.4%**	**3.9**
Total	46	42.2	11.8	47.7	8.3	39.9	7.7	**-18.8%**	**6.7**

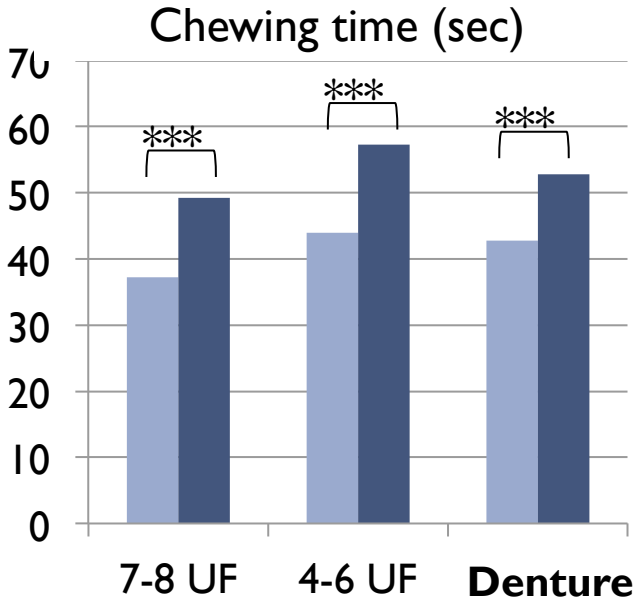

8 posterior
functional units
(MAX=10)

Carrot bolus granulometry at swallowing

Before surgery

After surgery





7-8 UF

4-6 UF

Denture

After surgery, all groups significantly increased their chewing activity

Carrot bolus granulometry at swallowing

Before surgery

After surgery

As expected, the bolus granulometry did not change in fully dentate patients .

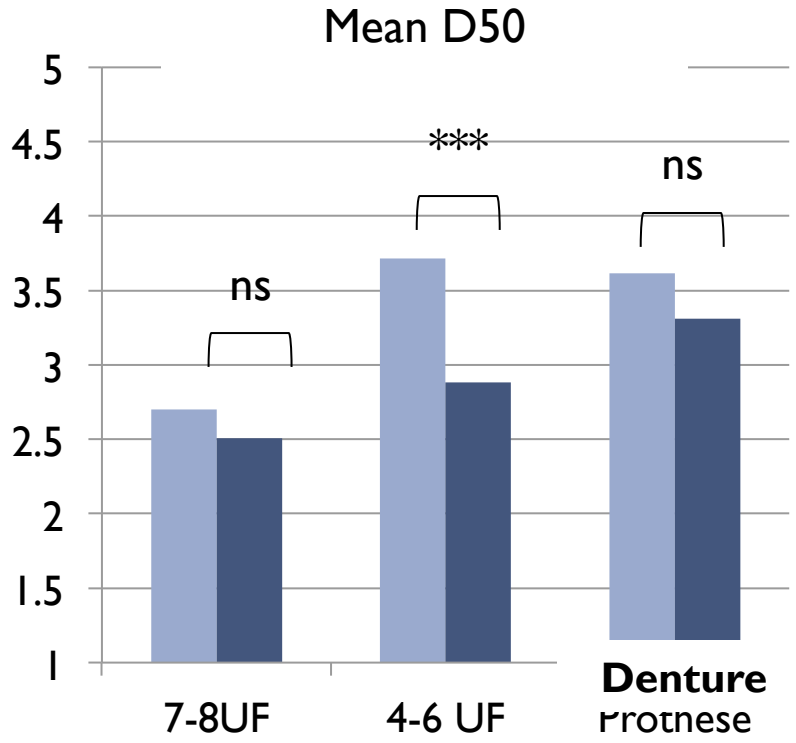
This motion was efficient for patients with 4-6-PFU which improved their bolus granulometry.

However it had no effect in fully dentate patients . Their bolus granulometry remained insufficiently reduced.

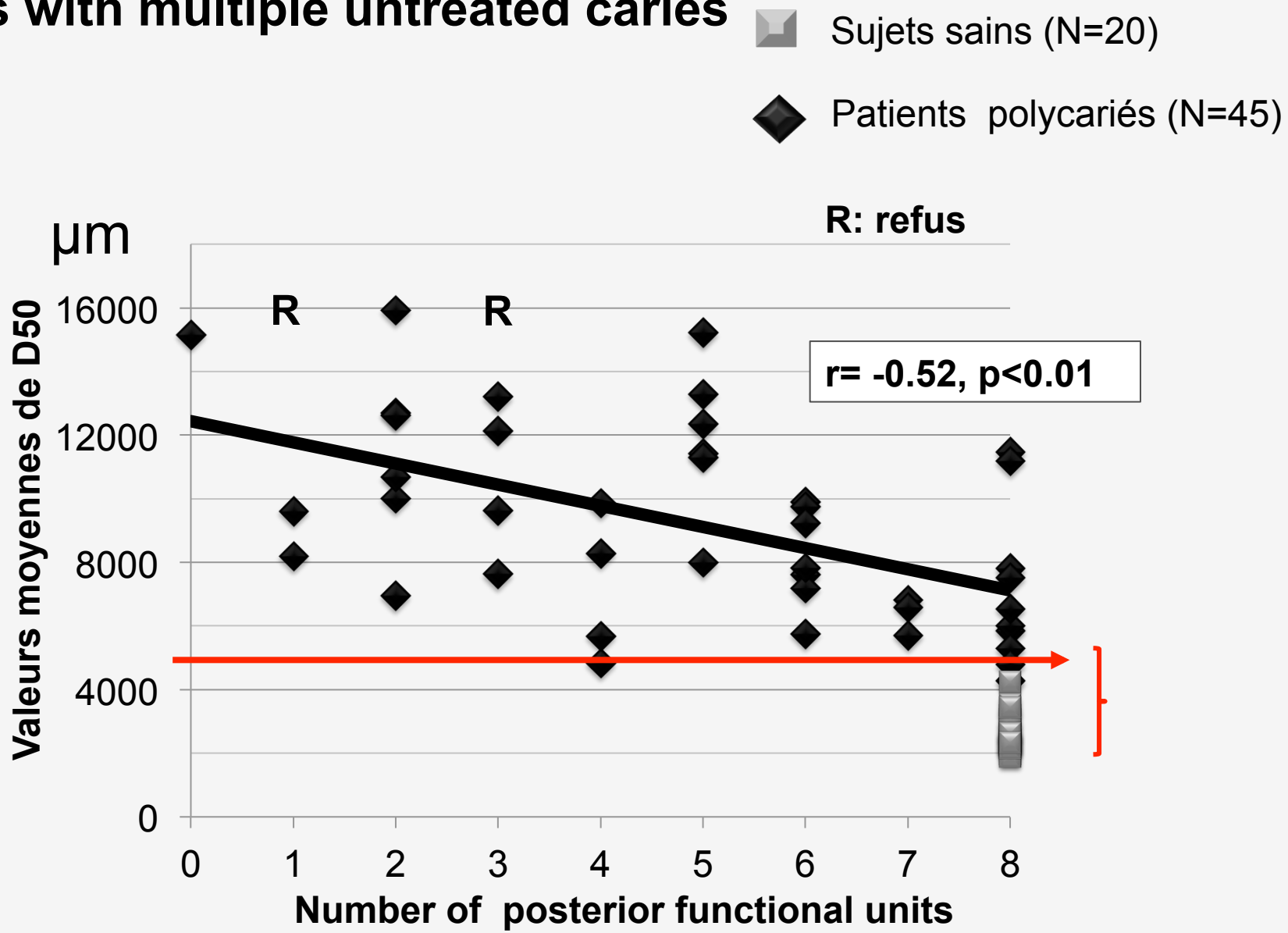
7-8 UF

4-6 UF

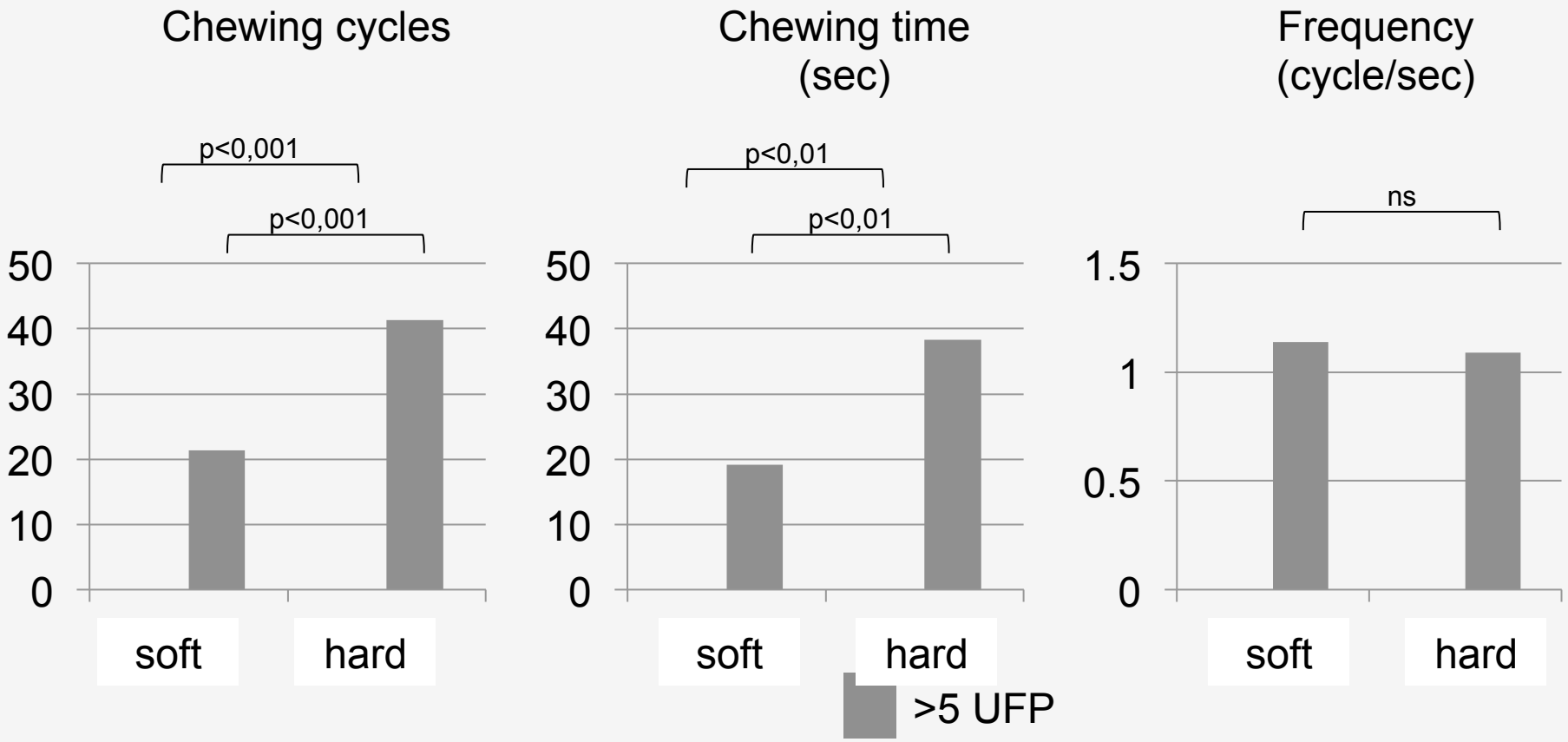
Denture



Patients with multiple untreated caries

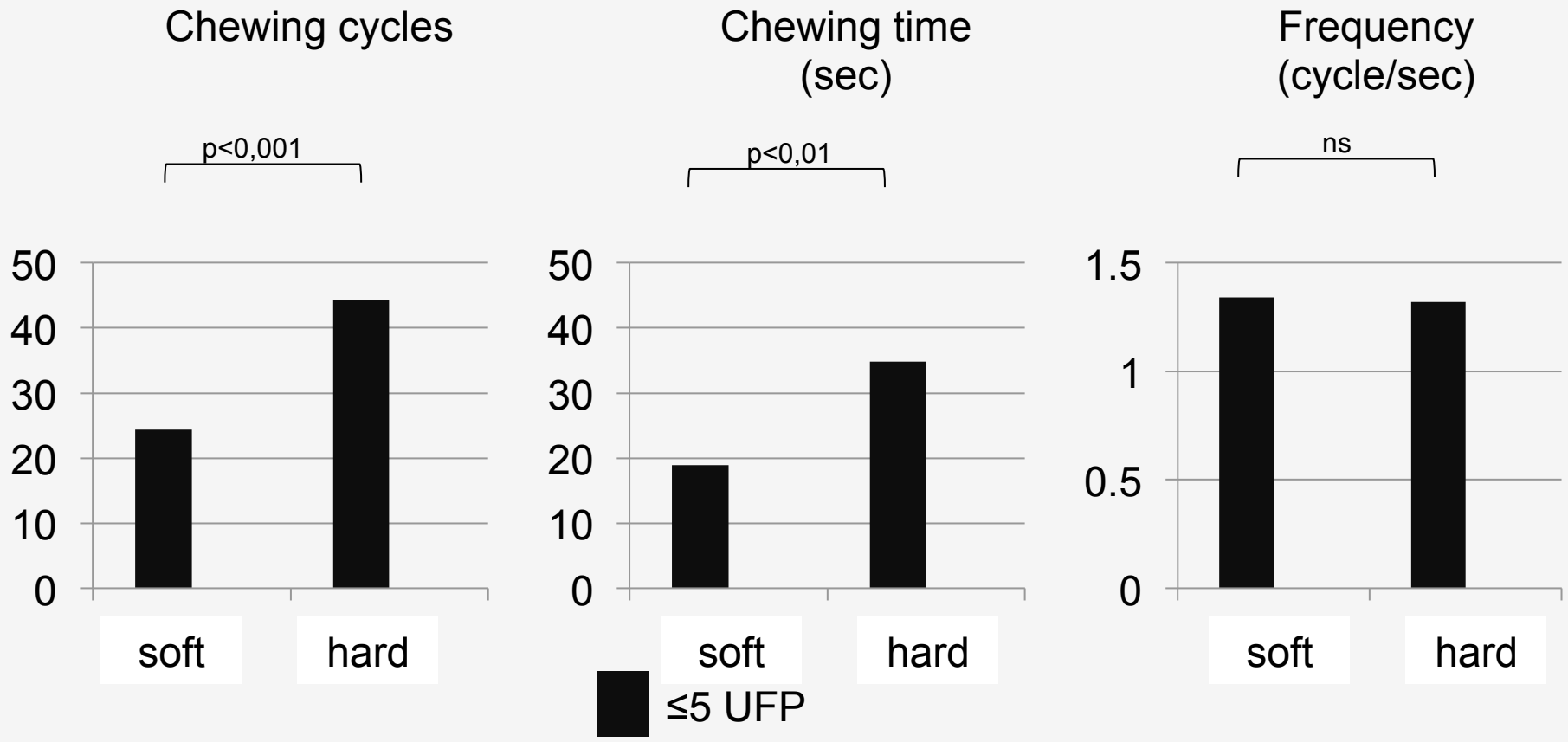


Adaptation to food texture



When the food hardness increase, patients wit caries adapt their chewing strategy
Whatever their number of functional units

Adaptation to food texture

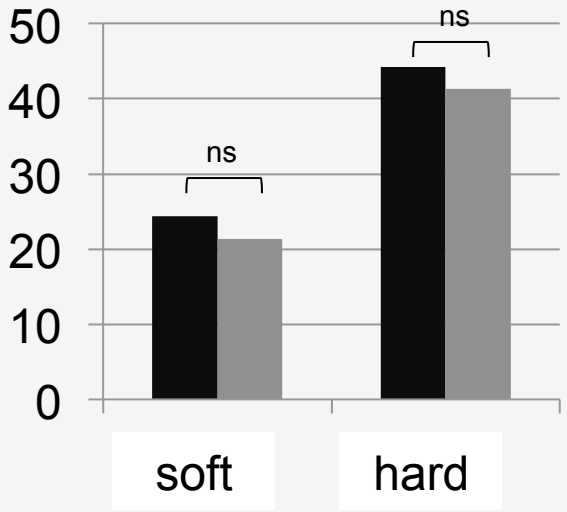


When the food hardness increases, patients with caries adapt their chewing strategy

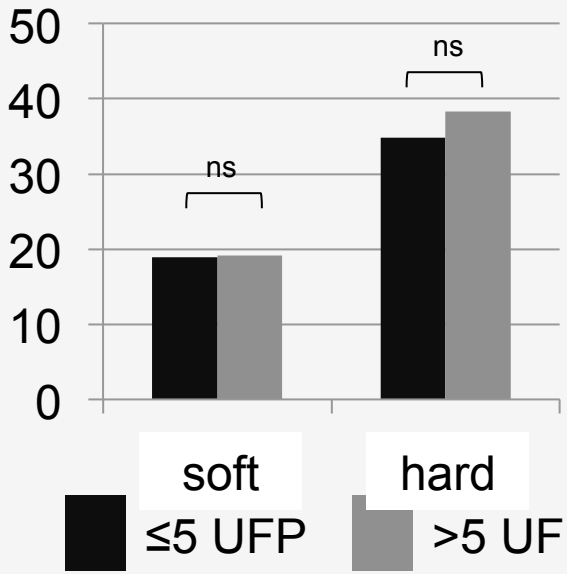
The chewing frequency remains constant.

Adaptation to food texture

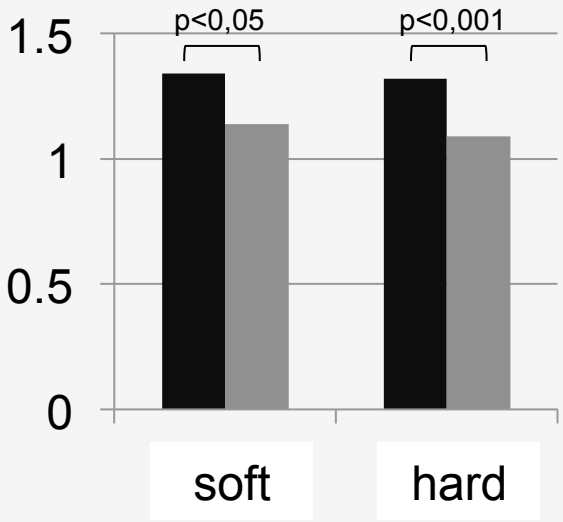
Chewing cycles



Chewing time (sec)



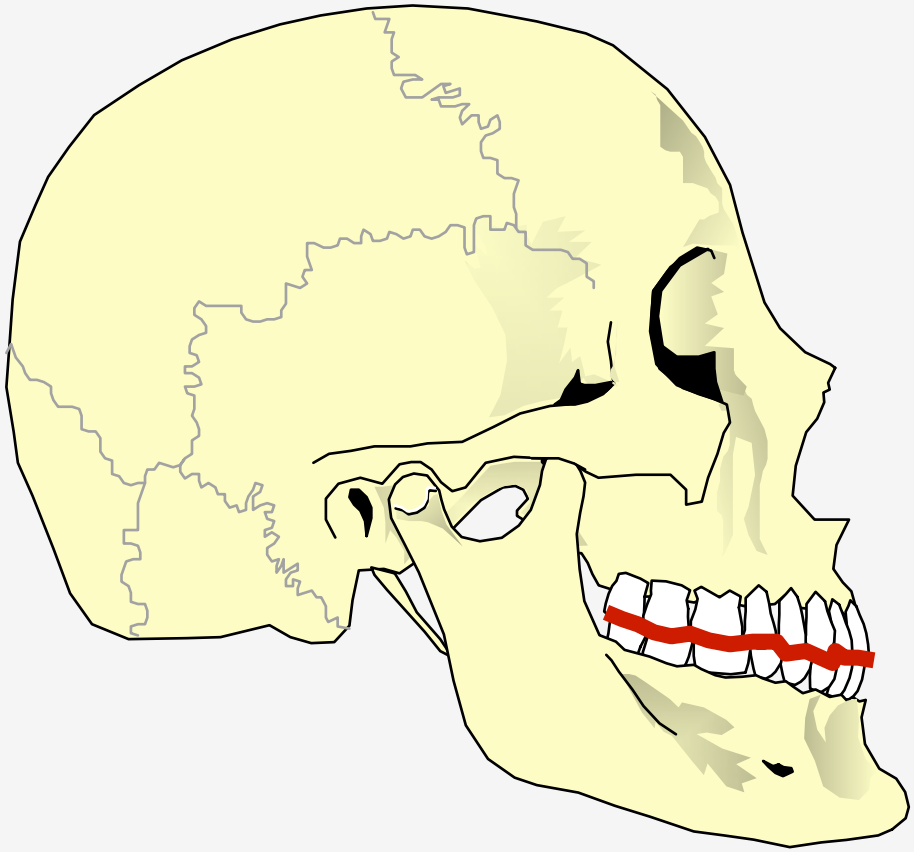
Frequency (cycle/sec)

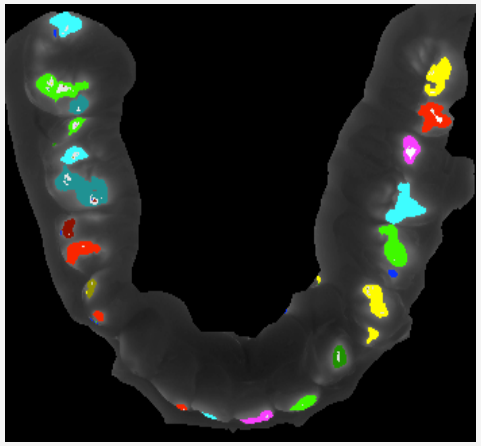


However the chewing frequency is slower for patients with few UFP

Chewing deficiencies related to dental diseases

Patients with orofacial dysmorphologia

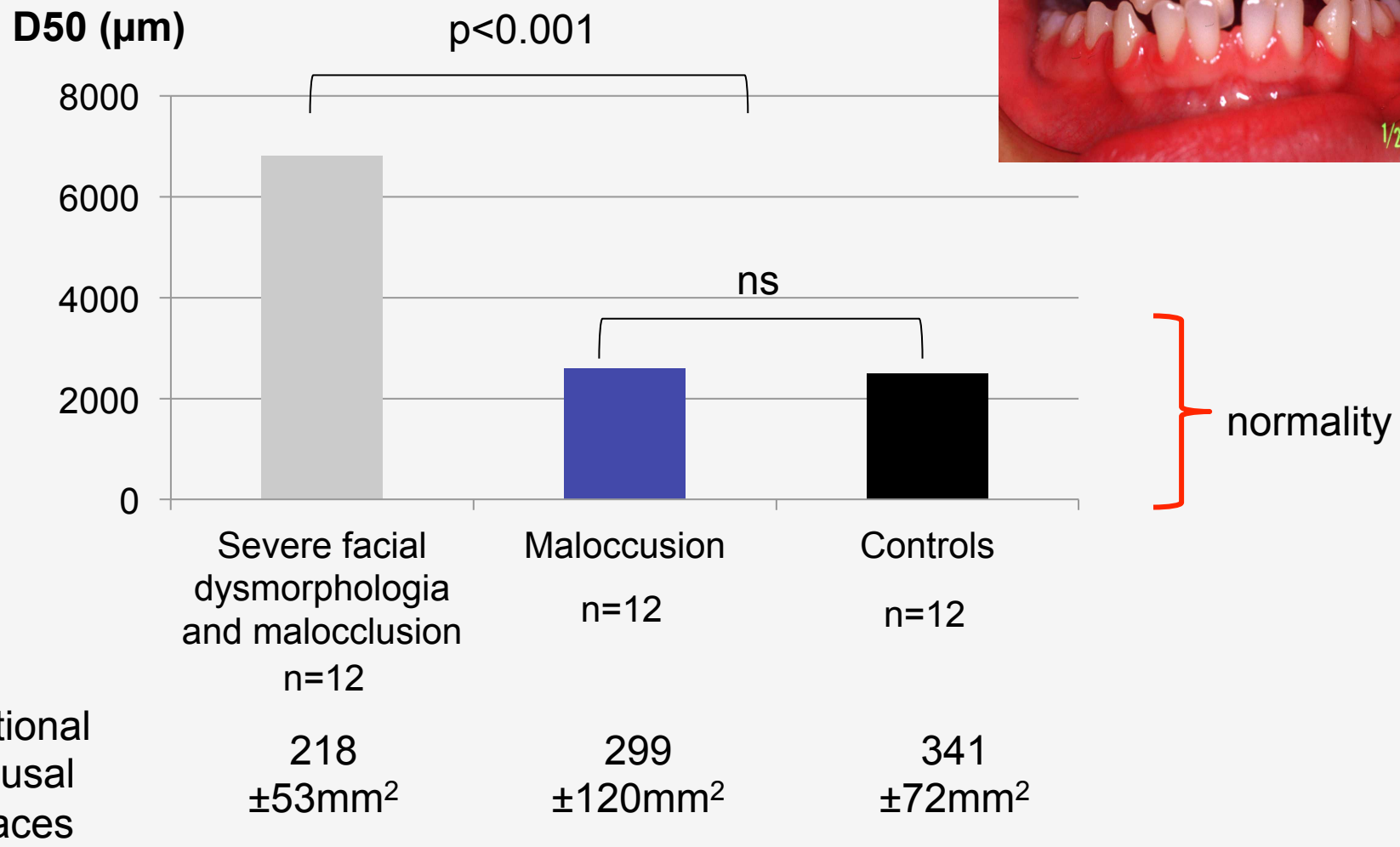




The thickness of the interarches dental spaces that participated to chewing varies from 0 et 500µm. That can be measure with a silicone impression

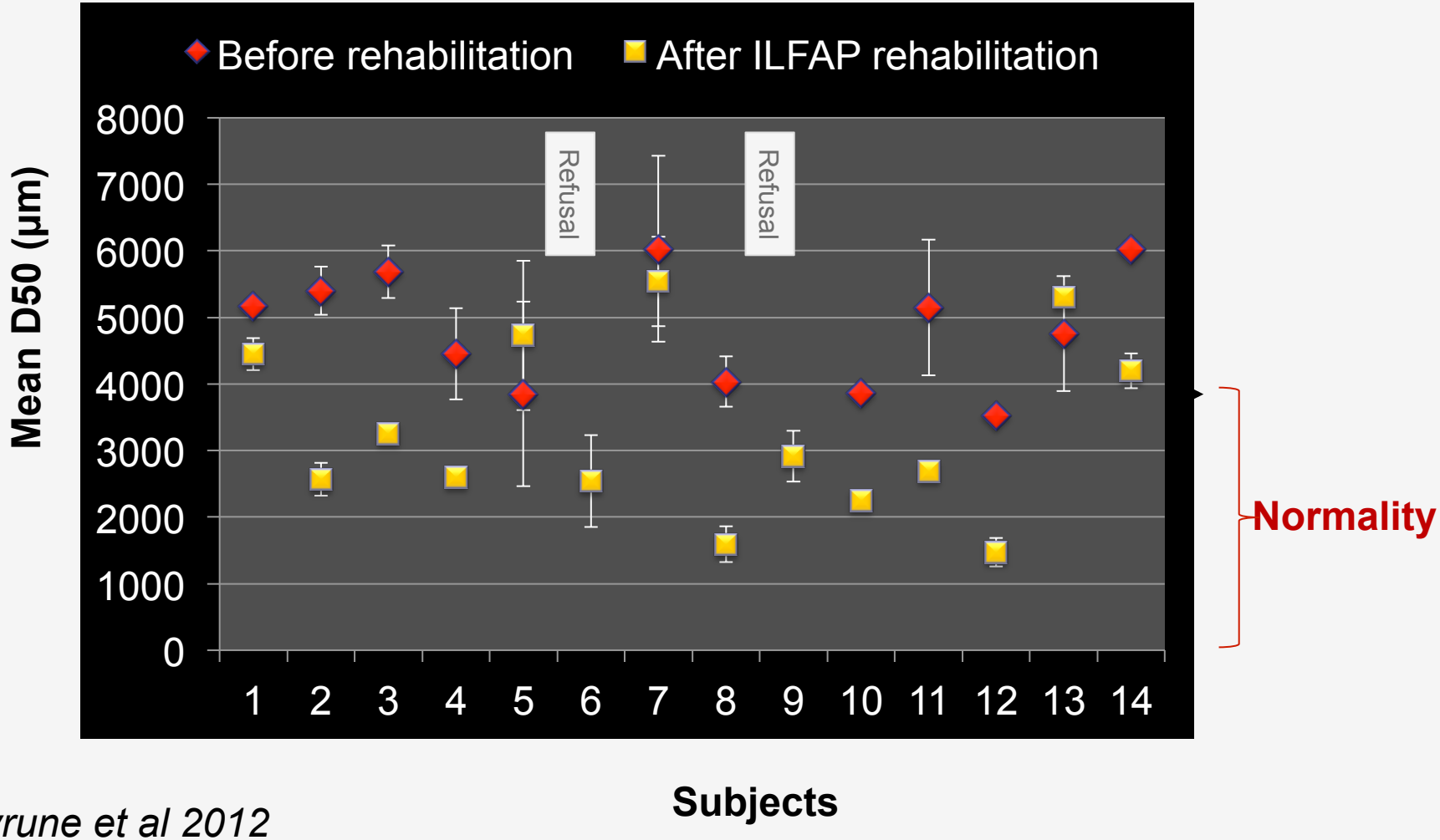
Chewing deficiencies related to dental diseases

Patients with orofacial dysmorphologia



Chewing deficiencies related to dental diseases

Patients with removable partial denture
After immediate full arch implants rehabilitation



Veyrune et al 2012

Irish Society for Disabilities in Oral Health

Healthy oral status is a factor that control chewing and nutrition.

In patients with obesity, feeding behaviour and nutritional status could be aggravated by a poor oral health.

Conservative dental treatments should be considered in a comprehensive approach.

Thank you for your attention