

T H E C E C S M O R U B R I C

The smile : objectivity of criteria
for its restoration and enhancement

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ABSTRACT

In general, the smile that orthodontists try to create at the end of treatment satisfies objective functional criteria as well as subjective esthetic criteria.

It's obvious that in today's society, a smile plays an important role in non-verbal communication: restoring or enhancing this smile is, in fact, the main reason patients consult their orthodontists.

After reviewing the literature, we were able to identify various factors involved in the perception of a smile and to underscore the esthetic connection between the smile and the face.

Is there a relationship between the smile and facial harmony?

What are the objective criteria that allow us to discern whether a smile is pleasant or not?

Our study confirmed that the esthetics of the face correlates with the perception of the smile and that the factors discussed in the literature pertaining to this correlation are valid.

However, the study has also made it possible to clarify the respective influence of various factors as they relate to a pleasant smile, an unattractive smile or an unsightly smile. Therefore, our study has shown that objective functional criteria are involved in the entirely subjective esthetic realm of a smile.

KEY WORDS

Smile

Perception

Objective

Subjective

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1 – INTRODUCTION

The smile is a wonderful non-verbal means of communication that orthodontists modify during treatment. A number of studies have attempted to evaluate and quantify the position of the teeth using objective measures, but factors such as initial perception, overall feeling and the first impression that a smile makes are hard to assess.

So, in a dual-purpose study supported by statistical analysis, we created a questionnaire to identify totally subjective unquantifiable perceptions and at the same time to highlight some factors that should be reconsidered during restoration and enhancement of the smile.

2 – METHODS AND MATERIALS

As a first step, comparable to the approach taken by Dong⁷, we decided to deal only with smiles photographed close-up, in order to obtain a ranking based on the type of smile in and of itself and not on the overall esthetics of the face. We then photographed the same smiles in a full-face view and placed them in a different order (see questionnaire in Annex).

Given that the faces in the display were in random order, and also in a different order from the smile close-ups, it was now possible to investigate the ways in which the esthetics of the smile affects the esthetics of the face.

For the photographs with just the smile, we listed the age and the orthodontic history of the subjects who were models for this study.

We grouped the subjects who filled out the questionnaire according to age, sex, profession, and orthodontic history.

The results of this questionnaire allowed us to examine the influence that these four factors have on how we react to the esthetics of a smile.

2 – 1 – Population

- **The photographic models** (plates I-VI):
 - 24 subjects grouped according to:
 - **orthodontic history:** 9 were treated, 15 were not;
 - **age:** 2 older patients (> 50 years old), 14 adults (30 to 50 years old), 7 young adults (20 to 30 years old), 1 adolescent (< 20 years old)
- **The examiners:**
 - 30 examiners grouped according to:
 - **profession:** 10 dentists, 10 orthodontists, 10 non-professionals;
 - **sex:** 15 men, 15 women;
 - **age:** 4 older adults (> 50 years old), 22 adults (30 to 50 years old), 10 young adults (20 to 30 years old), 4 adolescents (< 20 years old)
 - **orthodontic history:** 13 were treated, 17 were not.

2 – 2 – Nine general questions were asked

- 1 – *Did the sex of the examiners affect their reaction to the different criteria we proposed?*

- 2 – *Did the age of the examiners affect their reaction to the different criteria we proposed?*
- 3 – *Did the orthodontic history of the examiners affect the grade for the smiles?*
- 4 – *Is there a difference in perception between the professionals and the non-professionals? Between general dentists and orthodontists?*
- 5 – *Is there a correlation between the esthetics of the smile and the esthetics of the face?*
- 6 – *Did the age of the subject in the photo affect the grade for the face or for the smile?*
- 7 – *Did the orthodontic history of the subject in the photo affect the grade for the smile?*
- 8 – *Which factors influenced the grade for the smile?*
- 9 – *Which factors influenced the grade for the pleasant smile, the unattractive smile, and the unsightly smile?*

3 – RESULTS

3 – 1 – Factors related to the examiners

1. Did the sex of the examiner affect the grade for the face and/or for the smile?

The sex of the examiner did not influence the grade for the face or the grade for the smile or the rank given to the smile (analysis of variance (ANOVA), $p > 5\%$).

2. Did the age of the examiner affect the grade for the face and/or for the smile?

The age of the examiner did not influence the grade for the face or for the smile (ANOVA, $p > 5\%$).

3. Did the orthodontic history of the examiner affect the grade for the smile?

The orthodontic history of the examiner did not influence the grade for the smile (ANOVA, $p > 5\%$).

4. Is there a difference in perception between professionals and non-

professionals? Between general dentists and orthodontists?

The profession of the examiner did influence the grade for the smile (ANOVA, $p = 0.049$).

The perception of professionals differed from that of non-professionals. (a Duncan test, $p = 0.002$).

However, there was no difference in perception between general dentists and orthodontists; nor, by the way, between orthodontists and non-professionals.

But, there was a significant difference in perception between non-professionals and dentists.

In their grading, dentists were the most severe and non-professionals were the most lenient.

3 – 2 – Factors related to the models

5. Is there a correlation between the grade for the face and the grade for the smile?



Plate I



Plate II

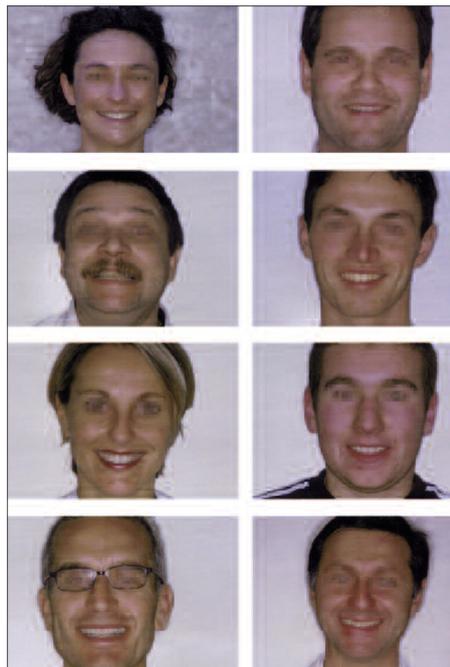


Plate III

(The photo displays are available see material online).



Plate IV



Plate V



Plate VI

The esthetics of the face is interconnected with the esthetics of the smile. (correlation analysis by the least-squares method, $p = 0.03$).

6. Did the age of the photographed subject affect the grade for the face and/or the grade for the smile?

The age of the photographed subject influenced the grade for the face and the grade for the smile (ANOVA $p = 0.001$ for the face and $p = 0.03$ for the smile).

The smiles of the older adults were graded significantly lower than the smiles of the other age groups (*a posteriori* Duncan test, $p = 0.002$).

So, "older" smiles are not as attractive as "younger" smiles.

7. Did the orthodontic history of the photographed subject impact the grade for the smile?

The orthodontic history of the photographed subject did not affect the grade for the smile (ANOVA, $p > 5\%$).

Therefore, orthodontically modified smiles are not perceived as better or worse than natural smiles.

8. Which factors influenced the grade for the smile?

The nine main factors selected from the literature (the appearance of the lips, the relation between lips and teeth, the appearance of the gums, the relation between the gums and the teeth, the shape of the teeth, the hue of the teeth, the appearance of

teeth surfaces, the tooth to tooth proportionality of the teeth and the position of the teeth) influenced the grade for the smile (ANOVA, p has values varying according to the factors between $p = 0.001$ and $p = 0.0001$).

9. We were looking for a method to determine values for these different factors, based on the ranking for the smile, i.e., pleasant, unattractive, unsightly (table I).

We repeated the tests in these different groups (ANOVA).

- **For pleasant smiles**

Only **the appearance of the lips** ($p = 0.02$), **the hue of the teeth** ($p = 0.03$) and **the position of the teeth** ($p = 0.05$) influenced the grade for the smile.

- **For unattractive smiles**

Only the appearance of the surface of the teeth ($p = 0.03$), the hue of the teeth ($p = 0.02$), the appearance of the gums ($p = 0.02$) and the relation between the gums and the teeth ($p = 0.03$) influenced the grade for the smile.

- **For unsightly smiles**

Only **the position of the teeth** ($p = 0.0001$) influenced the grade for the smile.

The final conclusion of this study, completely justifies the procedures that orthodontists perform when considered from an esthetic viewpoint, given the impact that our sense of esthetics has on our psyche and perception.

	LIPS		GINGIVA		TEETH				
	Appearance of Lips	Relation lips teeth	Appearance of gingival	Relation gingival teeth	Shape	Hue	Appearance of surface	Proportionality tooth to tooth	Position
Smile	$p = 0.0001$	$p = 0.0001$	$p = 0.001$	$p = 0.0001$	$p = 0.0001$	$p = 0.0001$	$p = 0.0001$	$p = 0.0001$	$p = 0.0001$
Pleasant Smile	$p = 0.02$	NS	NS	NS	NS	$p = 0.03$	NS	NS	$p = 0.05$
Unattractive smile	NS	NS	$p = 0.02$	$p = 0.03$	NS	$p = 0.02$	$p = 0.03$	NS	NS
Unightly smile	NS	NS	NS	NS	NS	NS	NS	NS	$p = 0.0001$

Table 1

4 – DISCUSSION

4 – 1 – Our view of esthetics: objective or subjective?

Esthetics: “related to feelings of beauty”¹¹.

The etymology of the word esthetics, from the Greek *aisetetos* = measurement, shows that by definition beauty and therefore facial esthetics can be measured².

Many orthodontists are trying to find quantifiable and reproducible esthetic standards for their practice.

For Larabee¹², facial beauty is an objective multicultural concept not based on the average of the characteristics of a population but on a biological basis. Facial beauty would therefore be objective, more or less free of cultural bias (a 2 month old baby and adults are equally drawn to attractive faces). Therefore, Larabee gives a biological definition of beauty: “a beautiful face is a face that is attractive for the visual segments of the central nervous system”. Beauty might then be based on the recogni-

tion of certain patterns, as in chess and math.

Philippe¹⁵ defines a “beautiful” face as one with harmonious proportions outside the norm due to certain differences that are perceived to be expressive and whose surface is free of irregularities, except if they highlight the outstanding trait, as wrinkles sometimes do.

The impression that we feel is subjective because it depends on who the beholder is. The sight of a beautiful face jolts us and creates an esthetic emotion.

This meaning of the word “beauty” is quite simple, and rather common.

Certain features suggest or symbolize an idea or a feeling. The perception of beauty, be it objective or subjective, is the link between an image and a feeling.

Chatenay⁶ thinks that a visual image is the interface between self and others, between consciousness and unconsciousness.

T H E J O U R N A L O F O R T H O D O N T I C S

4 – 2 – Observation of the other

Patzer analyzes the factors that determine physical attraction:

- first: the face;
- second: body weight
- third: size

Factors that determine attraction to the face:

- first: the mouth or the oral region;
- second: the eyes, ranked just below the mouth;
- third: the nose

When we look at a face, our eyes do not focus very long on any one area. Using a computer, the eye movements of an observer were tracked and recorded for three minutes, (“the man watching”).

When recording the movement of the eyes on paper, we see that the eyes of the observer rapidly scan the contours of the face but dwell repeatedly on the eyes and the mouth¹⁰ (fig. 1).

The criteria that determine attractiveness are often those that focus on youth and by extension, fertility, an essential element of selection and evolution of the species¹⁴.

For Canut³, six criteria can be used to evaluate the beauty of a face, based on a judgment, and consequently, on distinct ideal norms. The characteristics of these norms are the very definition of a young face: attractive, in demand, the contemporary ideal.

For him, the six criteria of beauty for a woman are:

- a prominent mouth: it fits the young profile;
- prominent cheek bones: they are equated with a svelte body (some-



Figure 1

one round or “chubby” isn’t attractive);

- the mandibular contour: women are becoming more like men (a well-defined chin is a sign of confidence and intelligence, whereas a weak chin is a sign of timidity and feeble-mindedness);
- a short upper lip: it signals sensuality (a lip slightly covering the upper incisors is a sign of youth and feminine seduction. When the lips are slightly open, it takes on an erotic quality);
- perfect dentition, equals optimal health;
- a broad smile, indicates a feeling of personal well-being.

Women evaluate contemporary males using basically the same criteria, but with certain qualifications added in order to have a masculine image (masculinity = strength, aggressiveness and a sense of being in

charge). The shape of the facial skeletal structure is mostly oval or rectangular, the lips are full and the chin is prominent; male models share these same features.

Hage⁹ points out that it's disturbing to see these masculine features on the face of a woman, because they go against signs of reproduction and perpetuation of the species.

4 – 3 – What is a smile?

It's a non-verbal means of communication.

It starts from a position of physiological rest¹⁶. In this position, the lips cover, and are supported by, the anterior teeth and the alveolar processes. Producing a smile requires complex muscular coordination.

The first hint of a smile appears in the eyes, then in the labial commissures that spread out laterally and posteriorly. As the smile becomes more obvious and wider, the lips separate and the corners of the mouth make a curved movement that goes up and back.

So when someone smiles, we see:

- a development of the naso-labial angle;
- a widening at the base of the nose;
- a narrowing of the eyes;
- a widening of the labial commissures;
- a shortening of the upper lip;
- an opening onto the posterior teeth;
- a smile line that appears.

The smile ends where the laugh begins¹⁶.

There are two main categories of smiles correlated with the human



Figure 2

psyche: static smiles and spontaneous smiles.

Static smiles have some things in common; they are reproducible, expressed as needed, under control and sustainable. They are called "social smiles", as opposed to **spontaneous smiles**, that are explosive, disappear as quickly as they appear, are impossible to reproduce when asked and, in fact, are a window into the soul. Spontaneous smiles reflect a real, almost animal-like, emotion.

The spontaneous smile is rather dynamic and often differs from the

social smile that is controlled so as to hide possible defects of the dentition.

When taking photographs, it's easy to get pictures of "social" smiles but "spontaneous" smiles are hard to capture.

For all these reasons, it would be useful if orthodontists included videos of their patients' smiles in their records.

4 – 4 – The psychological aspect of the smile

Even if Larabee¹² thinks otherwise, the perception of the smile is intimately linked to culture.

In prehistoric times, raising the upper lip and baring the teeth was undoubtedly considered a sign of aggression, a defensive gesture similar to a dog showing his canines by raising his drooling lips¹⁶.

The most famous smile is the enigmatic smile of the Mona Lisa, a Leonardo da Vinci painting. People will be talking about her for ages to come.

But teeth are strikingly absent from this smile as they were in most classical portraits and, more generally, from all classical paintings. They were only depicted in representations of death, for example on a dissection table.

However, today, teeth are omnipresent in the smiles displayed in magazines, on billboards, and on television. A smile, because of the positive image it sends, is used to sell everything and anything (Fig. 2).

Still, the perception of the esthetics of a smile varies from society to society. Each social group has com-

mon standards for recognizing physical attractiveness, even if there is no way to objectively measure it.

Beauty appears to have more to do with culture than with the actual perception of the individual.

For example, in Viet Nam, smiles adorned with gold teeth are highly valued because gold is a sign of wealth and social success. In Laos in earlier times, teeth were covered with black lacquer. Among certain tribes in the Amazon forest, front teeth were filed into points. In the United States, teeth have to be white and straight with a flat line smile. In Europe, they prefer more natural curvatures.

Presently, we live in a very cosmetic-conscious time; facial appearance, whether described from a social, psychological or clinical perspective, is essentially a phenomenon of perception. In a study of cognitive experience, Baudoin¹ highlighted the extremely positive value of a smile by showing that it created a feeling of thankfulness in total strangers.

The smile is crucial in emotional development, changing it can influence the self-image of the individual¹⁷.

There are various levels of alteration that the smile can undergo, from dental crowding in the anterior maxillary sector, to the quasi-total destruction of the buccal dentition because of trauma or illness.

However, the psychological impact is not the same for everyone because people's perception of their smiles varies.

An orthodontist or a dentist as professionals of the "smile" would be upset to see a simple chip of the incisal edge of an upper anterior tooth

whereas the man in the street wouldn't even notice it.

Requests to replace missing teeth as well as the psychological impact of their loss are linked to the position of the missing tooth. The more anterior they are, the more pressing are the demand. For the majority of the population, in an intensely subjective way, the absence of teeth in the posterior areas doesn't change the subject's appearance⁸.

In extreme cases of destruction to buccal dentition, there are three different scenarios:

- **alteration of buccal dentition due to neglect and poor hygiene:** the patient is responsible for this condition;
- **alteration due to trauma:** the psychological impact is enormous because of the blunt force involved;
- **alteration due to disease with a life changing prognosis:** for example, in cases of mouth or ENT cancer. In hopes of curing the disease, a part of the face and oral cavity must be removed. Maxillo-facial surgeons try to reconstruct the missing parts of the face and oral cavity in order to restore vital functions such as swallowing, mastication and the social function of phonation.

Initially, they maintain a positive perception vis-à-vis this life-saving procedure, but a period of depression follows as the patient realizes that his image has been significantly altered.

In our view, the perception of the smile with all its psychological implications is quite complex.

The main reason patients come to see us is to enhance their smiles;

therefore it is important to know what are the best procedures to use to achieve maximal results, especially in cases where we have to compromise, which is frequently true when adults receive orthodontic treatment.

Since a number of authors are attempting to measure and rank each element of a smile in order to obtain optimal results and reproducibility of those results, we made a list of the elements and came up with nine. Then, we began an investigation to determine the order of importance of these elements in the perception of a smile. We tried to objectify a perception that is entirely subjective.

It's obvious that, in our society, the smile plays an important role as a means of non-verbal communication; enhancing the smile is the main reason patients come in for a consultation.

Our review of the literature demonstrated how complex the perception of the smile is. It also allowed us to categorize the various factors that come in to play in perception and to underscore the interdependent nature of the esthetics of the smile and the esthetics of the face.

Through the use of photography, we were able to highlight the dynamic aspect of the smile; this dynamism is mostly downplayed in other studies.

In general, the smile that orthodontists are trying to create at the end of treatment satisfies objective functional criteria as well as subjective esthetic criteria. These criteria make it possible to evaluate the result of their work.

The crucial element in social relations is the impression of harmony

that emanates from the face. If there is a connection between the beauty of a smile and the harmony of the face, orthodontists must therefore do research into this link, because it affects factors such as function and as well as quality of treatment.

Orthodontists must also investigate factors that modify the smile in order to know where they should concentrate their efforts during the course of treatment.

In this transversal study, we have therefore attempted to determine if there was a connection between the smile on the lips and the harmony of the face and, secondly, what were the objective criteria for knowing whether a smile is pleasant or not.

If our study confirmed that the esthetics of the face correlates with the perception of the smile and that the factors discussed in the literature pertaining to this correlation are valid, it also made it possible to clarify the respective influence of the various factors involved in a pleasant smile, an unattractive smile and an unsightly smile.

Therefore, the study has shown that objective functional criteria are

involved in the entirely subjective realm of perception.

Pleasant smiles are linked with the appearance of the lips, the hue of the teeth and their position.

Unattractive smiles are linked with the hue and surface of the teeth, the appearance of the gingiva and the relation between teeth and gingiva.

Unsightly smiles are linked to the position of the teeth.

In order to transform an unsightly smile into a pleasant smile, dentists perform procedures to modify: the appearance of the gums, the relation between teeth/gums, the hue of the teeth, the surface of the teeth; cosmetic M.D. surgeons change the appearance of the lips. Orthodontists improve the smile of their patients by changing the position of their teeth.

It might be worthwhile to investigate all the factors implicated in the positioning of teeth and to do a longitudinal and not a transversal study, and finally, to initiate a truly dynamic study with more sophisticated technology, such as videos that are tracked by a computer.

5 – CONCLUSION

In our study we were able to objectify a totally subjective perception and to highlight the positive influence of orthodontic treatment on the evaluation of smiles and, accordingly, of the important role our profession plays in helping people to employ

a vital non-verbal means of communication that has important psychological consequences.

NOTE – The photographic plates can be consulted as material online with this article.

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QUESTIONNAIRE

Sex:

DOB

where

Nationality:

Profession:

Have had any previous orthodontic procedures? y/n

If so, what kind?

removable appliance

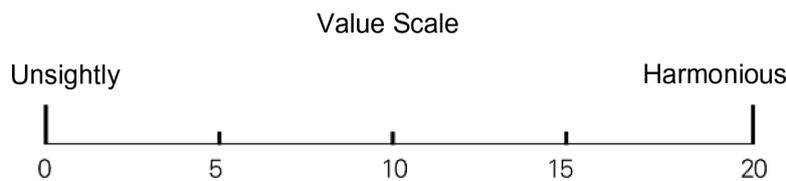
a bridge

orthodontic surgery

At what age? _____

This questionnaire is anonymous so as not to influence the answers. Factors such as age, sex, profession and orthodontic history were important for this study.

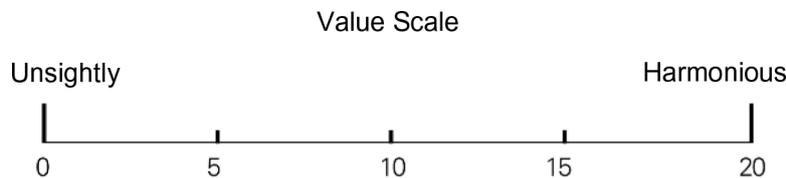
Rate these smiles in ascending order of preference, from the most unsightly to the most harmonious on a scale of 0 to 20.



A value scale was used by analogy with rating systems for the evaluation of pain.

The rating system was intended to establish both a grade and a ranking.

Rate these faces in ascending order of preference, from the most unsightly to the most harmonious on a scale of 0 to 20.



The rating system was intended to establish both a grade and a ranking to measure the influence of the esthetics of the smile on the esthetics of the face.

We used all 10 questions for each smile.

We have listed and described the 10 key criteria selected from the literature in order to now show their impact on the perception of the esthetics of a smile.

1. Do you think this smile is...?

- Pleasant
- Unpleasant
- Unsightly

2. Are you satisfied with the relation between the lips and gums/teeth system?

Y or N

If not, why? (you can check more than one item)

- The teeth don't fill the mouth opening
- Too many shadowy areas
- Lower teeth are too visible
- Lower teeth not visible enough
- Upper teeth are too visible
- Upper teeth are not visible enough
- The line of the upper teeth is not parallel to upper lip
- The line of the upper teeth is not parallel to the inside part of the lower lip
- The line of the smile is below the corners of the lips
- The line of the smile is above the corners of the lips
- The smile is too gummy
- You can't see the upper teeth
- You can't see the lower teeth
- Others: _____

3. Are you satisfied with the way the lips look? Y or N

If not, why? (you can more than one item)

- Too thick
- Too thin
- Too pursed
- Too asymmetric
- Lack of harmony in the shape of the upper lip
- Lack of harmony in the shape of the lower lip
- Curvature of the inner arc of the upper lip is not harmonious
- Curvature of the inner arc of the lower lip is not harmonious
- Upper lip is too long
- Upper lip is too short
- The smile it too broad
- The smile is too narrow
- Others: _____

4. Are you satisfied with the relation between the teeth and the gums? Y or N

If not, why? (You can check more than one item)

- The line of the gums is too irregular/broken up
- The line of the gums shows the teeth too much

- The line of the gums covers the teeth
 Dark spaces between the teeth
5. Are you satisfied with the way the gums look? Y or N *If not, why? (you can check more than one item)*
- Too visible
 Irregular contours
 Appearance
 Color
 Others: _____
6. Are you satisfied with the tooth to tooth proportionality? Y or N
If not, why? (you can check more than one item)
- upper teeth are too big in relation to lower
 upper teeth are too small in relation to lower
 central incisors are too big in relation to lateral incisors
 central incisors are too small in relation to lateral incisors
 others: _____
7. Are you satisfied with the position of the teeth? Y or N
If not, why? (you can check more than one item)
- Too regular
 Too irregular
 Too spaced
 Too close to one another
 Some are slightly rotated
 Turned in towards one another
 Turned back too much
 Too many differences in height
 middle teeth are mismatched
 Others: _____
8. Do you like the shape of the teeth? Y or N
If not, why? (you can check more than one item)
- Too round
 Too broad
 Too narrow
 Too short
 Too long
 Too triangular
 Too square
 Too bulgy

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9. Are you satisfied with the color of the teeth? Y or N

If not, why? (You can check more than one item)

- Too dark
- Too light
- Irregularity in color
- Look fake
- Tooth crown(s) visible
- Good restorations visible
- The dental filling are unsightly
- Others: _____

10. Are you satisfied with the surfaces of the teeth? Y or N

If not, why? (you can check more than one item)

- Irregular
- Striated
- Pitted
- Others: _____