Diagnosis, Treatment and Prevention of Oral Malodor

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I don’t care about my bad breath!

If we live alone in the remote island, bad breath is not a problem.

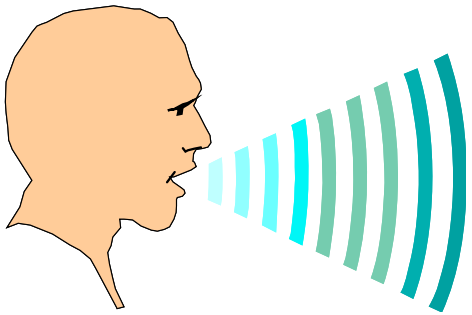
ปัญหาที่เกิดจากการมีกลิ่นปาก

Problems of bad breath

- Difficulties in human communication
- Disturbance of social relationship

บุคคลที่กังวลเกี่ยวกับกลิ่นปาก

The persons who concern about their bad breath



- About 15～20%
- Increasing by age
- Male＞Female
- Urban area＞Rural area

สาเหตุหลักของการเกิดกลิ่นปาก

Main causes of malodor

About 90 % of the malodor originate from oral problems.

- **Tongue coating**
- **Periodontal disease**
- **Decreasing of saliva flow**
- **Dental caries**
- **Lack of oral hygiene**
- **Systemic diseases**

เชื้อแบคทีเรียที่เกี่ยวข้องกับกลิ่นปาก

Oral bacteria related to producing malodor

- *Porphyromonas gingivalis*
- *Prevotella intermedia/nigrescens*
- *Actinobacillus actinomycetemcomitans*
- *Campylobacter rectus*
- *Fusobacterium nucleatum*
- *Peptostreptococcus micros*
- *Bacteroides forsythus*
- *Eubacterium species*
- *Spirochetes*

Sources of nutrients

- Protein
- Saliva, shed epithelium, food debris, gingival crevicular fluid, interdental plaque, postnasal drip, and blood

Tonzetich J (1977). *J Periodontol* 48(1)*:*13-20.

Kleinberg I, Codipilly, M. (1995). Tel Aviv: Ramut Publishing.

Odor compounds

- Sulfur compounds : Hydrogen sulfide, Methyl mercaptan, Dimethyl sulfide
- Short-chain fatty acids: Propionic, butyric, valeric
- Polyamines: Cadaverine, putrescine
- Alcohols: 1-propoxy-2-propanol
- Phenyl compounds: Indole, skatole, pyridine
- Alkanines: 2-methyl-propane
- Ketones
- Nitrogen-containing compounds: Ammonia
- Unknown compound n=34

Sources: adapted from data shown in Claus et al, Goldberg et al and Kleinberg&Codipilly

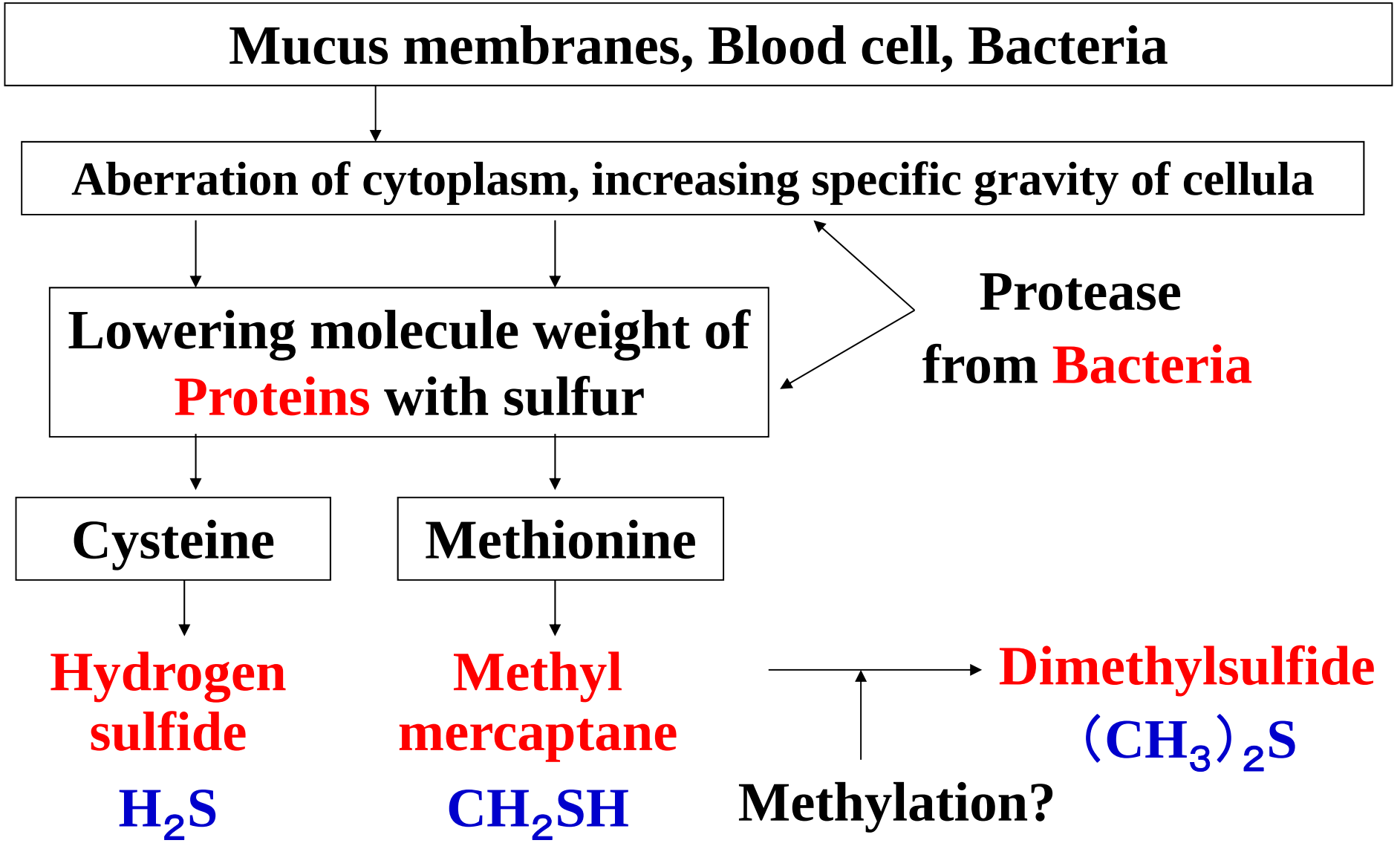
Volatile Sulfur Compounds(VSCs)

1. Main malodor substances

***Hydrogen sulfide**	**H_2S**
***Methyl mercaptan**	**CH_3SH**
***Dimethyl sulfide**	**$(CH_3)_2S$**

2. About more than 80% of malodor originated from hydrogen sulfide and methyl mercaptan .

Production of VSCs



Toxicity of VSCs

- Increasing the permeability of the oral mucosa
- Altering collagen metabolism
- Changing cell shape by affecting the cytoskeleton
- Modifying enzymatic and immunologic activities

Toxicity of VSCs

- Ratcliff & Johnson (1999) have reported the potential importance of VSCs in the transition of periodontal tissues from clinical healthy to gingivitis and then to periodontitis.[1]
- CH_3SH has been demonstrated to be more cytotoxic than H_2S.[2]

1. Ratcliff PA, Johnson PW (1999). *J Periodontol* 70(5)*:*485-9.
2. Ng W, Tonzetich J (1984). *J Dent Res* 63(7)*:*994-7.

In February 2003, “Fresh Breath Clinic” was established in the dental hospital of Tokyo Medical and Dental University.

Fresh Breath Clinic

Special clinic for diagnosis, treatment and prevention of halitosis patients

Fresh Breath Clinic

ขั้นตอนการรักษา **Clinical procedures**

1. Questionnaire for halitosis
2. Malodor assessment
3. Diagnosis
4. Treatment and counseling
5. Maintenance and prevention

Questionnaire for Halitosis

1. present status of bad breath
2. the first time of bad breath
3. the first situation
4. treatment experience
5. strongest time of bad breath
6. place & occasion of bad breath
7. social disturbances
8. trial for decreasing bad breath
9. oral hygiene habits
10. oral symptoms
11. systemic diseases
12. medication
13. rhythm of daily living
14. sleeping time
15. diet
16. nutrition balance
17. habit of smoking
18. habit of drinking alcohol
19. sports
20. hobby
21. worries
22. social relationships
23. cause of bad breath

ประเภทของผู้ป่วยโรคกลิ่นปาก

Classification of Halitosis

1. **Genuine Halitosis**

   (1) Physiologic Halitosis (TN1)

   (2) Pathologic Halitosis

      1) Oral Pathologic Halitosis (TN1&2)

      2) Extraoral Pathologic Halitosis (TN1&3)

2. **Pseudo-Halitosis** (TN1&4)

3. **Halitophobia** (TN1&5)

Treatment Needs

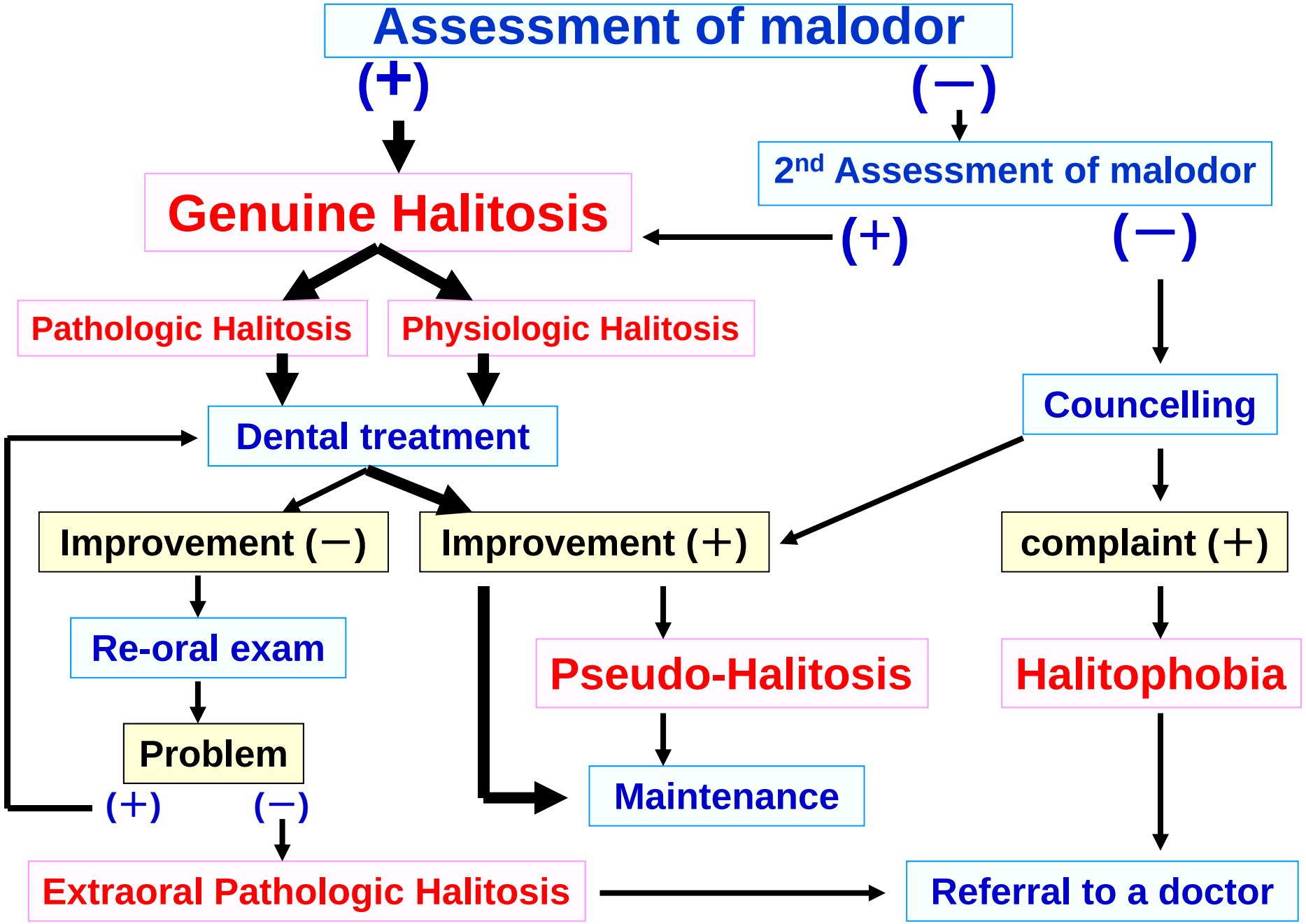
TN1: Explanation of halitosis and instructions for oral hygiene.
Support and reinforcement of a patient's own self-care for further improvement of their oral hygiene.
TN1 is applicable to all cases.

TN2: Oral prophylaxis（Professional cleaning）
and　treatments
for oral diseases, especially periodontal diseases.

TN3: Referral to a physician or medical specialist.

TN4: Explanation of examination data, further professional instruction, education and reassurance for improvement of the condition.

TN5: Referral to a clinical psychologist, psychiatrist or other psychological specialist.


Assessment of malodor
(+)
(−)
2nd Assessment of malodor
Genuine Halitosis
(+)
(−)
Pathologic Halitosis
Physiologic Halitosis
Councelling
Dental treatment
Improvement (−)
Improvement (+)
complaint (+)
Re-oral exam
Pseudo-Halitosis
Halitophobia
Problem
(+)
(−)
Maintenance
Extraoral Pathologic Halitosis
Referral to a doctor

1. ผู้ป่วยที่มีกลิ่นปาก
Genuine Halitosis

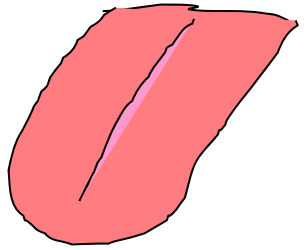
Obvious malodor intensity beyond the socially acceptable level is perceived.

However habitual halitosis, which is caused by tobacco, cigars, spices, or foods, is not involved in halitosis classification.

(1) กลิ่นปากที่เกิดจากระบบของร่างกาย

Physiologic Halitosis

Malodor arises through putrefactive process within the oral cavity. Neither specific disease nor pathologic condition, which could cause halitosis is found. Origin is mainly the posterior-dorsum region of the tongue.



(2) กลิ่นปากที่เกิดจากโรค

Pathologic Halitosis

1)กลิ่นปากที่เกิดจากโรคในช่องปาก

Oral Pathologic Halitosis

Halitosis caused by disease, pathologic condition or malfunction of oral tissues. (Halitosis, derived from tongue coating modified by pathological condition, e.g., periodontal disease, xerostomia etc, is included in this category.)

(2) กลิ่นปากที่เกิดจากโรค

Pathologic Halitosis

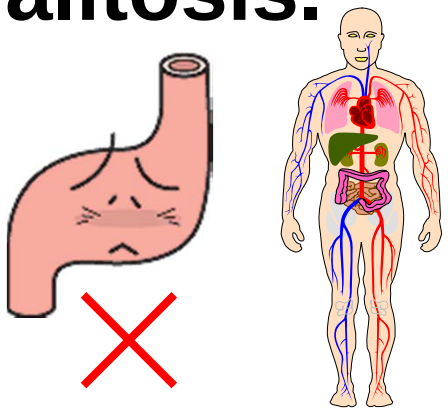
2) กลิ่นปากที่เกิดจากโรคภายนอกช่องปาก

Extraoral Pathologic Halitosis

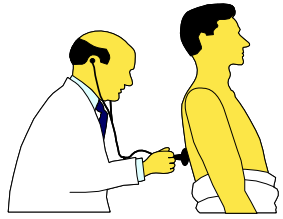
***Nasal, paranasal and laryngeal halitosis.**

***Other systematic halitosis**

. Diabetes mellitus, Hepatic cirrhosis, Uremia, Internal bleeding, Trimethyl Amine Uria



***Referral to a physician or medical specialist is necessary**



2. กลิ่นปากเทียม

Pseudo-Halitosis

Obvious malodor is not perceived by others, although a patient stubbornly complains of the existence of his/her halitosis.

Improvement of this condition is highly promising by explanation of examination results, counseling and simple treatment measures (TN1&4).

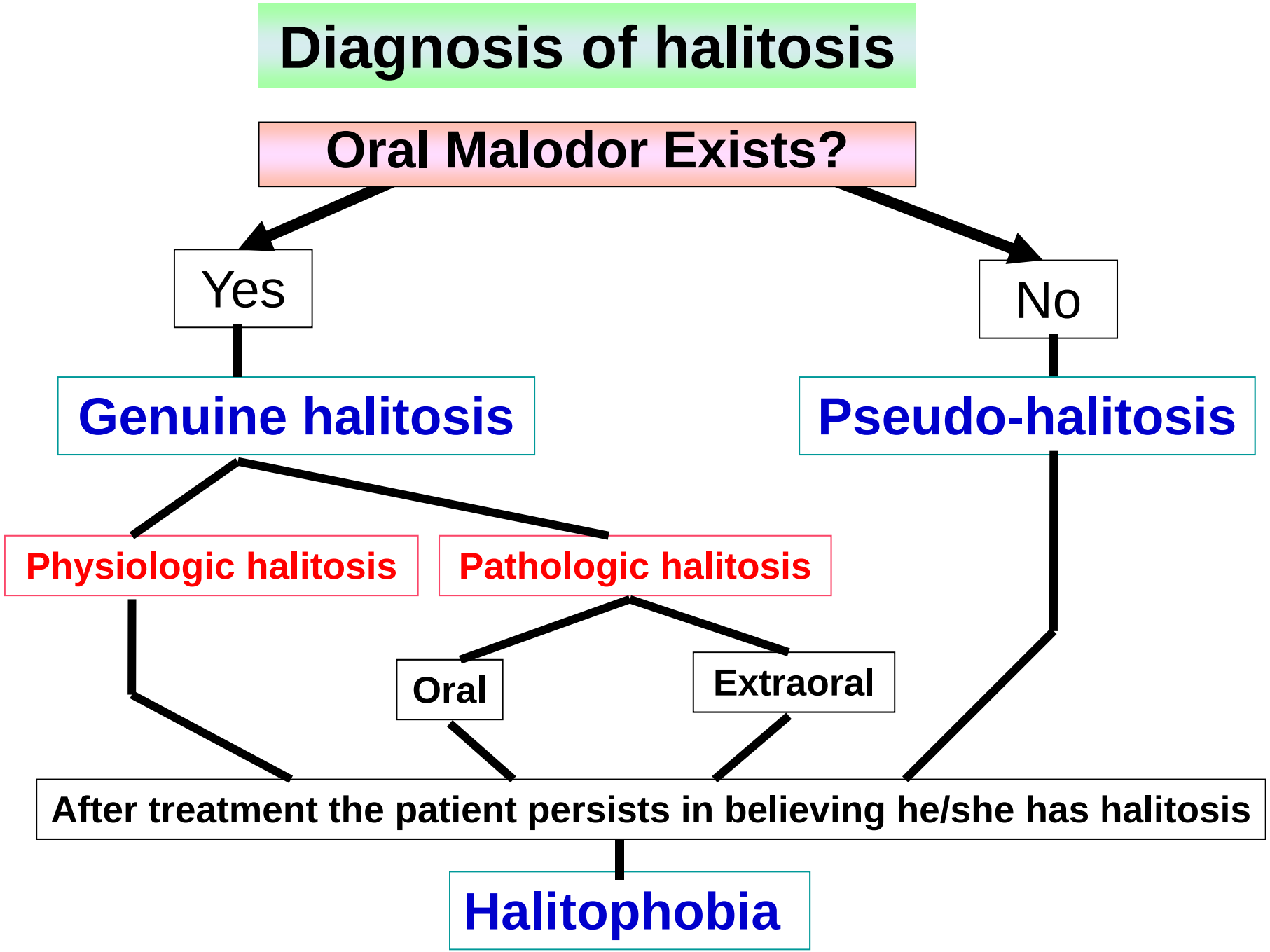
3. ผู้ป่วยที่มีความกังวลเกี่ยวกับกลิ่นปาก

Halitophobia

After treatment for genuine halitosis or pseudo-halitosis, a patient persists in believing that they have halitosis, although no physical nor social evidence exists to suggest their belief.

Referral to a clinical psychologist, psychiatrist or other psychological specialist is recommended (TN1&5).

imaginary halitosis, obsessive halitosis
olfactory hallucination, psychosomatic halitosis
self-perceived halitosis, self-reporting halitosis


Diagnosis of halitosis
Oral Malodor Exists?
Yes
No
Genuine halitosis
Pseudo-halitosis
Physiologic halitosis
Pathologic halitosis
Oral
Extraoral
After treatment the patient persists in believing he/she has halitosis
Halitophobia

การประเมินระดับกลิ่นปาก

Assessment of oral malodor

1. Gas sensor assecement

- Breathtron
- Halimeter
- Oral Chroma

2. Gas Chromatography

3. Organoleptic test

（Using human's nose）

Halimeter

Oral Chroma

Brethtron

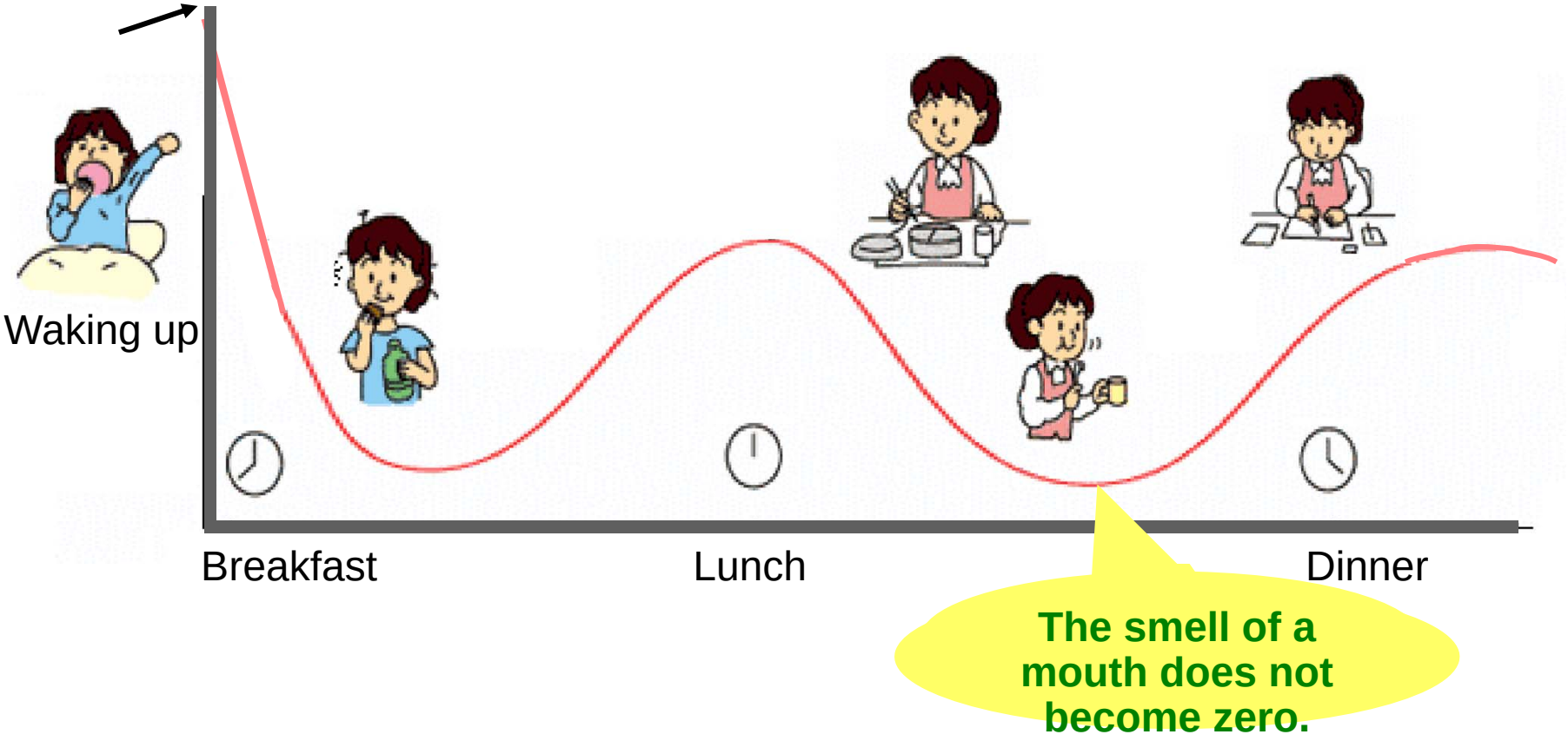
Gas chromatography

เครื่องมือวัดกลิ่นปาก

Malodor assessment machine

Daily circadian rhythm of malodor

- **Everyone has physiological odor**
- **The level of odor is different during the day**



Morning breath odor

- It has been postulated that a decrease in salivation during sleep promotes proliferation of the oral bacteria responsible for the release of the offending gases in morning bad breath.
- Strong evidence that morning breath odor can be used as a model to investigate other offensive breath odors is still lacking but universally accepted.

Conditions for Breath Odor Assessment

Morning breath

On the day of assessment patients are instructed to abstain from:

1) food and drink
2) oral hygiene practices
3) use of oral rinse and breath fresheners
4) smoking for 12 hours before assessment

Before the day of assessment patients are instructed to abstain from:

1) taking antibiotics 3 weeks prior to assessment.
2) garlic, onion and spicy foods for 48 hours before assessment
3) scented cosmetics for 24 hours before assessment

Semiconductor gas sensor

BREATHTRON

① Assessment of VSCs

② For 45 seconds the machine can measure smell of mouth air automatically.

③ Measurement can be effected by tooth paste, mouth rinse, alcohol consumption.

BREATHTRON

Category	Result（ppb）	Evaluation
NORMAL －	0～250	Normal odor
MILD ±	251～600	Slight malodor
MODEREATE ＋	601～1500	Moderate malodor
SEVERE ＋＋	1501～3000	Strong malodor

Advantages

- **Lower cost**
- **Can be operated by non-skilled personnel**
- **Portability**
- **Rapid turn-around time between measurements**

Disadvantages

- **Its inability to distinguish between individual sulfides**
- **Measurement cannot be made in the presence of high levels of ethanol or essential oils**
- **Low sensitivity and specificity for CH_3SH, especially in periodontal disease patients**

Table 1 – Correlations between organoleptic scores and gas chromatography measurements, directly taken from the source articles

Study	Correlation coefficient	p-Value
Schmidt et al.[28]		
Study I	$r = 0.28$	$p < 0.05$
Study II	$r = 0.35$	$p < 0.001$
Shimura et al.[107]	$r = 0.71$	$p < 0.01$
Oho et al.[86]	$r = 0.69$	$p < 0.0001$
Amano et al.[31]	$r = 0.47$	$p < 0.01$
Tanaka et al.[109]	$r = 0.63$	$p < 0.05$
Nonaka et al.[110]	$r = 0.73$	$p < 0.05$
Hunter et al.[96]		
H_2S	$r = 0.63$	$p < 0.001$
CH_3SH	$r = 0.61$	$p < 0.001$
$(CH_3)_2S$	$r = 0.46$	$p < 0.001$
Total sulphur compounds	$r = 0.65$	$p < 0.001$
Iwanicka-Grzegorek et al.[114]	$r = 0.78$	$p < 0.001$

M.W.T. van den Broek A., Feenstra L., Baat C. A review of the current literature on aetiology and measurement methods of halitosis. *Journal of Dentistry* 2007; **35**:627-635.

Halimeter

Breathtron

Table 2 – Correlations between organoleptic scores and sulphide monitor measurements, directly taken from the source articles

Study	Correlation coefficient	p-Value
Rosenberg et al.[98]		
Judge A	$r = 0.60$	$p < 0.05$
Judge B	$r = 0.52$	$p < 0.05$
Rosenberg et al.[83]	$r = 0.60$	$p < 0.001$
De Boever et al.[36]		
Sulphide monitor measurement		
After 30 s	$r = 0.53$	$p < 0.001$
After 60 s	$r = 0.63$	$p < 0.001$
Greenstein et al.[90]		
Judge A, before treatment	$r = 0.27$	$p = 0.003$
Judge A, after treatment	$r = 0.27$	$p = 0.003$
Judge B, before treatment	$r = 0.39$	$p < 0.001$
Judge B, after treatment	n.s.	
Willis et al.[119]	$r = 0.41$	$p = 0.027$
Oho et al.[86]	$r = 0.66$	$p < 0.0001$
Sterer et al.[26]		
Judge A, whole-mouth	$r = 0.37$	$p = 0.002$
Judge A, tongue dorsum	$r = 0.26$	$p = 0.036$
Judge B, whole-mouth	$r = 0.46$	$p < 0.001$
Judge B, tongue dorsum	$r = 0.38$	$p = 0.002$
Iwanicka-Grzegorek et al.[114]	$r = 0.78$	$p < 0.001$
Stamou et al.[52]	$r = 0.55$	$p < 0.001$
Sopapornamorn et al.[102]		
Periodontal disease group	$r = 0.42$	$p < 0.05$
Non-periodontal disease group	$r = 0.61$	$p < 0.01$
Total group	$r = 0.56$	$p < 0.01$
Sopapornamorn et al.[103]	$r = 0.64$	$p < 0.01$

M.W.T. van den Broek A., Feenstra L., Baat C. A review of the current literature on aetiology and measurement methods of halitosis. *Journal of Dentistry* 2007; **35**:627-635.

Gas chromatography

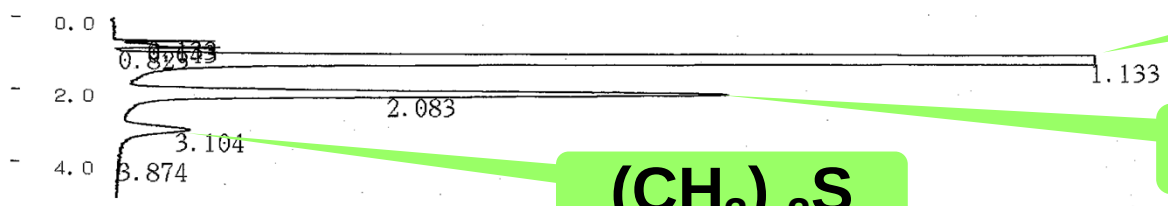
Assessment by gas chromatography

Volatile Sulfur Compounds (VSCs)

		acceptable level
H_2S	Hydrogen sulfide	1.5ng/10ml
CH_3SH	Methyl mercaptan	0.5ng/10ml
$(CH_3)_2S$	Dimethyl sulfide	0.2ng/10ml

Gas chromatography

Case1



H_2S

CH_3SH

$(CH_3)_2S$

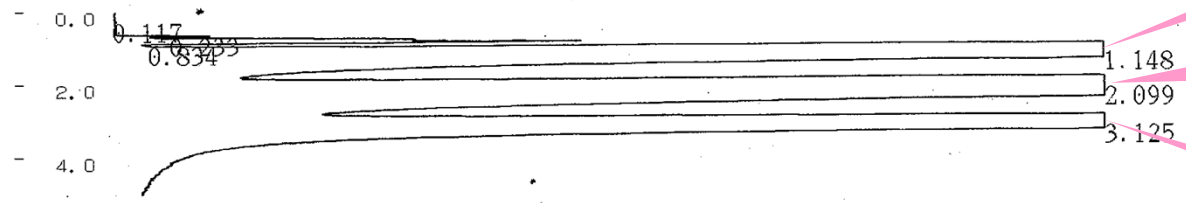
** CALCULATION REPORT **

CH	PKNO	TIME	AREA	HEIGHT	MK	IDNO	CONC	NAME
1	2	0.643	393	189	V			
	3	0.823	911	210	V			
	4	1.133	420345	42687	V	1	4.5504	H2S
	5	2.083	15675	1239	V	2	0.8182	CH3SH
	6	3.104	2501	144	V	3	0.3813	(CH3)2S
		TOTAL	439824	44470			5.7499	

C-R8A CHROMATOPAC CH=1 DATA=1:@CHRM1.C73 ATTEN= 1 SPEED= 5.0

Tongue coating

Case2



H_2S

CH_3SH

$(CH_3)_2S$

** CALCULATION REPORT **

CH	PKNO	TIME	AREA	HEIGHT	MK	IDNO	CONC	NAME
1	3	0.834	5679	770				
	4	1.148	6966646	702551	V	1	22.9075	H2S
	5	2.099	4588929	420437	V	2	27.086	CH3SH
	6	3.125	281153	20263	V	3	5.2064	(CH3)2S
		TOTAL	11842404	1144020			55.1999	

Periodontal disease

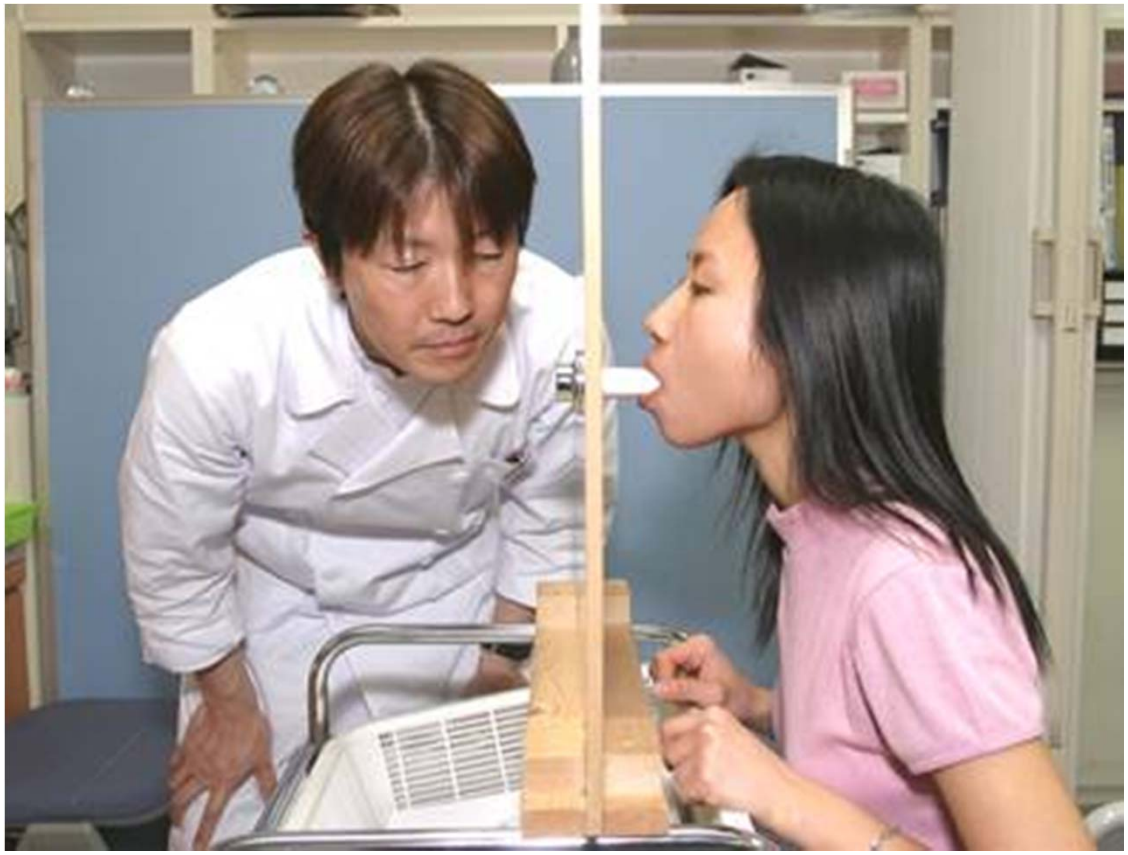
Advantages

- **Separation and quantitative measurement of individual gases**
- **The ability to measure extremely low concentrations of gases**

Disadvantages

- **Relatively high cost**
- **The need for skilled personnel**
- **Lack of portability**
- **The time required for detection and measurement**

Organoleptic Test



Malodor detection by human nose. Screen is used for privacy protection.

Organoleptic Scoring Scale

0	**Absence of odor**	No-detectable odor
1	**Questionable**	Odor is detectable though a judge could not recognize it as malodor
2	**Slight malodor**	Odor is deemed to exceed the threshold of malodor recognition
3	**Moderate malodor**	Malodor is definitely detected
4	**Strong malodor**	Strong malodor, but examiner can tolerate at this level
5	**Severe malodor**	Overwhelming malodor. Examiner can not tolerate malodor at this level

The judge of organoleptic test is required to refrain from drinking coffee, tea, juice, smoking, and using scented cosmetics prior to the assessment. The judge must have **normal sense of smell.**

Smell test by Orfactometer

Alternative measurement methods

- **BANA test**
- **polymerase chain reaction (PCR)**

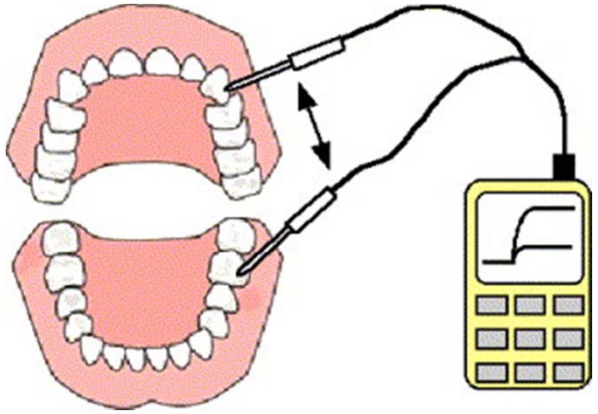
- **chemical sensors/electronic nose**
- **ammonia monitoring**
- **salivary incubation test**
- **ninhydrin method**
- **quantifying β-galactosidase activity**
- **etc.**

Self assessment of oral malodor

- **Hands over mouth**
- **Interproximal flossing**
- **Licking one’s wrist**

Future prospects

- **Improved and simplified instrumentation for more reliability and for multiple kind of gases**
- **Development of site-specific sampling methods within the mouth**



Mitsubayashi K.et al. Optical bio-sniffer for methyl mercaptan in halitosis. Analytica Chimica Acta. 2006; **28**:573-574:75-80.

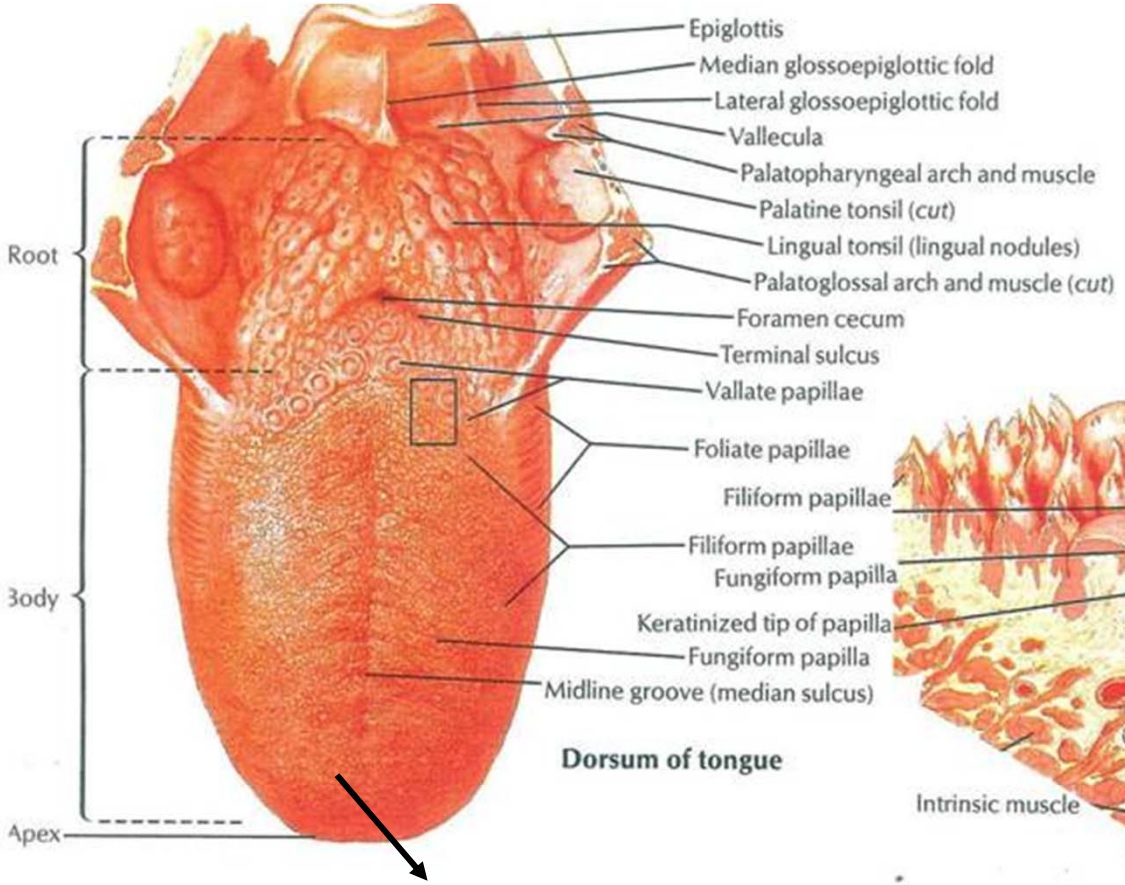
Therapeutic approach

- **Reduction of bacterial load**
- **Reduction of nutrient availability**
- **Conversion of VSC to nonvolatile**
- **Masking the malodor**

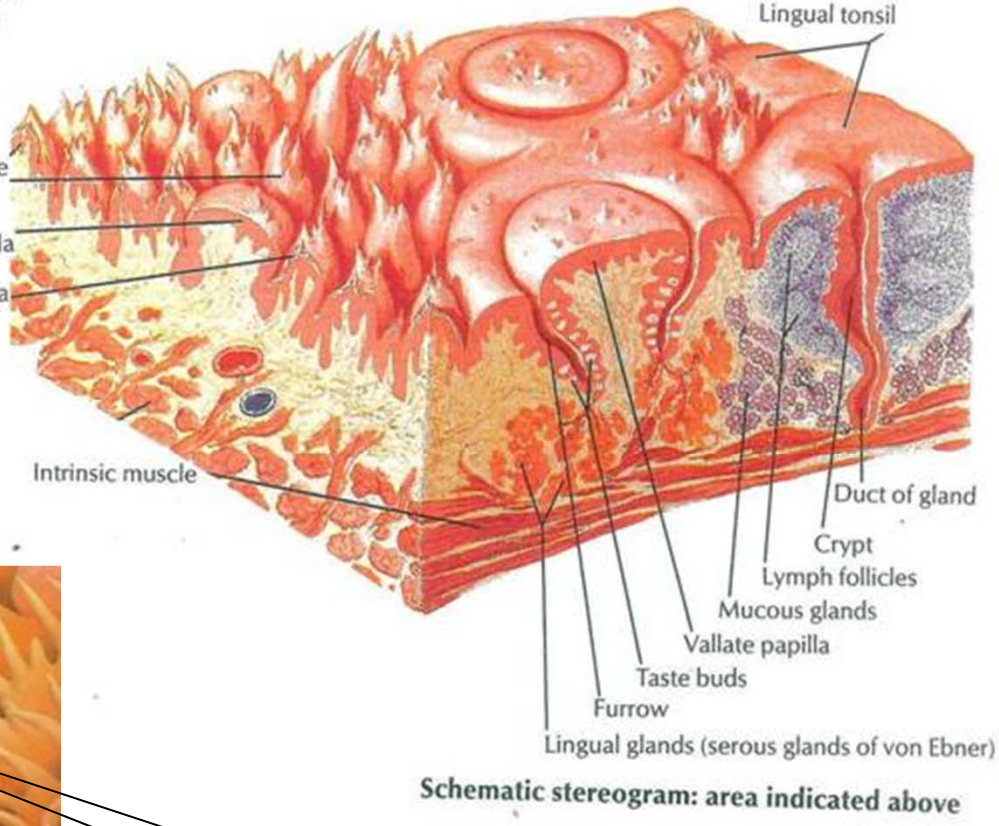
Mechanical approach

- Tongue brushing
- Tooth brushing
- Interdental cleaning

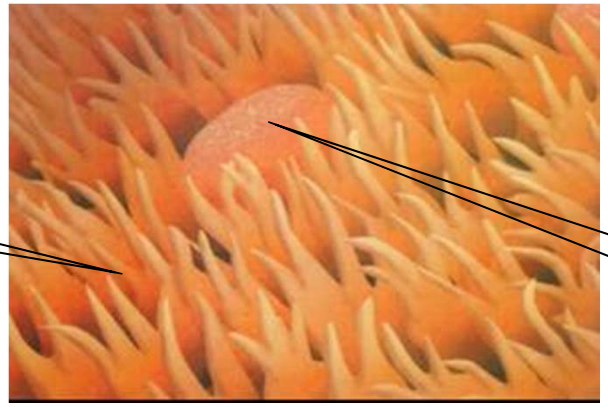
Tongue



Dorsum of tongue



Schematic stereogram: area indicated above

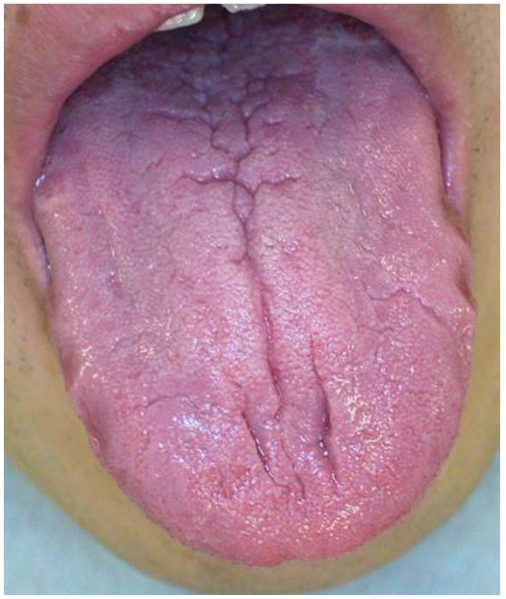


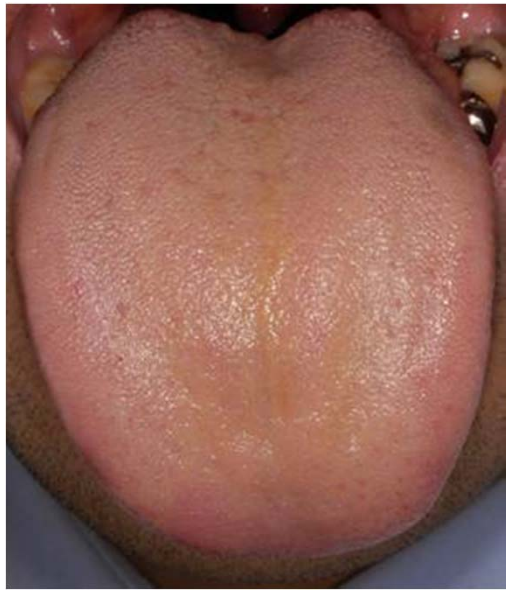
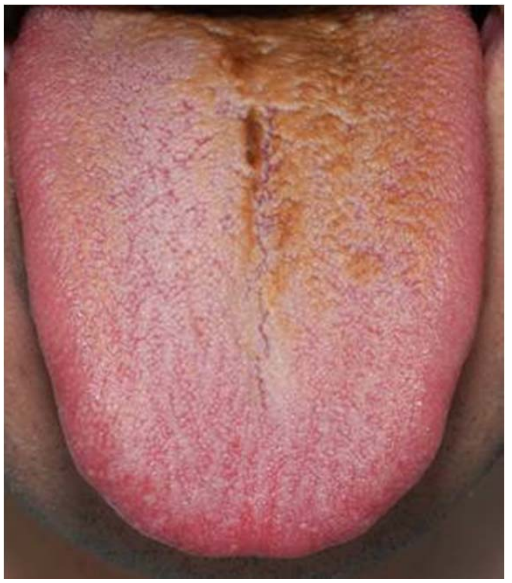
Filiform papilla

Fungiform papilla

Tongue

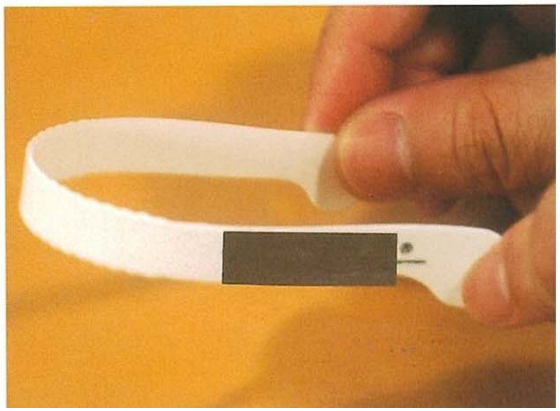




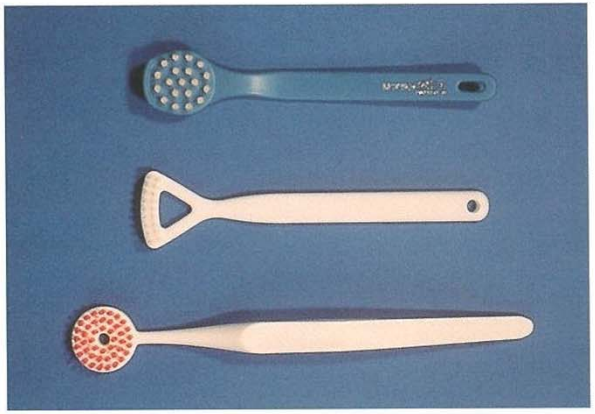



Tongue coating

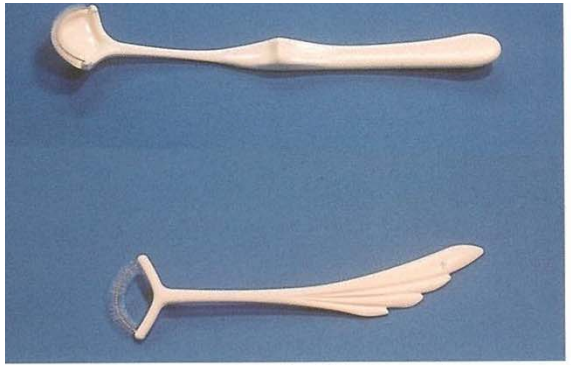
Tongue Cleaning Tools



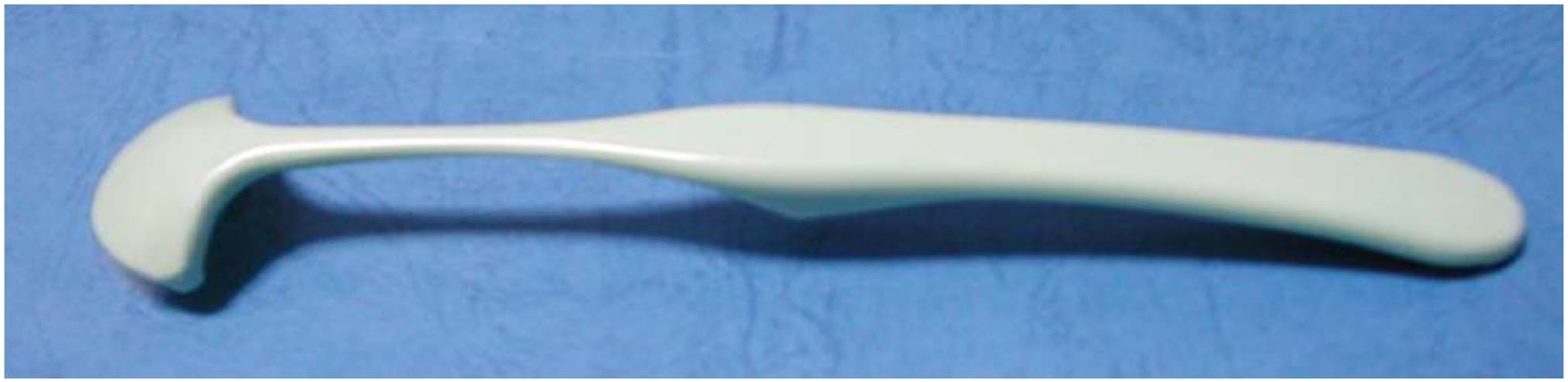
Tongue spatula



Tongue brush



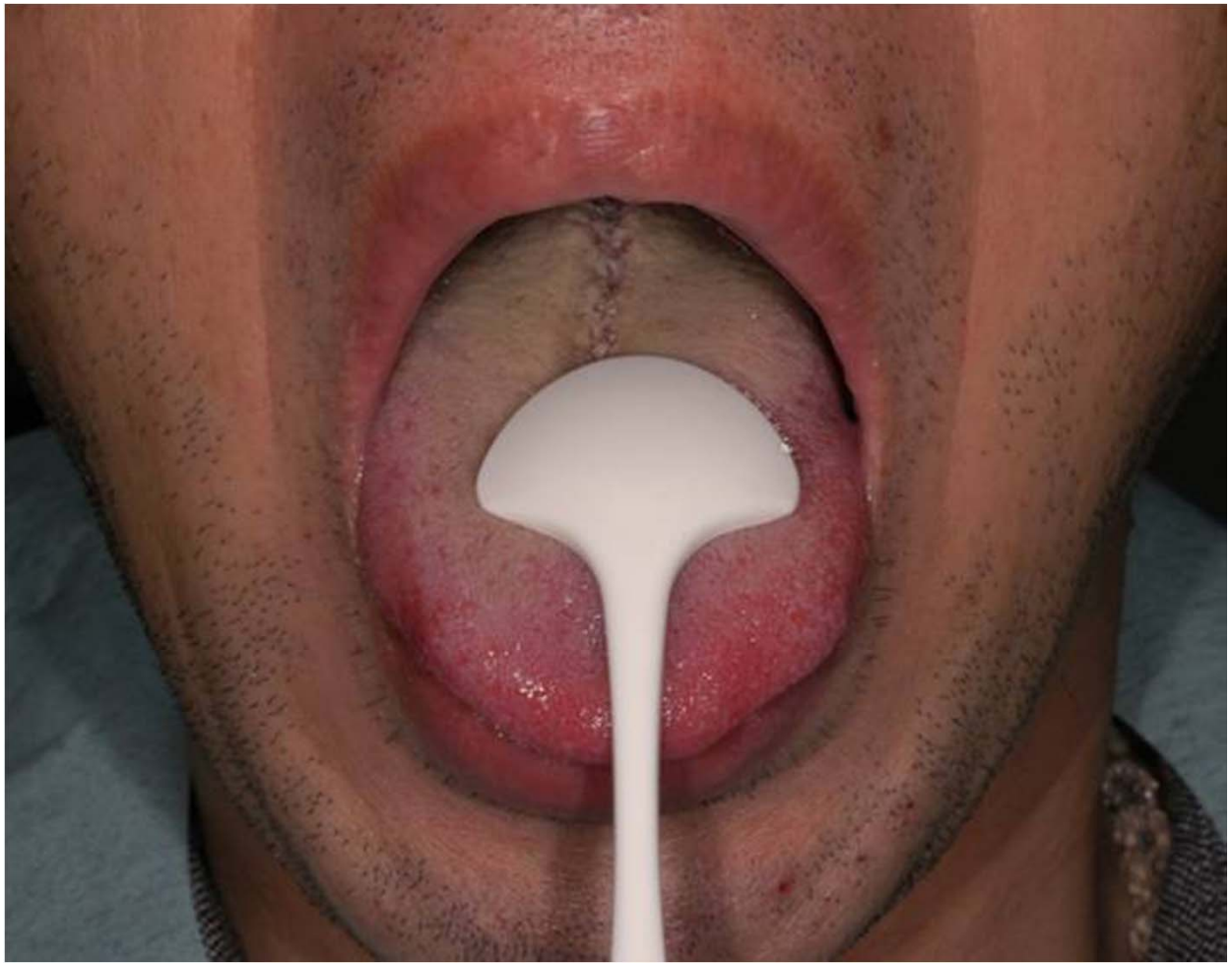
Tongue Cleaning Tools

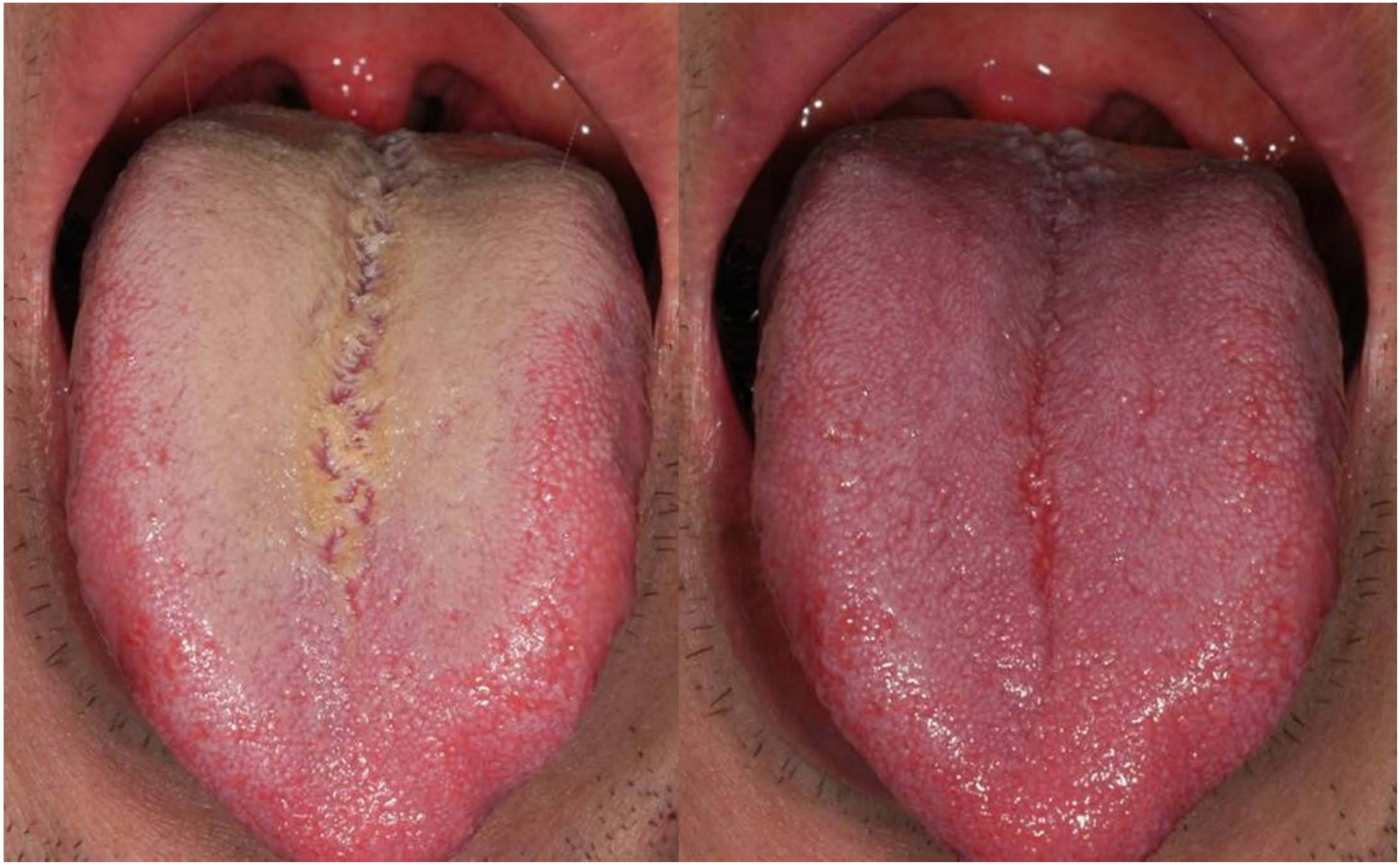


Tongue cleaning by toothbrush

Thick tongue coating

Removing tongue coating

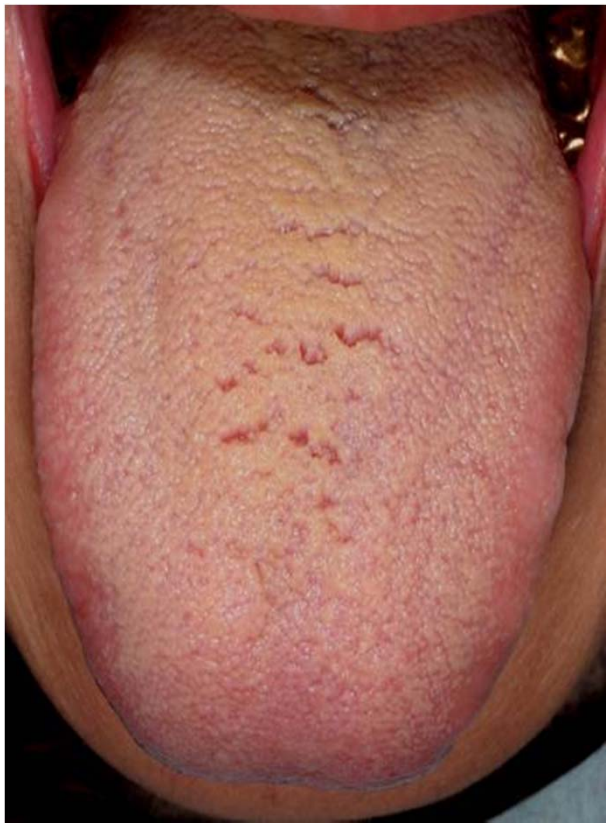




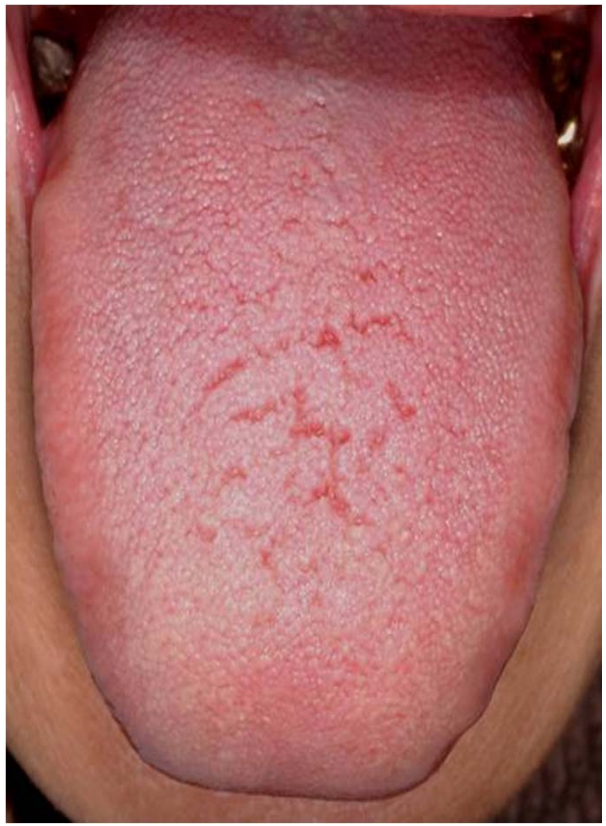
Before

After

Removing tongue coating



Before

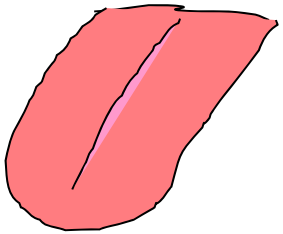


After

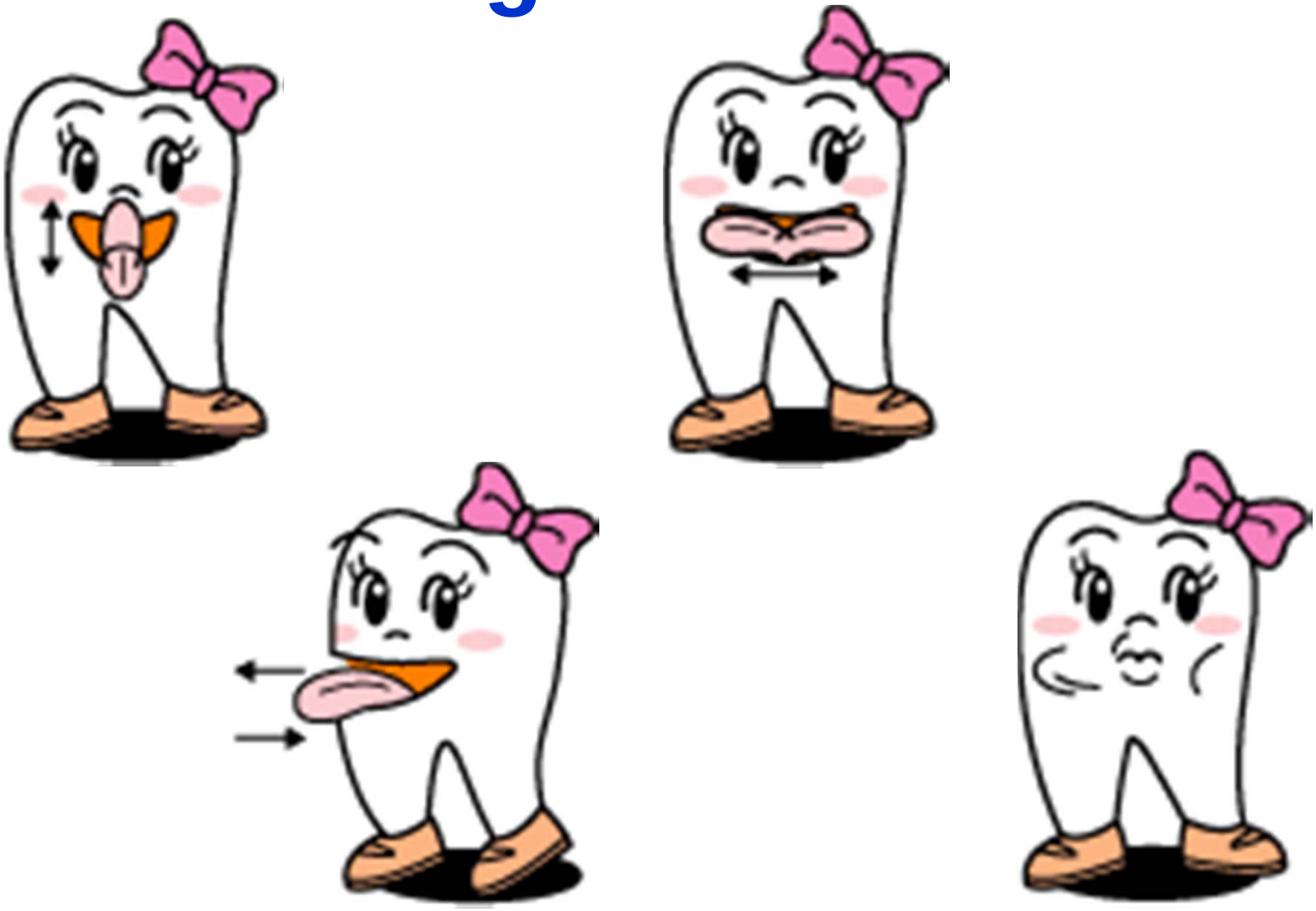
วิธีการทำความสะอาดลิ้น

Methods of tongue cleaning

- **Clean your tongue before toothbrushing**
- **Use only water (no toothpaste)**
- **Stop breathing for several seconds while cleaning your tongue**
- **Do not touch your palate with brush**
- **Once a day is enough (When waking-up)**



การบริหารลิ้น
Tongue exercise



Breath care goods

Breath care goods

Chemical approach

- **Reducing the number of microorganisms**
  - **Chlorhexidine (CHX)**
  - **Essential oils**
  - **Triclosan**
  - **Cetylpyridinium chloride (CPC)**
- **Neutralizing odor compounds**
  - **Metal ions**
  - **Oxidizing agents**

Deodorant effect of breath care goods

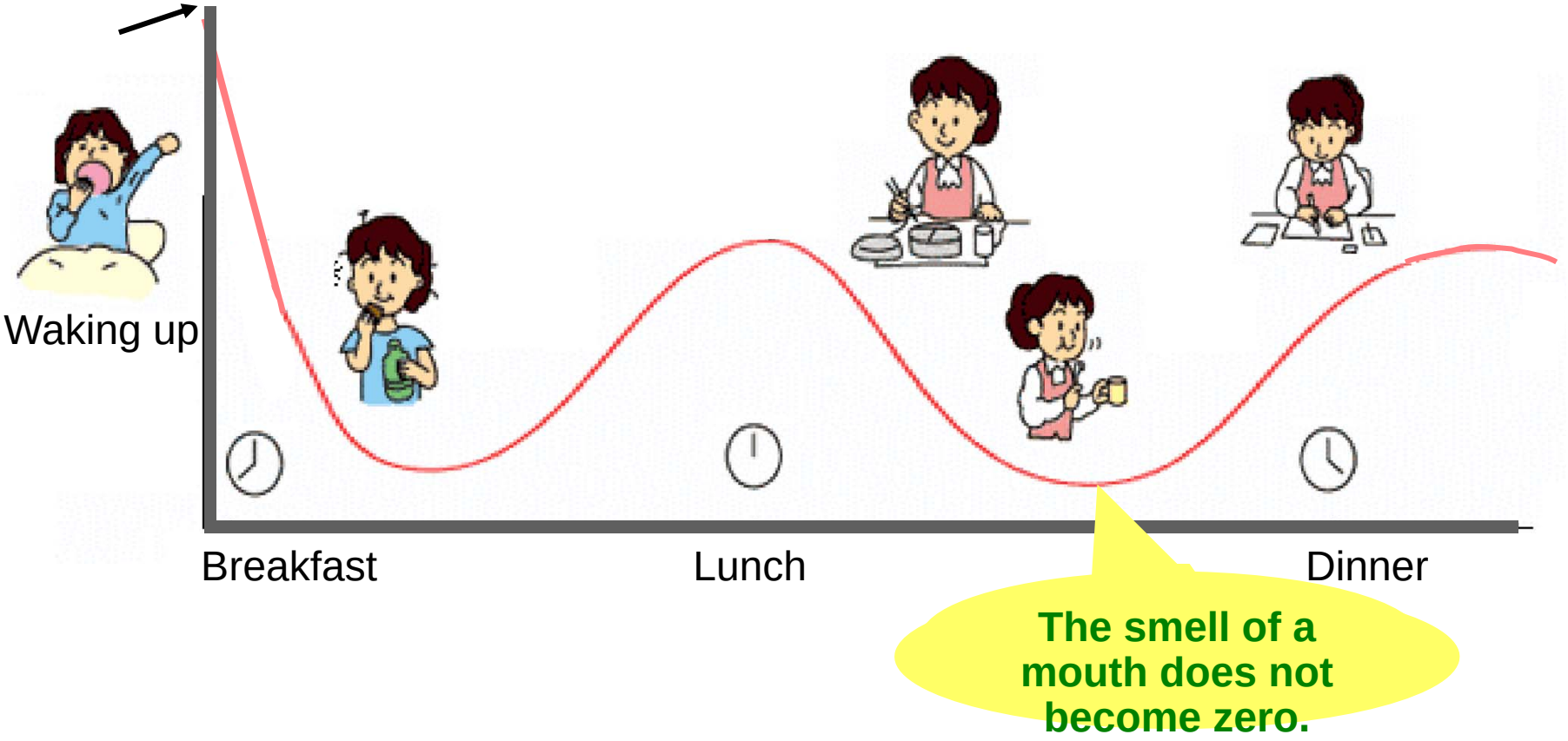
Market share of mouth-rinsing solution, oral tablets, toothpaste, and chewing gum (which advertise the effects of releasing oral malodor level) is increasing.

However, deodorant effect of these material is weak and temporary (Masking effect or psychological effect).

Breath care goods

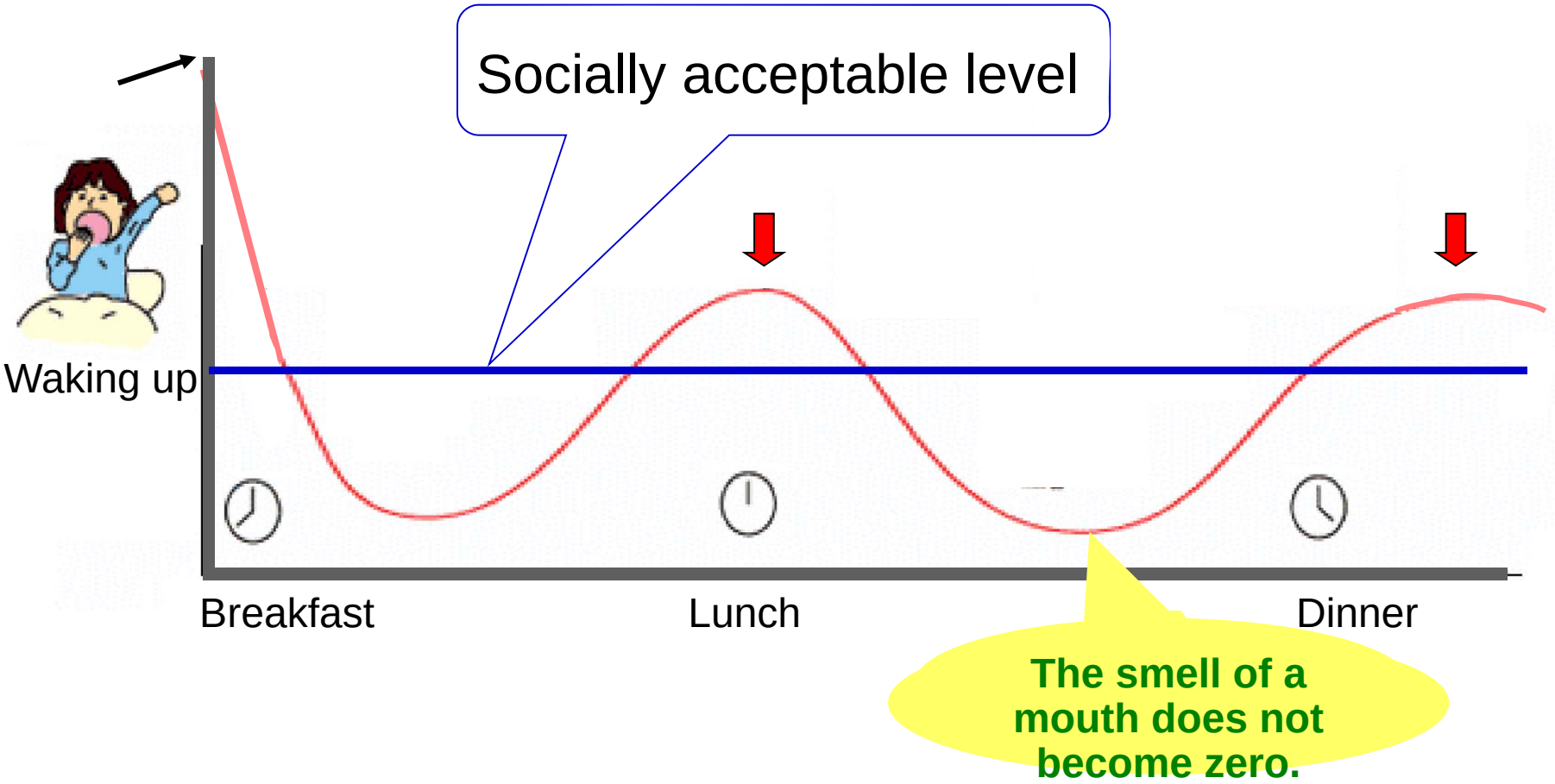
Daily circadian rhythm of malodor

- **Everyone has physiological odor**
- **The level of odor is different during the day**

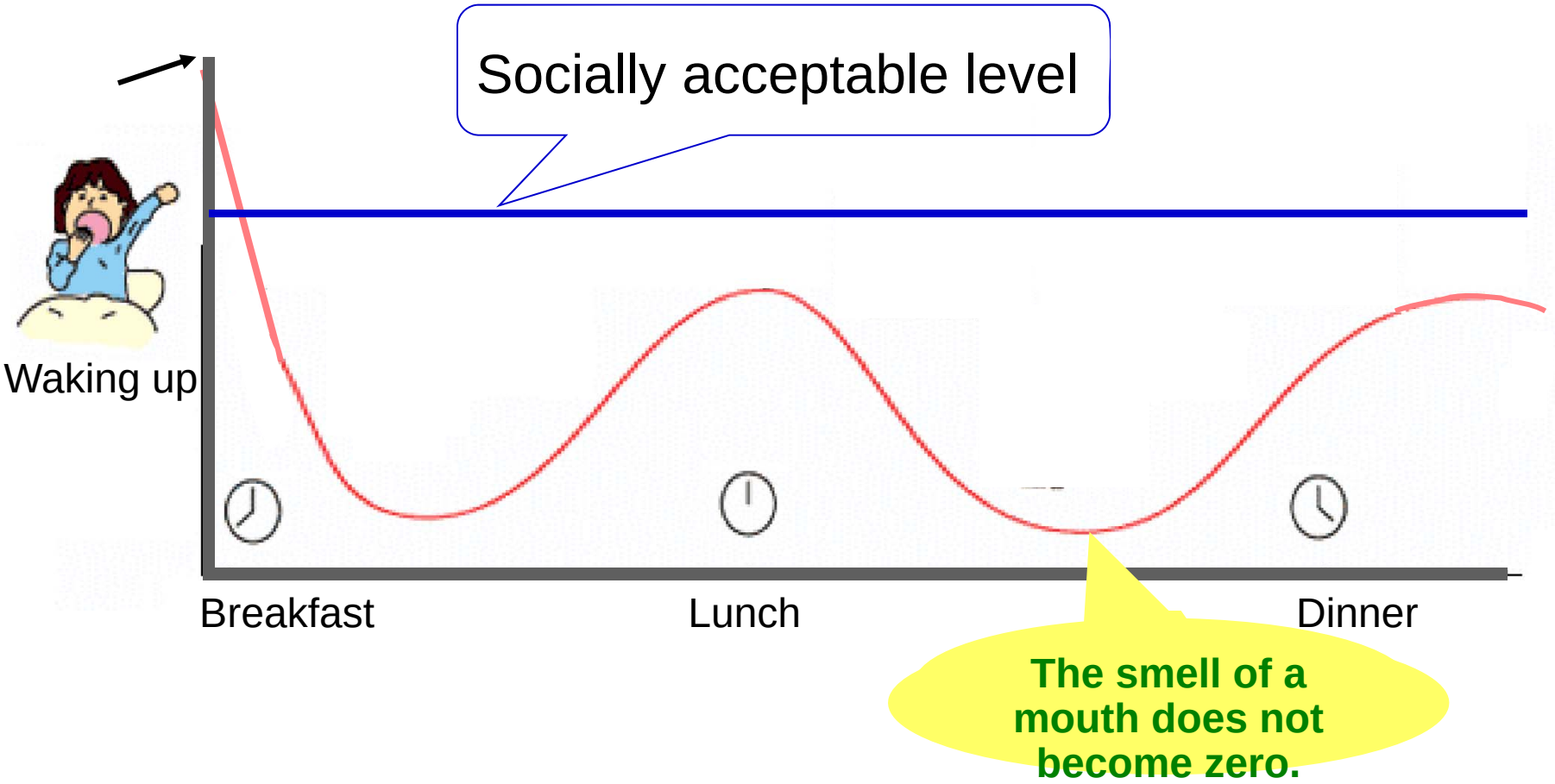


Daily circadian rhythm of malodor

Check the time and situation of malodor occurs



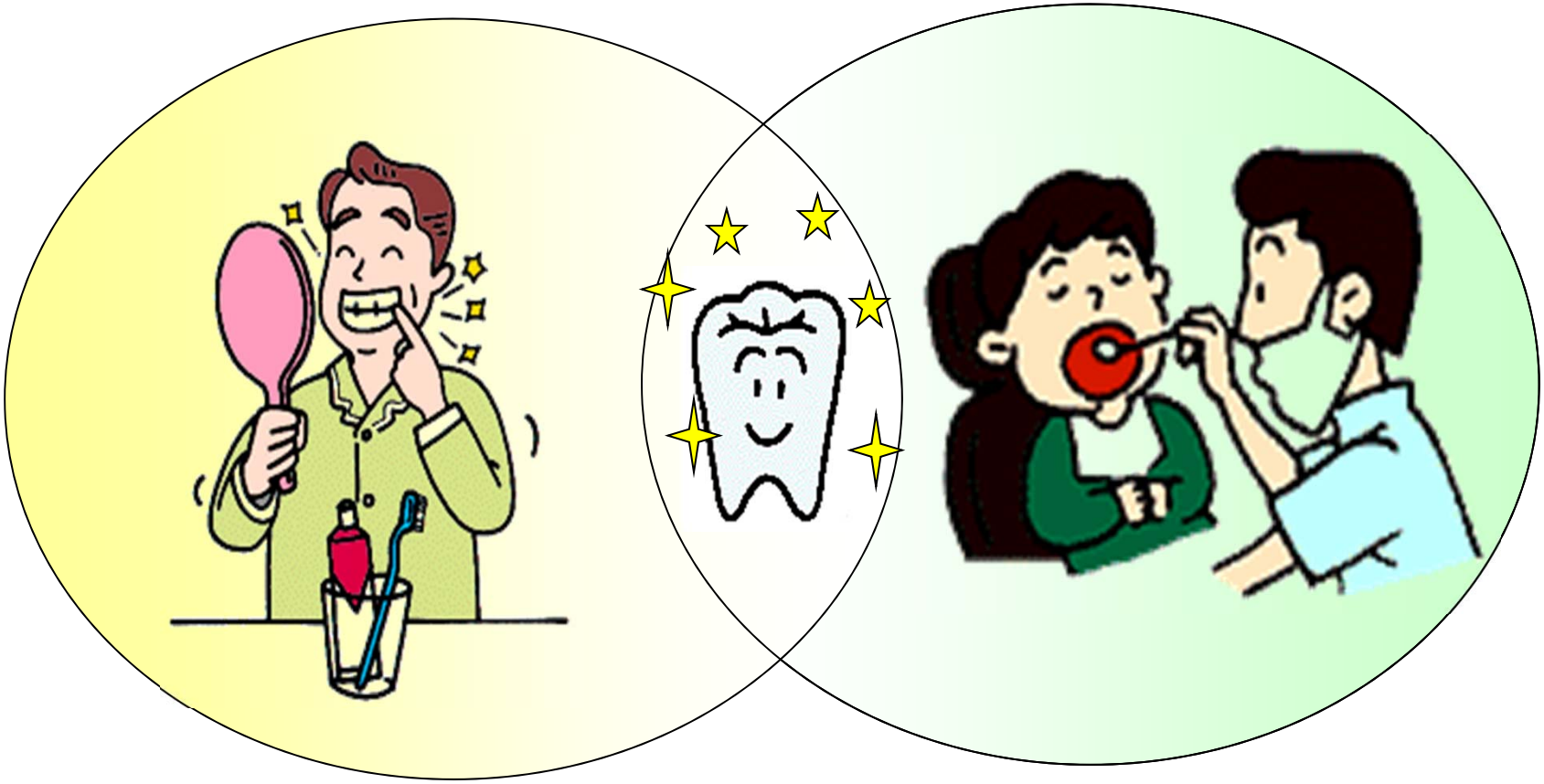
Daily circadian rhythm of malodor



Why oral activities such as eating, drinking and brushing decrease the level of oral malodor?

- Stimulate saliva flow
- Reduce the number of VSC-producing bacteria in the mouth
- Eating decreases the pH value, and low pH value inhibits the production of malodor

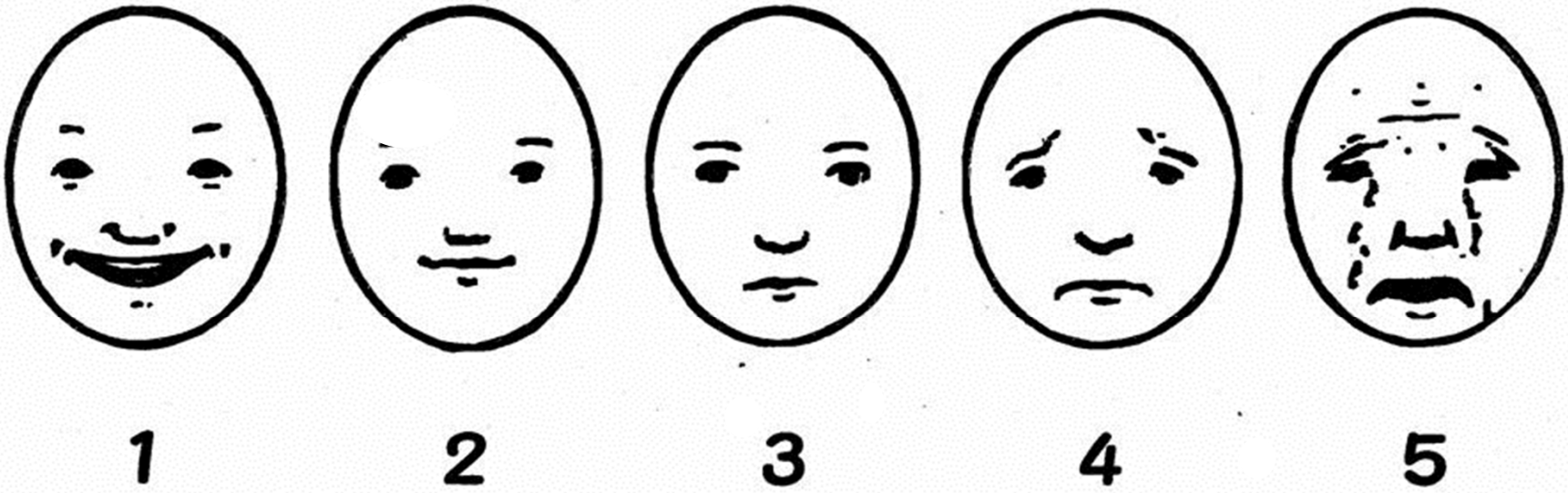
การป้องกันกลิ่นปาก
Prevention of halitosis



Self care

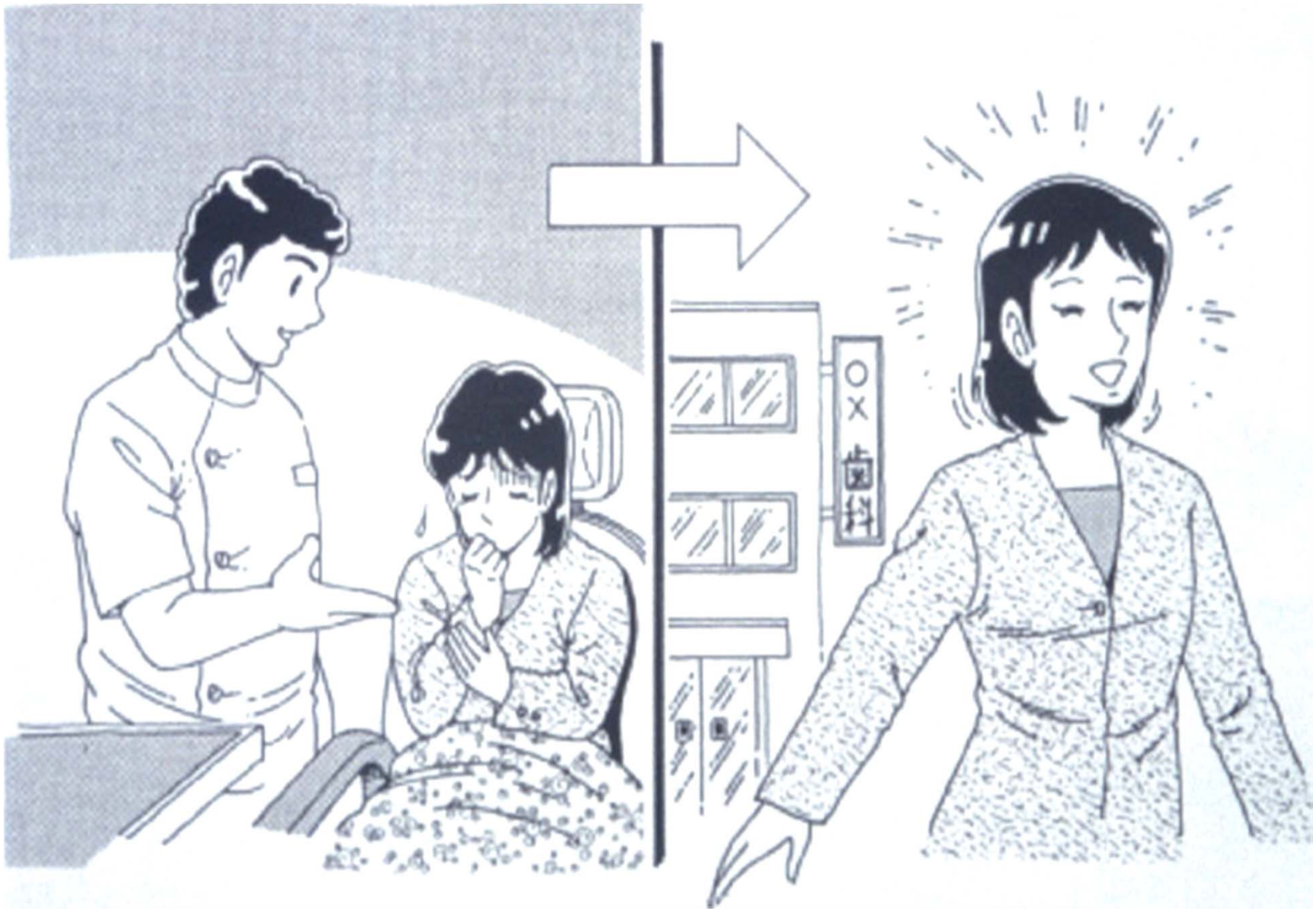
Professional care

Which face is expressing your feeling ?



Face scale

Change of patients




Thank you
for your attention