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a new intuitive graphic visualization of quality of life in acne patients

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SUMMARY

Acne radar: a new intuitive graphic visualization of quality of life in acne patients

Background: There are many instruments available in literature to evaluate the influence of acne on Quality of Life (QoL), but many of these questionnaires rarely are performed in daily clinical practice. Many of these instruments require a long time for the compilation, and often they are not self completed. There are no simple and intuitive instrument that can be completed by patients alone, with a graphical representation of the results.
Objective: To develop a new, rapid and intuitive graphic instrument to a questionnaire allowing both a quick assessment of the impact of acne on patients and, at the same time, increase patient's compliance and self-esteem.
Methods: In our study 50 patients were recruited and questionnaire was administered following the main items evaluated in the validated index of QoL from previous studies for acne patients. We have applied an intuitive graph representation, the "Radar Graph", and other statistical methods like the Decisional Map and the Principal Component Analysis, to this questionnaire allowing a quick assessment of the impact of acne on patients.
Results: The questionnaire evaluated have 10 items regarding 3 different area: the objective symptoms such as negative perception of their image (imperfection), sting and insomnia; the subjective symptoms such as depression, perception of illness, lack of serenity and shame; and the relational difficulties such as social relationships, working relationships, and intimate relations. The answers are given on a 10-point visual analogue scale.
Conclusion: Our survey can be a new, rapid and intuitive graphic instrument to use in clinical practice.

KEY WORDS: *acne, quality of life, acne radar.*

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Introduction

70-85% of adolescence is affected by acne, while 30% of young adult suffered of acne over 35 years [1]. The psychological impact of acne is very important especially for shy and emotional patients, causing a damage to their self-confidence and relationships. Therefore, acne can be considered a disease compromising patient's psychology [2]. The acne impact status on patient's quality of life (QoL) is rarely evaluated in daily clinical practice [3].

Besides there are a lot of questionnaires evaluating the QoL in dermatology [4,7] and in specific dermatological diseases, such as in psoriasis, contact dermatitis, alopecia areata [8-10], a simple and intuitive instrument that can be completed by patients alone, with a graphical representation of the results has not been created for patient affected by acne [11-13].

Many of these instruments require a long time for the compilation [11-15], and often they are not self completed. For these reasons, an intuitive graphic representation could be an interesting and useful instrument for dermatologist, to evaluate simply and rapidly the impact of acne in these patients. On the basis of previous evidence, we have applied an intuitive graph representation, the "*Radar graph*" associated to a self completed questionnaire, allowing a quick assessment of the impact of acne on patients. We have performed a statistical analysis of the graph, through the *Decisional map* and the *Principal component analysis*.

The questionnaire was based on items obtained from previous questionnaires of literature and from the clinical experience of a group of Italian dermatologists.

We have registered 10 items regarding 3 different area: the objective symptoms such as negative perception of their image (imperfection), sting and insomnia; subjective symptoms such as depression, perception of illness, lack of serenity and shame; and relational difficulties such as social relationships, working relationships, and intimate relations.

This study represent the first step of the development of a new, rapid and intuitive graphic instrument, easy to understand by patient, that can be useful in clinical practice.
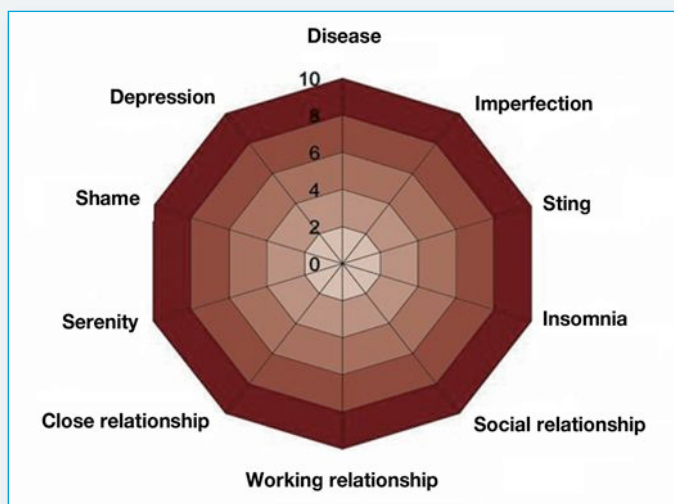
Materials and Methods

Patients were randomly selected from our outpatient dedicated to acne, of *University of Naples Federico II*, during the period from March 2012 trough September 2012.

This prospective study have been performed in accordance with the ethical standards approved by *Declaration of Helsinki* and its later amendments. Our sample was composed by 50 patients: 14 were men and 36 were women. Written informed consent was obtained from all 50 patients. Inclusion criteria were: patients aged between 16 and 28 years with mild, moderate and severe/very severe acne affecting the subjects from at least 3 months. The mean age of males was 18,7 years (age range 16-22 years) and of females was 19,6 years (age range 16-27 years). The patients were classified according to the severity of acne with three systems of classification: GAGS (*Global Acne Grading System*), lesion counts (number of blackheads, papules, pustoles and nodules) and a clinical evaluation given by expert dermatologists with a score from 1 to 10. The *Radar graph*h design and related questionnaire is shown in the Figure 1 and Table 1a-b.

Items were selected according to clinical experience of a group of ten members selected among the medical staff of specialized acne centers in Italy, and according to data obtained from the QoL international literature, in particular considering the model used for the Psodisk and the SAT-P quality of life assessment [9,16].

The first part of the questionnaire include questions about sex, age and kind of treatment, while the second part include 10 questions that evaluated, from 1 to 10 scale (1 for nothing agree, 10 completely agree) how acne can impact on daily life in the last month.

The ten items evaluated were divided in three areas:

- **objective symptoms**, such negative perception of their image (imperfection), sting and insomnia;

- **subjective symptoms** such as depression, perception of illness, lack of serenity, shame

- **relational difficulties** such as social relationships, working relationships, and intimate relations.

All these data were represented using *Radar graph*. The *Radar graph* is a visual method showing data of multiple variables. It consists

Figure 1.
Acne Radar Graph.

Table 1a.
Acne Radar questionnaire: personal data.

Name	
Surname	
Age	
Duration of disease	
Kind of treatment	

	1	2	3	4	5	6	7	8	9	10
Disease Acne cause you a disease										
Imperfections Acne influence significantly your skin, causing imperfections, due to its extension										
Sting Acne cause sting and/or itch										
Insomnia Acne cause you problems with sleep										
Social relations Acne limit your social interchange										
Working relationships and study Acne limit your working relationships or study										
Close relationships Acne limit your close relationships with the other sex										
Serenity Acne compromise hardly your serenity, causing anxiety										
Shame Acne cause you shame										
Depression Acne cause you depression										

in a sequence of rays, that born in a center, and forming equal angles between them; each ray is associated with a variable (item). The distance between the center and the point on the ray is proportional to the level of QoL for specific variables (varying between 1 and 10).

Connecting by straight lines all points, relatives to each subjects, on every rays, we obtain the patient profile. The *Radar graph* can be used as: an instrument of data collection, for a diagnostic evaluation of each symptoms; an instrument of comparison between subjects, or in the same subject in different times; an instrument of comparison between different categories of subjects (like male vs females)[17].

The main advantage of radar diagrams is to monitor and immediately put in evidence the most critical cases and features, just like a radar apparatus is used to identify high risk situations and to optimize the global approach to the patients affected by acne.

Besides, we subdivided the sample in 4 portions equally distributed (quartiles), corresponding to 25%, 50% and 75% of the sample[17]; we also applied the *Principal component analysis* (PCA)[17]. Through the PCA we studied possible correlations between several symp-toms, and if they impact on the daily life. To better understand the data by PCA we can use the circle of correlations, allowing to identify the main items that influence the patients feelings[17-19].

A further map, representing subjects on a factorial map allow to identify which ones have an higher discomfort (coordinate positive/negative on first axis) and characterized by objective symptoms on the second axis rather than characterized by subjective symptoms. Two subjects have similar profile when they stand nearby positions on the graph. To better understand the score obtained on daily life of patients, we transformed all data in a scale from 0 to 100: lower values, near to 0, indicate a low impact, while higher values, near to 100, indicate a high impact.

To verify if there is a correspondence between the Index and the data obtained by GAGS and evaluation performed by the dermatologist, we have used the Spearman Rank correlation coefficient; it can assume values from -1 to +1.

After these analyses, we performed a decisional map based on simultaneous representation of average of the different analyzed symptoms and their impact on the global score. The decisional

Table 2.
Values of average, Standard Deviation (SD) and Quartiles of variables.

Variable	Minimum	Maximum	Average	SD	1° Quartile	2° Quartile	3° Quartile
Disease	0.00	10.00	4.34	2.83	2	4.5	6
Depression	0.00	10.00	4.42	3.26	1	5	7
Sting	0.00	10.00	4.86	3.02	3	5	7
Insomnia	0,00	8.00	1.66	2.49	0	0	3
Social relation	0.00	10.00	3.12	3.34	0	2.5	5
Working relation	0.00	8.00	1.60	2.46	0	0	2.75
Serenity	0.00	10.00	4.70	3.09	3	5.5	7
Imperfection	0.00	10.00	6.42	2.74	5	7	8
Shame	0.00	10.00	4.72	3.53	1	5	7.75
Intime relation	0.00	10.00	3.46	3.14	0	3	6

map is an instrument that allow to localize in a graph the symptoms of acne patients obtained with radar methodology, and to classify them in four areas: symptoms at risk, to monitoring, to improve or not relevant. The main aim of this map is to identify what symptoms affect mainly the patients QoL, and obtain in this way a diagnostic and therapeutic route, identifying what are the priorities.

Results

Descriptive statistics

Data obtained were as follows: patient with mild acne (GAGS 1-18) were 20% (2 men and 8 women), with moderate acne (GAGS 19-30) were 44% (6 men and 16 women), with severe acne (GAGS 31-38) were 28% (4 men and 10 women) and with very severe acne (GAGS > 39) were 8% (2 men and 2 women). Acne was localized principally on face (70% of total patients) and on face plus chest/back of the remaining 30%. Patients were treated, for six months, with the most common topical acne therapies: *topical retinoids*, *salicylical acid*, *benzoylperoxid plus topical retinoids*, *topical antibiotics plus retinoids* and *azelaic acid*.

From the descriptive statistical analysis, we can see that the scores assigned by patients to the 10 variables ranging from a minimum of 1 to a maximum of 10; except for insomnia and working relationship, whose maximum is up to 8. These are also variables for which we have very low average (1.66 and 1.60 for insomnia and work-

ing relationships respectively), because they less influence the daily life of these patients. In contrast, patients have higher severity in the perception of aesthetic factor (6.42), sting (4.86) and shame (4.72). In order to assess the reliability of the average of symptoms, we have considered the standard deviation (SD); in particular working relations (2.46), insomnia (2.49) and the negative perception of the aesthetic factor (2.74) show a low value of SD, representing a good reliability of the corresponding statistics (Table 2). Besides, the analyses obtained by the division of sample into quartiles show that 25% of subjects has a value > 8 for imperfections, indicating that this variable is very important for patients; while 75% of subjects has values < 2.75 for working relationships, and < 3 for insomnia, indicating that these variable has a low influence (Table 2).

The Radar graph

Radar graph allows us to monitor the different results obtained for example, for patient n. 39 of our sample, at T0 (before treatment) and T1 (after treatment) (Figure 2a). We can also use this graph to observe patients that have high gravity symptoms (i.e higher than third quartile) but it's not recommended the use of same graph for many patients, in fact each individual patient has own graph. The same graph can be very useful to compare patients' categories: from the answers obtained by girls and boys, we can see, on *Radar graph*, the representation of third quartile, to assess the difference of behaviour among the male respect to female. As evidenced by the *Radar*, we can state that female are more sensitive respect to than male, for all parameters (Figure 2b).

Figure 2a-b.
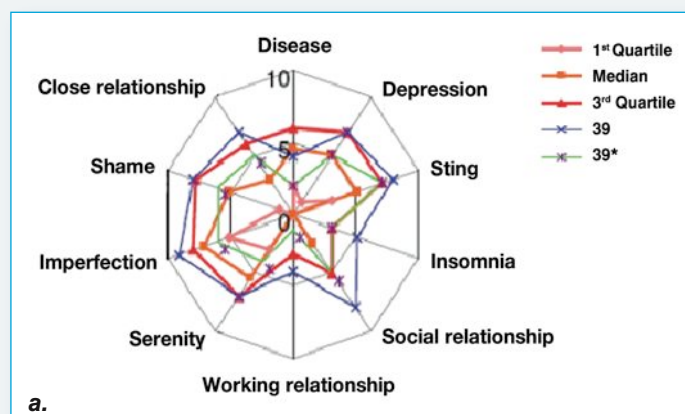
Representation of patient n. 39 on radar graph, pre and post-treatment: we can see, before the treatment (T0), an high impact of all variables (especially for social relationship), except for the perception of disease; successively, after the treatment (T1) we can see a reduction of perception of all variables.
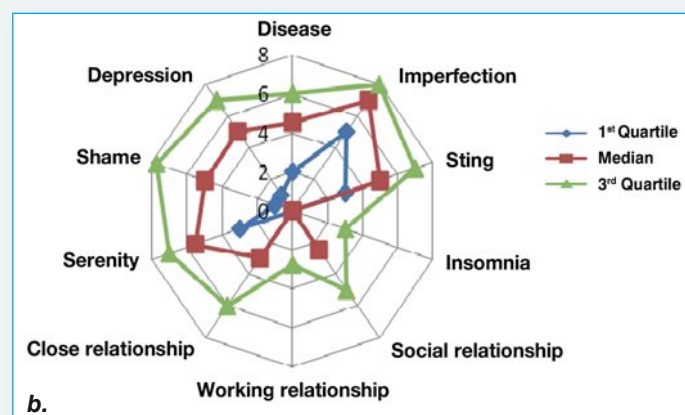
Distribution of quartiles in males and females: the graph shows that females are more sensitive than males for all variables: in fact women average values are higher than those of men.
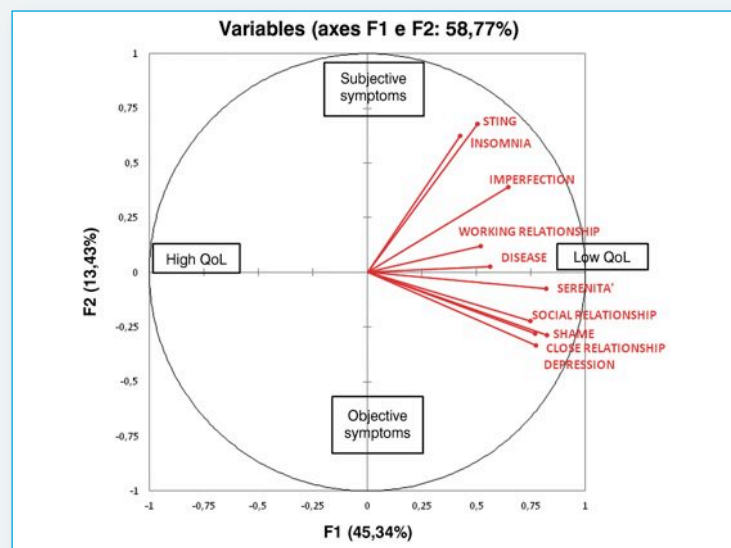
Principal Component Analysis (PCA)

PCA correlation circle (Figure 3), allows to highlight that all variables representing discomfort are positioned to the right of the graph showing how the first axe (factor) summarize the QoL size measurement. At the top of the graph we find the objective symptoms with greater impact on quality of life (sting, insomnia, skin problems), while in the lower part there are subjective symptoms and relational (shame, depression, and social relationships and intimate) with a lower impact on QoL.

Therefore the second axis represents a shape factor comparing objective and subjective symptoms in acne. At the same time position of the subject along this axis, highlights the patients in whom objective symptoms are more prevalent, compared to those patients in which subjective ones strongly prevail. Another aspect that can be detected on this graph is constituted by the correlations between the original variables: small angles (i.e. close to zero degrees) express strong positive correlations, large angles (i.e. close to 180 degrees) express inverse correlations, where angles of size intermediate (90 degrees) show absence of correlation. Examples of strong correlations are those between sting and insomnia, or between serenity and shame, or between social relationships and intimate ones. If we evaluate the distribution of patients on the map of QoL (Figure 4) according the 2 main factors issued by the PCA, we note that the majority of women, represented by blue label, is located on the right of the graph, indicating a greater discomfort than men, represented by green label, with the consequence that acne impact less in men than in women. If we evaluate the different distribution of sex in relation with symptoms, we can see that the objective symptoms have higher impact in men than in women, while the subjective symptoms have an higher impact in women respect to the men. Ever along the second axis, the increase of disease's duration, significantly correlate positively with the subjective symptoms increase.

The QoL score's distribution showed that 42% of patients have a good QoL, 30% of patients have discrete QoL, while 28% have a bad QoL and 10% have a very bad QoL (Figure 5).

Finally, we compared the GAGS value and data obtained from the clinical evaluation provided by the dermatologist (that is dermatologist's score DS) through the Spearman Rank correlation, and we showed a good agreement (0.558) (ρ (DS, GAGS) = 0,558). Later we compare GAGS score and dermatologist's score DS with the composite indicator of the QoL, always through the Spearman Rank correlation. We observed a low correlation of both classifications with the QoL-I. (ρ (QoL-I , DS) = 0,185; ρ (QoL-I, GAGS) = 0.097). This shows that, in the global approach to the disease, the evaluation performed by *Acne Radar Index* can be more exhaustive to evaluate the severity of illness and its impact on QoL respect the clinical evaluation alone.

Figure 3.
Principal component analysis:
Symptoms circle of correlations:
all variables representing discomfort are
positioned to the right of the graph;
at the top of the graph there are
the objective symptoms
with greater impact
on quality of life (sting, insomnia,
skin problems), while in the lower
part there are subjective
symptoms and relational
(shame, depression,
and social relationships and intimate).
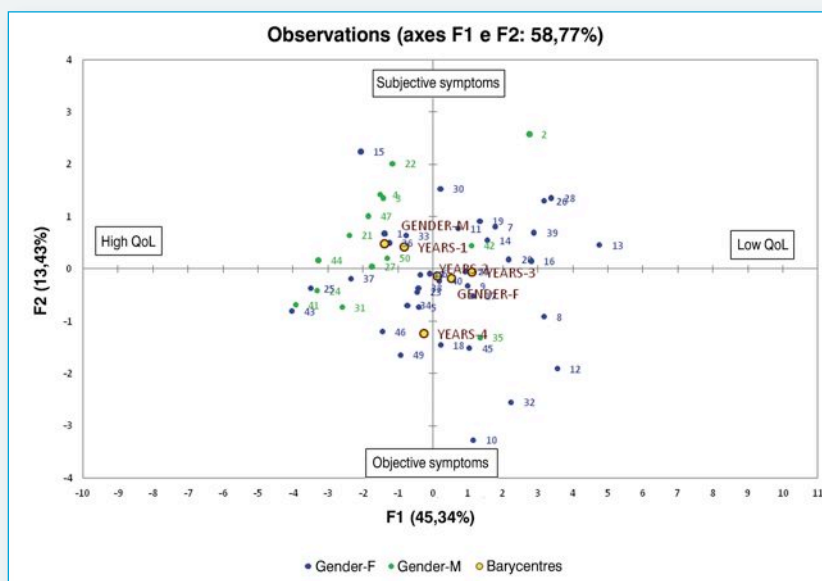
Figure 4.
Principal component analysis:
from patients' representation
on the map of QoL
we can see that numbers
41 and 43 patients have
the best QoL,
while the number
13 has the worst QoL.
We can also note that
in number 10 patient prevail
*objective symptoms,*
while in number 2 prevail
subjective ones.

Figure 5.
Distribution of QoL score:
from the histogram we note that 42%
of patients have a good QoL,
30% of patients have discrete QoL,
while 28% have a bad QoL
and 10% have a very bad QoL.

Figure 6.
The decisional map: the map is an instrument that allow to localize in a graph the symptoms of acne patients obtained with radar methodology, and to classify them in four areas: symptoms at risk, to monitoring, to improving and not relevant.
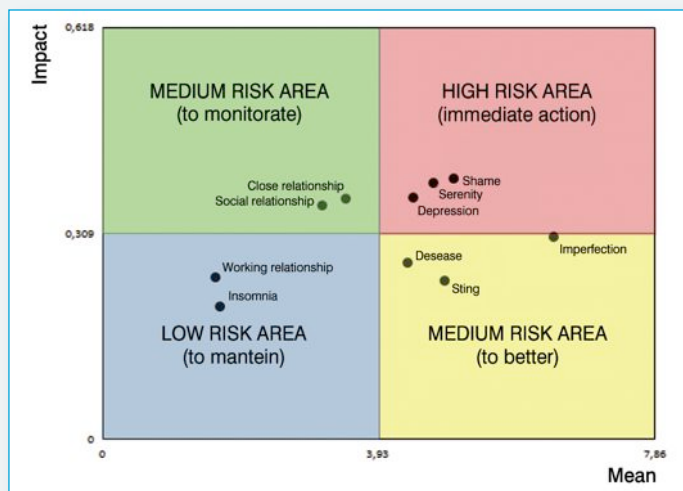
Decisional map

From the decisional map (Figure 6), we can classify our symptoms for according their average and their impact on the QoL size compositing indicators in four areas:

1. high risk area, in pink, containing the variables with high values both for the average and for the QoL impact, requiring an immediate intervention (depression, serenity and shame);

2. low risk area, in blue, containing the variables with very low values both for the perception and for the impact, that can be considered not important by dermatologist (insomnia, working relationship);

3. medium risk area, in green, containing variables to monitoring, with an high impact on QoL, but with a relatively low average values (intime relationship, social relations). For these variables are necessary a monitoring, but also an intervention, avoiding the passage to high risk area;

4. medium risk area, in yellow, containing variables to improving, with high average values, but with a minor impact on QoL (sting, imperfections, disease). For these variables are necessary some improvement, to reduce their impact on QoL.

Discussion and conclusions

As well known by literature, our data show that acne can negatively impact on daily life, self-esteem, and mood in adolescents, causing anxiety, depression, and suicidal ideation [2]. Acne vulgaris affects the QoL in adolescents with an higher impact in women. Our study propose a graphic representation, the acne *Radar*, as an instrument of immediate detection to evaluate the impact of acne in each patient, or as an instrument to compare the impact of different patients.

This graph can be represent a new scoring system, simple and rapid, to study the psychological aspects of patients.

We believe that this intuitive graphic representation could be useful also as supplement to clinical practice, to develop the best therapeutic plan for the patients: for example, if in the radar graph there is a great impact of item "*Imperfection*", the dermatologist could insist with topical retinoids, or peeling to reduce skin impurities; or in case of a great impact of items "*Social relationship*" or "*Depression*" the dermatologist could recommend a psychological support; while in case of a great impact of "*Sting*", the dermatologist could prefer the prescription of emollients and soothing creams. Furthermore, one of the advantages of this graphic instrument, is to use a rational methodology, well suited to the mentality of doctors.

In conclusion, our preliminary results provides information about the perception of disease among young people with acne: we believe that a simple and rapid representation of impact of acne in acne patients through acne *Radar graph* in daily clinical practice can increase patient's compliance and self-esteem; it can improve the communication between doctor and patient, and it can be influence positively patient's quality of life.

A greater validation of the graph, to evaluate potential beneficial effects on psychology of patients, will be obtained by further studies that will be performed in the future.

Acknowledgements

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