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European Survey on Criteria of Aesthetics for Periodontal Evaluation: the ESCAPE study

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ABSTRACT

Objective: The ESCAPE multicentre survey was designed to (1) compare the agreement of three relevant aesthetic scoring systems among different centres, and (2) evaluate the reproducibility of each question of the questionnaires.

Materials and Methods: EFP centres (n=14) were involved in an e-survey. Forty-two participants (28 teachers, 14 postgraduate students) were asked to score the one-year aesthetic outcomes of photographs using the Before-After Scoring System (BASS), the Pink Esthetic Score (PES) and the Root coverage Esthetic Score (RES). Mean values of kappa statistics performed on each question were provided to resume global agreement of each method.

Results: Between teachers, a difference of kappa ≥ 0.41 (p=0.01) was found for BASS (75%) and PES (57%). Similarly, RES (84%) and PES (57%) were different (p<0.001). No difference was found between BASS (75%) and RES (84%). No difference was found between students, whatever the scoring system. Questions of each scoring system showed differences in their reproducibility.

Conclusions: The outcomes of this study indicate that BASS and RES scoring systems are reproducible tools to evaluate aesthetic after root coverage therapies between different centres. Among the various variables, lack of scar, degree of root coverage, colour match and gingival margin that follows the CEJ show the best reliability.

CLINICAL RELEVANCE

Scientific rationale for the study: To compare the agreement of three relevant aesthetic scoring systems Before-After Scoring System (BASS), Pink Esthetic Score (PES), and Root coverage Esthetic Score (RES) among 14 centres using an e-survey, and to evaluate the reproducibility of each question used in each score.

Principal findings: The statistical analysis showed that there was no difference between RES and BASS reproducibility. Agreement with the PES system was lower than the BASS or RES systems. Besides, scores items showing the best properties were the lack of scar, degree of root coverage, colour match and the gingival margin that follows the cementoenamel junction.

Practical implications: The BASS and RES scoring systems are reproducible tools for objective aesthetic evaluation after root coverage procedures and are adapted for experienced professionals. Electronic surveys are convenient tools for transcultural scoring, especially when dealing with aesthetics.

INTRODUCTION

Aesthetics and physical appearance are of importance at the individual level since they are directly related to self-esteem (Adams, Tyler, Calogero, & Lee, 2017). Furthermore, beauty and social behaviour are positively associated. This means that human appearance not only impacts personal but also social development (Patrick, Neighbors, & Knee, 2004). The aim of aesthetic surgery is to improve the physical characteristics of individuals. Thus, aesthetic surgery, like any type of surgical procedure, must be evaluated. A self-evaluation can be carried out by the patient. This evaluation is mostly based on the perception of his/her body (Broer et al., 2014). The quality of the relationship between the patient and the surgeon may also impact the way the patient rates the outcome (Clever et al. 2008; Keles et Bos 2013; Pachêco-Pereira et al. 2015). Consequently, the patient's subjective approach is not reliable for professionals whose aim is to improve their surgical practice on a technical point of view. More robust qualified criteria are essential to enhance the objectivity of the outcome evaluation. However, an evaluation based on professional parameters remains challenging.

In aesthetic surgery, numerous indices have been proposed to score the aesthetic quality of the outcome as a function of the part of the body (Verhaegen et al. 2011; Maass et al. 2015; Dikmans et al. 2017). Smiling, with its intra and peri-oral components (lips, teeth, gums), ranks

foremost among the facial elements of interest in aesthetics (Lajnert et al. 2018; Chan, Mehta, et Banerji 2017). Thus, in developed countries, aesthetic dentistry is an important part of daily practice (Samorodnitzky-Naveh, Geiger, & Levin, 2007). Numerous tools for grading aesthetic improvements before and after treatments have been proposed. For instance, orthodontists frequently use the Dental Aesthetics Index or the Index of Orthodontic Treatment Need (Boronat-Catalá, Bellot-Arcís, Montiel-Company, Catalá-Pizarro, & Almerich-Silla, 2016). Regarding prosthetic dentistry, the Peri-Implant and Crown Index, Implant Crown Aesthetic Index, Pink Esthetic Score/White Esthetic Score, and Pink Esthetic Score have been proposed (Tettamanti et al., 2016).

The aesthetic aspect of the smile not only depends on the appearance of the teeth but also on the soft tissue environment (Rotundo et al., 2015). Aesthetic impairment caused by the apical shift of the gingival margin has become an important concern in periodontal plastic surgery (Cortellini et Bissada 2018; Jepsen et al. 2018). Thus, root coverage procedures have become increasingly popular over time, partly due to the increasing occurrence of gingival recessions (Sarfati, Bourgeois, Katsahian, Mora, & Bouchard, 2010). Periodontal surgery aimed at covering the exposed root surfaces are nowadays routine techniques (Cairo, 2017). It is therefore of interest to develop professional scoring systems for the aesthetic assessment of root coverage procedures as there is no currently available gold standard for aesthetic evaluation after root coverage procedures.

From the operator point of view, 3 scoring systems have been used to rate the aesthetic integration of the soft tissues around teeth following root coverage procedures: (1) the Root coverage Esthetic Score (RES; Cairo, Rotundo, Miller, & Pini Prato, 2009), (2) the Before-After Scoring System (BASS; Kerner et al., 2009), and (3) the Pink Esthetic Score (PES; Fürhauser et

al., 2005). The PES was originally designed to evaluate peri-implant soft tissue around dental implants but has also been used for periodontal aesthetic assessment following root coverage procedures (Salhi, Lecloux, Seidel, Rompen, & Lambert, 2014). The reproducibility of the three systems has not been evaluated concomitantly for a large sample of professionals. All these scoring systems are based on questionnaires and so far, no gold standard has been adopted. It is of interest to evaluate the reproducibility of the questionnaires, and the reproducibility of the questions included in each questionnaire.

The aims of the present study were (1) to compare the agreement of three relevant aesthetic scoring systems (RES, BASS, and PES) commonly used to evaluate root coverage procedures among different centres, and (2) to evaluate the reproducibility of each question of the questionnaires.

MATERIALS AND METHODS

1. Study design

The European Survey on Criteria of Aesthetics for Periodontal Evaluation (ESCAPE) is a multicentre online survey based on Multi-Item Scales. The timeline of the study flow is indicated in supplemental Figure A. In April 2017, fifteen accredited European Federation of Periodontology (EFP) Postgraduate Programmes were informed of the upcoming launch of the ESCAPE study. Fourteen EFP Postgraduate Programmes accepted to participate in the ESCAPE study on May 15th, 2017. EFP program directors were asked to designate three examiners including two teachers and one student. To be included in the study, examiners had to be part of the EFP Postgraduate Programme. Forty-two examiners agreed to participate in the aesthetic evaluation of root coverage procedures.

The study was based on an assessment with three different methods of scoring a series of 40

photographs. The pre- and postoperative photographs evaluated in the present study were retrieved from a previously used image database used previously. The minimum follow-up between the baseline and the postoperative photograph was six months. Further details regarding the setting up of the image database can be consulted in the study by (Kerner et al., 2007). Forty images were selected as best matches with the parameters evaluated through the three scoring systems. A stratified randomization of the 3 series was performed at baseline to send in one time 3 different series to the examiners of one centre. (Supplemental Figure A.).

A customized Google forms template was used to deliver the information to the participants, and to complete the survey questionnaire corresponding with a before-after aesthetic evaluation of the photographs (Supplemental Figure B). Each examiner assessed the series three times and each assessment corresponded to the RES, BASS, and PES scoring systems. The examiner was blinded to the scoring system. Following a training phase, the time estimate for each phase was 40 minutes.

Finally, the 40 pairs of photographs corresponding to pre- and postoperative views were evaluated by 42 examiners (28 teachers and 14 students) using the three methods. Photographs and the corresponding questionnaires were available online.

A centre was included in the analysis only if all three examiners completed all the questionnaires. Each photograph consisted of dual clinical views of gingival recessions before and after the surgical procedure. The acquisition and storage of the photographs included in the survey have already been described (Kerner et al., 2007). A training phase was performed prior to the evaluation of the series. The training phase included a set of four before-after photographs which had to be evaluated with each scoring system by each examiner. Once

completed, the randomization was performed.

The present survey was submitted to the data protection authority in France, namely the Commission Nationale Informatique et Libertés (CNIL, authorisation granted #1957108v0). This authorisation allowed the transfer of data outside the EU. Each centre was responsible for the regulatory authorisation of data according to their national Data Protection Authority.

2. Indices of aesthetic evaluation: BASS, PES and RES

Three indices were used in the ESCAPE study. Details of these indices have been described previously (Cairo et al., 2009; Fürhauser et al., 2005; Kerner et al., 2009). Supplemental Table A summarizes the characteristics of the scoring systems.

In summary, the Before-After Scoring System or BASS (Kerner et al., 2009) evaluates the following seven soft tissue criteria: (1) degree of root coverage, (2) colour match, (3) texture match, (4) volume match of the soft tissue, (5) absence of hypertrophic scars, (6) existing keratinized tissue, and (7) gingival contour. A five-point ordinal scale is used to rate each criterion according to aesthetic values. This includes: “poor” (1 point), “fair” (2 points), “good” (3 points), “very good” (4 points), or “excellent” (5 points). Additionally, overall aesthetic appearance is rated from poor to excellent with a 10-point numeric scale (0 to 10). It should be noted that the overall aesthetic appearance value is not rated in the overall BASS score.

The Pink Esthetic Score or PES (Fürhauser et al., 2005) also evaluates seven criteria: (1) shape of mesial papilla, (2) shape of the distal papilla, (3) level of the soft-tissue margin, (4) contour, (5) colour, (6) texture of soft tissues, and (7) alveolar process deficiency. A three-point ordinal scale is used to rate each criterion according to certain aesthetic values. These values are: “poor” (0 point), “medium” (1 point), or “good” (2 points).

The Root coverage Esthetic Score or RES (Cairo et al., 2009) evaluates five soft tissue criteria:

(1) level of gingival margin (GM), (2) marginal tissue contour, (3) soft tissue texture, (4) mucogingival junction alignment, and (5) gingival colour. A three-point ordinal scale is used to rate the level of gingival margin. This includes: “complete” (6 points), “partial” (3 points) or “failure” (0 point). A binary scale (correct/incorrect; i.e. 0 or 1) is used to rate the other criteria.

3. Statistical analysis

Inter-observer agreement evaluation: to assess the degree of agreement between experts’ ratings, one expert was randomly selected in each of the 14 centres and all the possible pairs of observers (91) were then defined. For each of the scale’s items (five items for the RES scale, eight items for BASS, seven items for PES), weighted Kappa statistics (Cohen, 1968) with squared weights were calculated for all the 91 pairs of observers. The mean values of these 91 kappa statistics obtained for each item were also provided to ensure the global agreement of each method. Additional comparisons of the proportion of Kappa values greater than or equal to 0.41 (moderate agreement) were also performed (no correction for multiple testing was performed as these tests were proposed in an explorative way). The same method was used to assess agreement between trainees (no random selection was needed, as there was only one trainee per centre). We used the Landis and Koch classification (Landis & Koch, 1977) to interpret the Kappa values. Statistical analyses were performed using R software, version 3.5.1. Additional Kappa statistics were performed to evaluate the reproducibility of each question within a scoring system.

RESULTS

One hundred and twenty-six questionnaires corresponding to 5040 before-after treatment photographs were evaluated. Agreement between the 14 centres based on the scoring

systems is indicated in supplemental Table B. Whatever the scoring system and the status of the examiner (teacher or student), neither a poor nor an almost perfect agreement was found. Agreement was mostly moderate (kappa 0.41-0.60) for teachers as well as students. For teachers agreement was substantial (kappa 0.61-0.8) in 11%, 13%, and 2% of the evaluations for the BASS, the RES, and the PES methods, respectively. The students' agreement was substantial in 10%, and 2% of the evaluations for the BASS and the RES methods, respectively. No substantial agreement was found for the PES.

Percentages of kappa ≥ 0.41 according to the examiner status are summarised in figure 1. Between teachers, a statistically significant difference (p=0.01) was found for BASS (75%) and PES (57%). Similarly, RES (84%) and PES (57%) were different (p<0.001). No difference was found between BASS (75%) and RES (84%). No difference was found between students, whatever the scoring system.

Tables 2 to 4 are based on the Landis and Koch classification, which ranges from 0 to 1 with a cut-off ≥ 0.41 for moderate agreement. Table 1 shows the kappa values for each question of the BASS method according to the examiner status. The questions with almost perfect agreement are rare, ranging from 0 to 7, independent of the examiner status. Figure 2 indicates the percentages of kappa ≥ 0.41 for each question. The volume match (Q4; 45%), and the gingival contour (Q7; 49%) showed weaker agreement than the rest of the questions, leaving aside the evaluation of the presence of keratinized tissues (Q6; 27%), which showed the poorest reproducibility. Table 1 does not indicate the percentage of kappa ≥ 0.41 for question 8 for the overall aesthetic appearance. This percentage was low for the both teachers (Q8; 30%) and the students (31%).

Regarding the PES method, almost perfect agreement was extremely rare, as with the BASS method, ranging from 0 to 2 (Table 2). The strongest inter-centre agreement between

teachers was found for the shape of the distal papilla (Q2; 97%); whereas, the strongest inter-centre agreement between students was for the evaluation of soft tissue colour (Q6; 88%). Figure 3 indicates a huge discrepancy between teachers and students for soft tissue volume (Q5), and a substantial difference for the soft tissue colour evaluation (Q6).

For the RES method, almost perfect agreement was again very rare, ranging from 0 to 5 (Table 3). Figure 4 indicates that the colour and the integration with the adjacent soft tissue (Q2), and the evaluation of the alignment of the mucogingival junction (MGJ) with the MGJ of adjacent teeth (Q4) shows a lower agreement than the rest of the questions, whatever the examiner status.

DISCUSSION

The data of this study indicate that agreement between teachers was good for the BASS and RES systems. No significant difference was found between the two systems (figure 1). Agreement with the PES system is significantly lower (57%) than the BASS or RES systems. No difference between student agreements was found whatever the system used. Figure 1 shows little difference in the percentage of agreement according to examiner status. It can be concluded that the BASS and RES systems are valuable and reproducible tools for professional aesthetic evaluation, whereas the PES system appears less reproducible at the centre level. The insufficient reproducibility of this scoring system in evaluating root coverage between students and teachers, together with a significantly lower percentage of agreement of the PES compared to the other systems at the centre level (figure 1) appears to disqualify the PES for the aesthetic evaluation of root coverage procedures. This poor reproducibility compared to the other systems may be due to the fact that the PES system was originally designed to rate soft tissue aesthetics around dental implants, and not to evaluate aesthetic improvement

following root coverage procedures. Interestingly, it was not possible to find perfect or poor agreement between the centres. Because of the large number of examiners and number of pairs, it is not surprising to find relatively low kappa values (Supplemental Table B). However, independent of the kappa value, the level of agreement was higher with the BASS and RES systems than with the PES system.

At the item level, the lack of scar was the most reproducible parameter common to the BASS and RES systems. The degree of root coverage also appears to be a common and highly reproducible parameter. The colour match was quite reproducible when the BASS system was used, whereas the gingival margin that follows the cementoenamel junction (CEJ) was the most reproducible parameter for the RES system. The evaluation of keratinized tissue was poorly reproducible with the BASS system. It may be speculated that accurately determining the presence of keratinized tissue based on clinical photographs was challenging for participants. Therefore, this item seems to be confusing. The BASS system suggests using a global evaluation of aesthetics. However, low reproducibility (≤ 31%) was found for the basic evaluation of the overall aesthetic appearance (percentage of kappa ≥ 0.41), whatever the examiner's status. This may be due to the fact that in the present study the scale used to grade overall aesthetic appearance was larger than that used for the other items (0 to 10 versus 0 to 5). This point should be clarified by the use of a 5-point ordinal scale. It can also be argued that a question that encompasses all the variables included in the aesthetic appearance is prone to the highest subjectivity.

The RES system includes an item (question 5) quantifying the degree of root coverage according to 3 options (complete = 6 points / partial = 3 points / failure = 0 point) that are imbalanced in terms of rating compared to the other dichotomic items. The value assigned for root coverage is 60% of the total score (Cairo et al 2009). The ease of the visual evaluation of

this quantitative variable positively influences the quality of the system's reproducibility, as the greater the quantity of root coverage, the higher the probability of a high RES score. In statistical terms, a quantitative variable (amount of root coverage) dramatically impacts a qualitative/categorical variable (aesthetic evaluation). Furthermore, the dichotomic evaluation of the MGJ aligned with the MGJ of adjacent teeth (question 4) presented the lowest reproducibility, whereas it should have exhibited good agreement due to the binary response. This may indicate that the parameter itself is unclear.

Taken together, the present data indicate a lower level of agreement between students than between teachers. This is a classical outcome when reproducibility is analysed. However, it indicates that these types of evaluation systems should be used by trained examiners and not be open to a large panel of non-specialists.

This study has several strengths. For the first time at the European level, a comparison of existing periodontal scoring systems was performed, involving 28 periodontists plus 14 post-graduate students as examiners chosen from 14 EFP centres. In addition, the multicentre design gave a transcultural approach to this survey. Indeed, the RES system was designed by Italian professionals, whereas the BASS system and the PES system were developed by French and Austrian teams, respectively. It is therefore of interest to evaluate the reproducibility of the different systems according to various cultural approaches. Another strength of the present study is that the e-methodology was used for the first time in a periodontal plastic surgery assessment, even if this approach had been suggested previously, more than 10 years ago (Kerner et al., 2008). This international e-survey was made possible by the Google questionnaire forms. The method of assessment was easy to use for each examiner and facilitated data collection. Moreover, the examiners were blinded to the scoring systems, in order to limit information bias and conflict of interests. However, the blind process can be

challenged as some reviewers may have been able to identify the scoring system. The methods included the randomization of each dispatch, since no examiner had to evaluate the same series at the same time as another examiner in a given centre. The method was easy to use, except for one examiner who needed help during the training phase. Moreover, a comparison between students' and teachers' assessments was performed for the first time. A nonresponses bias was avoided since all the centres included in this study and all the corresponding participants filled-in all the questionnaires.

The major limitation of this survey was the specificity of the target population. Only EFP centres were involved. The external validity of the present results requires confirmation by larger samples. This study dealt with reproducibility only. It did not indicate if a system is more qualitatively appropriate than another. It would be of interest to identify reproducible individual variables in a set of questions that best capture overall aesthetic appearance, and to build a new score based on these questions. Another weakness was the assessment material used, i.e. photographs. However, the use of photographs has been widely validated in various fields, such as conservative treatment for breast cancer (Merie et al., 2017), palatal clefts (Nur Yilmaz, Germeç Çakan, & Nalbantgil, 2018), facial plastic surgery (Weinkle et al., 2018), and, finally, periodontal plastic surgery (Cairo et al., 2010; Kerner et al., 2007)

CONCLUSION

The outcomes of this study indicated that BASS and RES scoring systems are reproducible tools for evaluating objectively aesthetics after root coverage therapies. Nevertheless, the questions included in the scoring systems did not have the same reproducibility. Lack of scar, degree of root coverage, colour match and gingival margin following CEJ presented the best reliability. However, these scores seem to be primarily intended for experienced clinicians.

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FIGURES AND LEGENDS

Figure 1. Percentages of kappa ≥ 0.41 according to the examiner status. A total of 91 kappa was evaluated. BASS, Before-After Scoring System. PES, Pink Esthetic Score. RES, Root coverage Esthetic Score.

Figure 2. Percentages of kappa ≥ 0.41 for each question according to the examiner status. Q1: Degree of root coverage / Q2: Colour match / Q3: Texture match / Q4: Volume match / Q5: Lack of hypertrophic scars / Q6: Existing keratinized tissues / Q7: Gingival contour.

Figure 3. Percentages of kappa ≥ 0.41 for each question according to the examiner status. Q1: Shape of the medial papilla. Q2/ Shape of the distal papilla Q3/ Soft tissue level (recession). Q4/ Natural effect of the soft tissue contour. Q5/ Soft tissue volume. Q6/ Soft tissue colour difference. Q7/ Soft tissue texture difference.

Figure 4. Percentages of kappa ≥ 0.41 for each question according to the examiner status. Q1/ Lack of scar or keloid formation. Q2/ Normal colour and integration with the adjacent soft tissue. Q3/ Gingival margin follows the CEJ. Q4/ Mucogingival line (MGJ) aligned with the MGJ of adjacent teeth. Q5 / coverage: complete (6 points) / partial (3 points) / failure (0 point).

Supplemental figure A. Timeline of the ESCAPE study.

Supplemental figure B. Illustration of Google forms for each scoring system (case # 1). (1) BASS scoring system. (2) PES scoring system. (3) RES scoring system.

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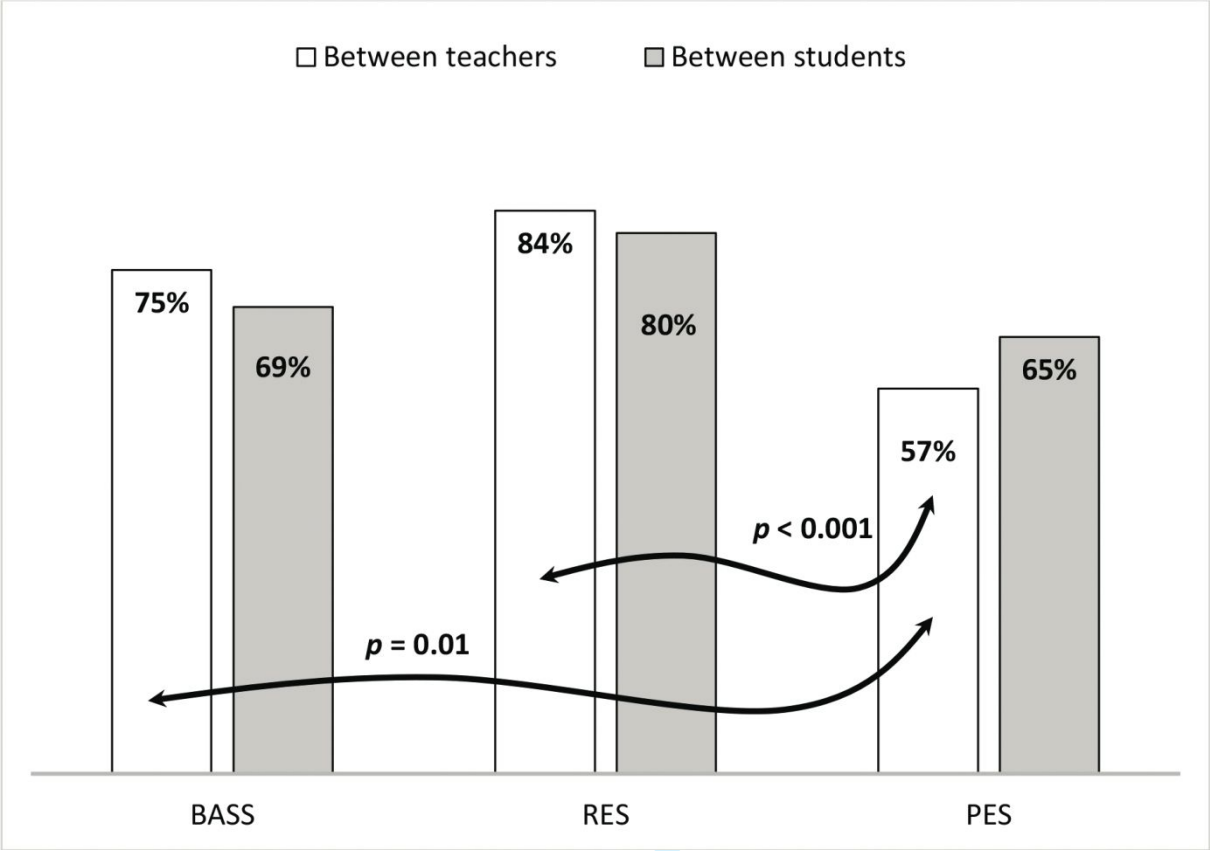
Table 3. Root coverage Esthetic Score method. Inter-centre agreement based on the questionnaire according to examiner status. Q1: Lack of scar or keloid formation. Q2: Normal colour and integration with the adjacent soft tissue. Q3: Gingival margin follows cementoenamel junction (CEJ). Q4: Mucogingival junction (MGJ) aligned with the MGJ of adjacent teeth. Q5: Degree of root coverage: complete (6 points) / partial (3 points) / failure (0 point).

Supplemental Table A: Characteristics of the 3 scoring systems. BASS, Before After Scoring System; RES, Root coverage Esthetic Score; PES, Pink Esthetic Score; NA, not available.



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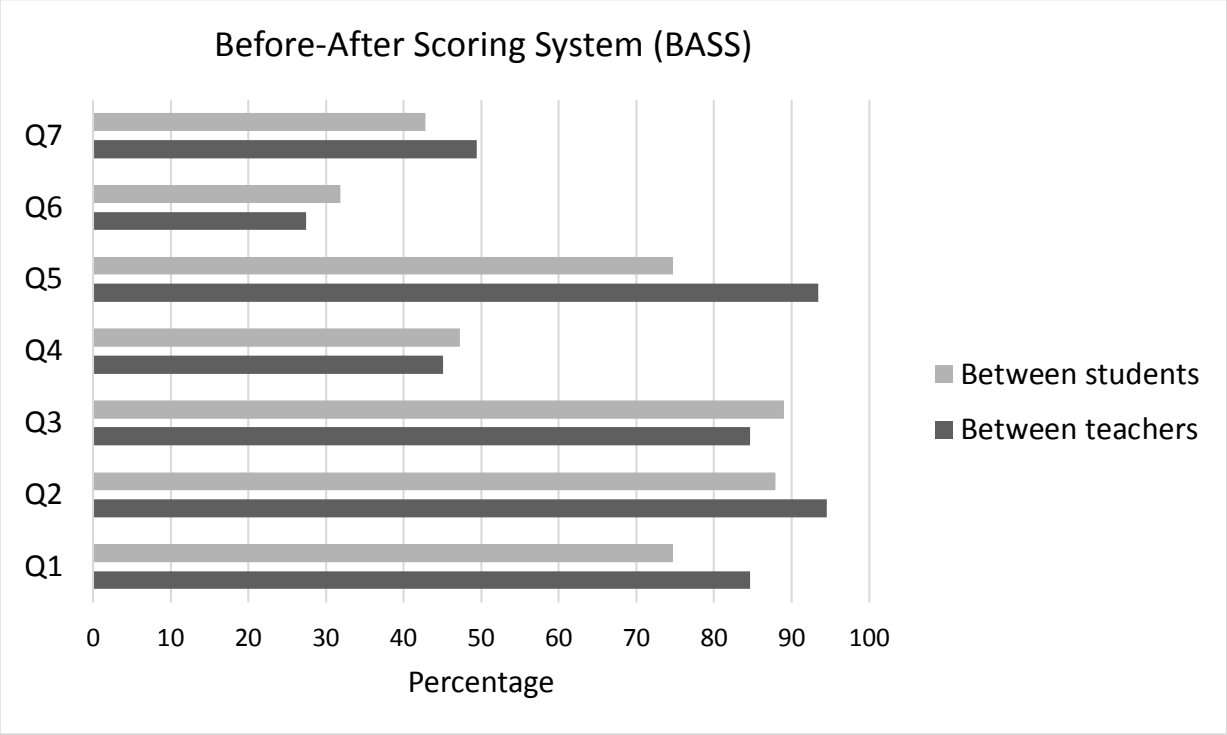

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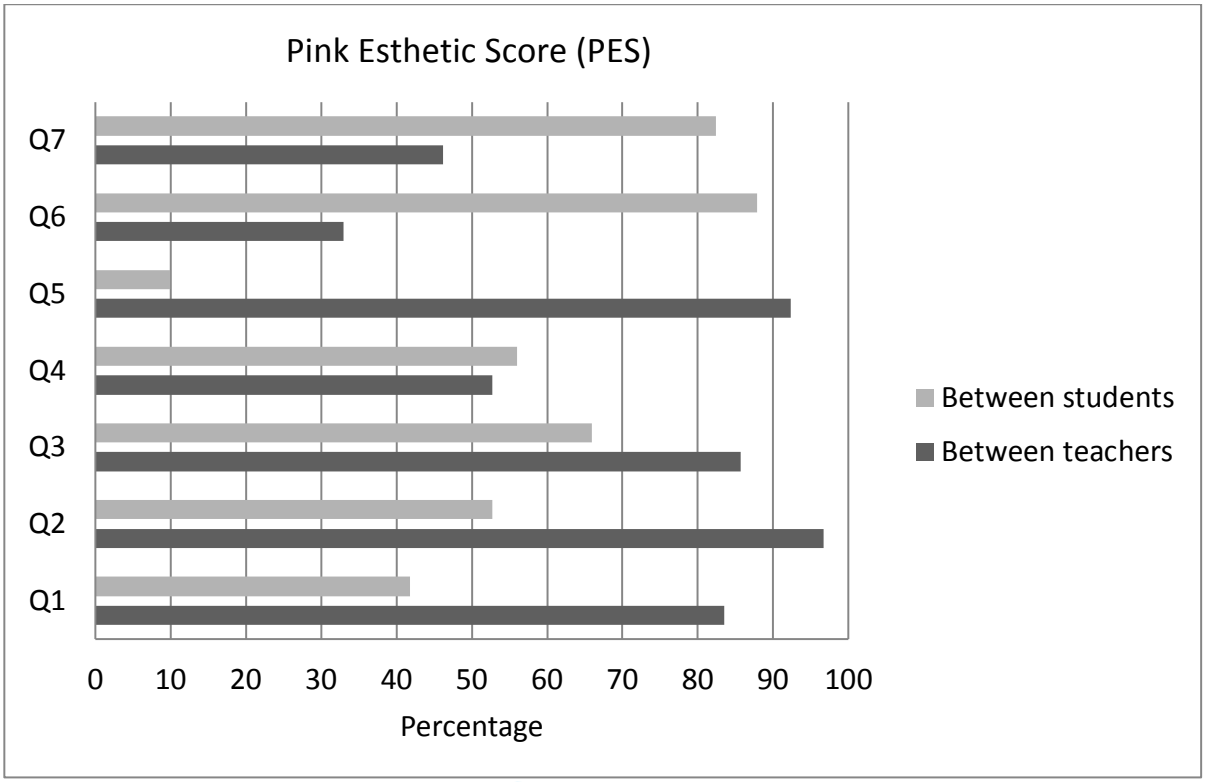

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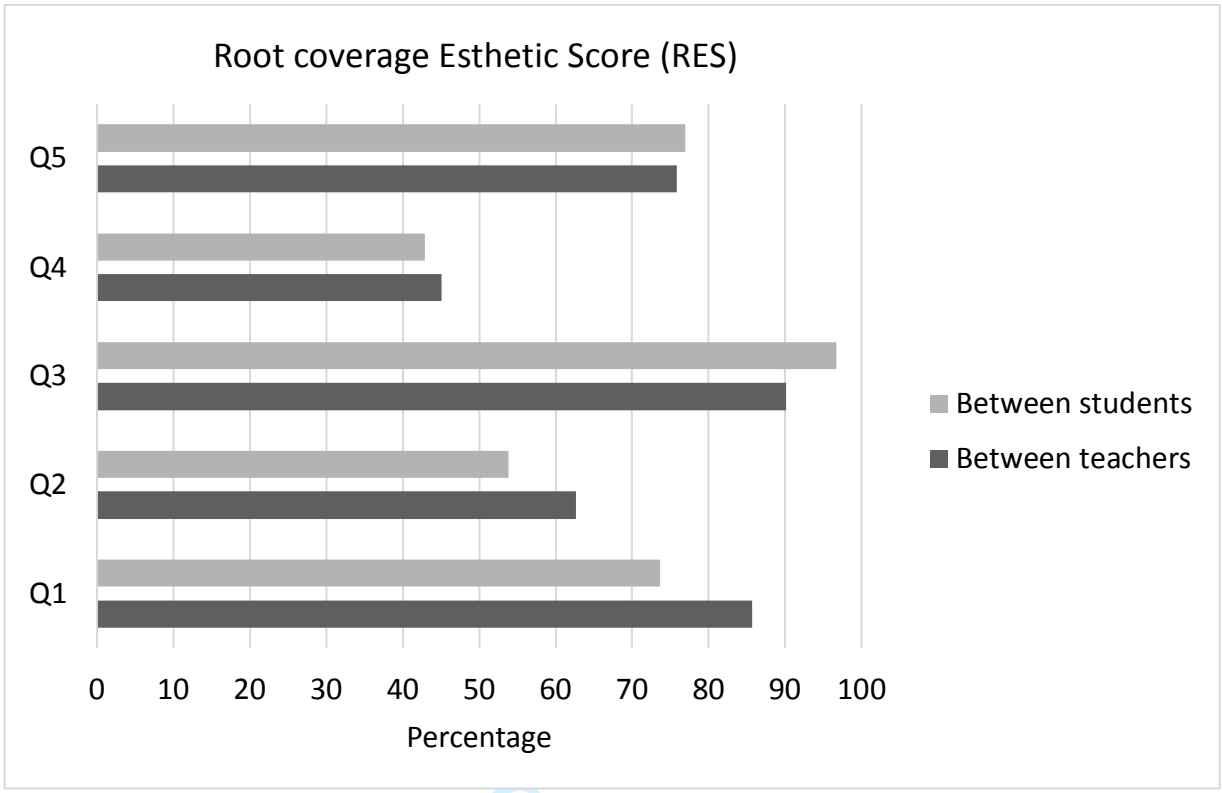

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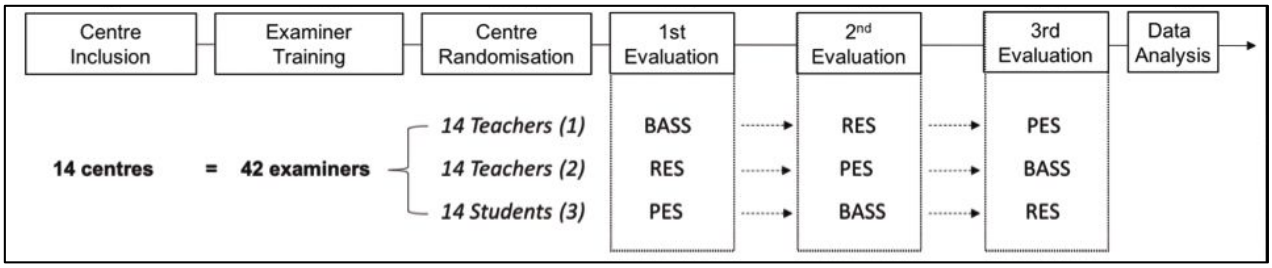
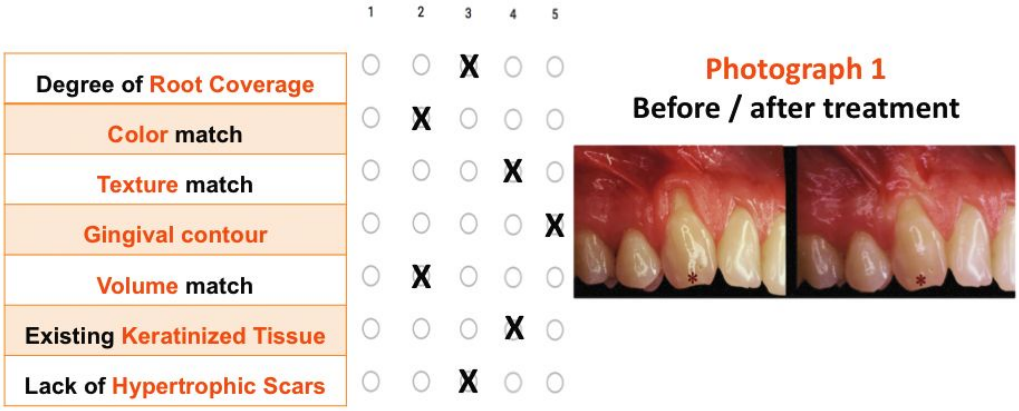


Supplemental figure A. Timeline of the ESCAPE study.

(1) BASS scoring system.

(2) PES scoring system.



(3) RES scoring system.

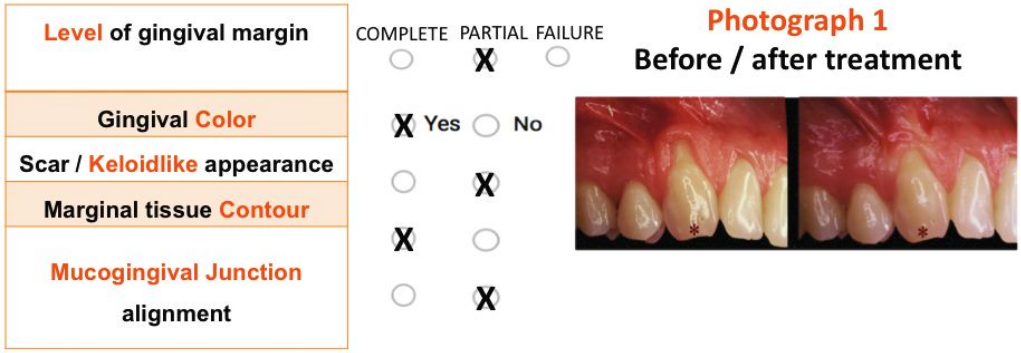


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Table 1. Before-After Scoring System method. Inter-centre agreement based on the questionnaire according to the examiner status. Q1: Degree of root coverage. Q2: Colour match. Q3: Texture match. Q4: Volume match. Q5: Lack of hypertrophic scars. Q6: Existing keratinized tissues. Q7: Gingival contour.

		Q1	Q2	Q3	Q4	Q5	Q6	Q7
Between teachers	Poor	0	0	0	8	0	3	0
	Slight	2	0	1	5	0	24	9
	Fair	12	5	13	37	6	39	37
	Moderate	37	37	37	30	36	21	36
	Substantial	37	44	38	11	44	4	8
	Almost perfect	3	5	2	0	5	0	1
Between students	Poor	0	0	0	1	0	6	0
	Slight	2	0	0	24	10	34	11
	Fair	21	11	10	23	13	22	41
	Moderate	41	28	39	26	49	24	35
	Substantial	27	45	38	17	19	5	4
	Almost perfect	0	7	4	0	0	0	0

Table 2. Pink Esthetic Score method. Inter-centre agreement based on the questionnaire according to examiner status. Q1: Shape of the medial papilla. Q2: Shape of the distal papilla Q3: Soft tissue level (recession). Q4: Natural effect of the soft tissue contour. Q5: Soft tissue volume. Q6: Soft tissue colour difference. Q7: Soft tissue texture difference.

		Q1	Q2	Q3	Q4	Q5	Q6	Q7
Between teachers	Poor	0	0	0	9	0	4	0
	Slight	2	0	1	5	0	26	9
	Fair	13	3	12	29	7	31	40
	Moderate	33	40	38	38	40	22	29
	Substantial	41	46	39	10	43	8	13
	Almost perfect	2	2	1	0	1	0	0
Between students	Poor	0	0	0	1	0	6	0
	Slight	2	0	0	24	10	34	11
	Fair	21	11	10	23	13	22	41
	Moderate	41	28	39	26	49	24	35
	Substantial	27	45	38	17	19	5	4
	Almost perfect	0	7	4	0	0	0	0

Table 3. Root coverage Esthetic Score method. Inter-centre agreement based on the questionnaire according to examiner status. Q1: Lack of scar or keloid formation. Q2: Normal colour and integration with the adjacent soft tissue. Q3: Gingival margin follows cementoenamel junction (CEJ). Q4: Mucogingival junction (MGJ) aligned with the MGJ of adjacent teeth. Q5: Degree of root coverage: complete (6 points) / partial (3 points) / failure (0 point).

		Q1	Q2	Q3	Q4	Q5
Between teachers	Poor	0	1	0	1	0
	Slight	0	2	0	14	2
	Fair	13	31	9	35	20
	Moderate	47	38	32	34	50
	Substantial	30	17	48	7	19
	Almost perfect	1	2	2	0	0
Between students	Poor	0	14	0	2	1
	Slight	1	10	0	6	7
	Fair	23	18	3	44	13
	Moderate	41	37	38	30	44
	Substantial	24	11	45	9	26
	Almost perfect	2	1	5	0	0

Supplemental Table A: Characteristics of the 3 scoring systems. BASS, Before After Scoring System; RES, Root coverage Esthetic Score; PES, Pink Esthetic Score; NA, not available.

Criteria	BASS	RES	PES
Degree of root coverage	0 to 5	0-3-6 (level of gingival margin)	0-1-2 (soft tissue level)
Colour match	0 to 5	0-1 (gingival colour)	0-1-2 (soft tissue colour)
Texture match	0 to 5	0-1 (soft tissue texture)	0-1-2 (soft tissue texture)
Volume match	0 to 5	NA	NA
Lack of hypertrophic scars	0 to 5	NA	NA
Existing keratinized tissues	0 to 5	NA	NA
Gingival contour	0 to 5	0-1 (marginal tissue contour)	0-1-2 (soft tissue contour)
Mucogingival Junction Alignment	NA	0-1	NA
Shape of Mesial Papilla	NA	NA	0-1-2
Shape of the Distal Papilla	NA	NA	0-1-2
Alveolar process Deficiency	NA	NA	0-1-2
Maximum Score	35	10	14

Supplemental Table B. Inter-centre agreement (kappa values) based on the scoring systems according to the examiner status. BASS, Before-After Scoring System. PES, Pink Esthetic Score. RES, Root coverage Esthetic Score.

		BASS	RES	PES
Between teachers	Poor	0	0	0
	Slight	0	0	2
	Fair	23	15	37
	Moderate	58	64	50
	Substantial	10	12	2
	Almost perfect	0	0	0
Between students	Poor	0	0	0
	Slight	3	1	0
	Fair	25	17	32
	Moderate	54	71	59
	Substantial	9	2	0
	Almost perfect	0	0	0

Table 1. Before-After Scoring System method. Inter-centre agreement based on the questionnaire according to the examiner status. Q1: Degree of root coverage. Q2: Colour match. Q3: Texture match. Q4: Volume match. Q5: Lack of hypertrophic scars. Q6: Existing keratinized tissues. Q7: Gingival contour.

		Q1	Q2	Q3	Q4	Q5	Q6	Q7
Between teachers	Poor	0	0	0	8	0	3	0
	Slight	2	0	1	5	0	24	9
	Fair	12	5	13	37	6	39	37
	Moderate	37	37	37	30	36	21	36
	Substantial	37	44	38	11	44	4	8
	Almost perfect	3	5	2	0	5	0	1
Between students	Poor	0	0	0	1	0	6	0
	Slight	2	0	0	24	10	34	11
	Fair	21	11	10	23	13	22	41
	Moderate	41	28	39	26	49	24	35
	Substantial	27	45	38	17	19	5	4
	Almost perfect	0	7	4	0	0	0	0

Table 2. Pink Esthetic Score method. Inter-centre agreement based on the questionnaire according to examiner status. Q1: Shape of the medial papilla. Q2: Shape of the distal papilla Q3: Soft tissue level (recession). Q4: Natural effect of the soft tissue contour. Q5: Soft tissue volume. Q6: Soft tissue colour difference. Q7: Soft tissue texture difference.

		Q1	Q2	Q3	Q4	Q5	Q6	Q7
Between teachers	Poor	0	0	0	9	0	4	0
	Slight	2	0	1	5	0	26	9
	Fair	13	3	12	29	7	31	40
	Moderate	33	40	38	38	40	22	29
	Substantial	41	46	39	10	43	8	13
	Almost perfect	2	2	1	0	1	0	0
Between students	Poor	0	0	0	1	0	6	0
	Slight	2	0	0	24	10	34	11
	Fair	21	11	10	23	13	22	41
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Table 3. Root coverage Esthetic Score method. Inter-centre agreement based on the questionnaire according to examiner status. Q1: Lack of scar or keloid formation. Q2: Normal colour and integration with the adjacent soft tissue. Q3: Gingival margin follows cementoenamel junction (CEJ). Q4: Mucogingival junction (MGJ) aligned with the MGJ of adjacent teeth. Q5: Degree of root coverage: complete (6 points) / partial (3 points) / failure (0 point).

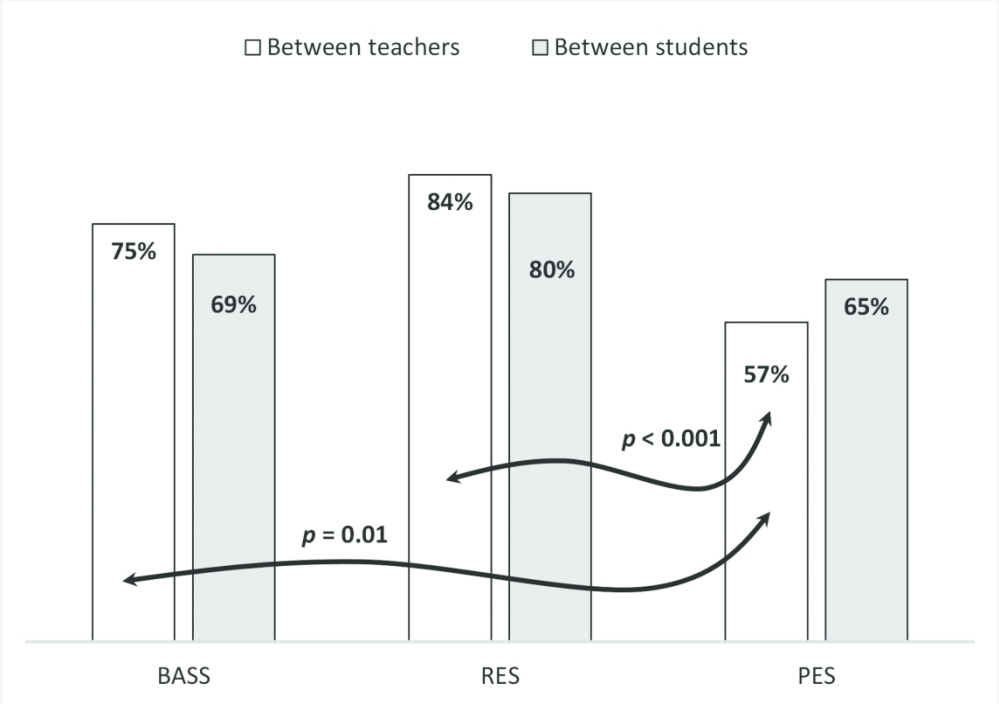
		Q1	Q2	Q3	Q4	Q5
Between teachers	Poor	0	1	0	1	0
	Slight	0	2	0	14	2
	Fair	13	31	9	35	20
	Moderate	47	38	32	34	50
	Substantial	30	17	48	7	19
	Almost perfect	1	2	2	0	0
Between students	Poor	0	14	0	2	1
	Slight	1	10	0	6	7
	Fair	23	18	3	44	13
	Moderate	41	37	38	30	44
	Substantial	24	11	45	9	26
	Almost perfect	2	1	5	0	0

Supplemental Table A: Characteristics of the 3 scoring systems. BASS, Before After Scoring System; RES, Root coverage Esthetic Score; PES, Pink Esthetic Score; NA, not available.

Criteria	BASS	RES	PES
Degree of root coverage	0 to 5	0-3-6 (level of gingival margin)	0-1-2 (Soft Tissue Level)
Colour match	0 to 5	0-1 (gingival colour)	0-1-2 (Soft Tissue Colour)
Texture match	0 to 5	0-1 (soft tissue texture)	0-1-2 (Soft Tissue Texture)
Volume match	0 to 5	NA	NA
Lack of hypertrophic scars	0 to 5	NA	NA
Existing keratinized tissues	0 to 5	NA	NA
Gingival contour	0 to 5	0-1 (Marginal Tissue Contour)	0-1-2 (Soft Tissue Contour)
Mucogingival Junction Alignment	NA	0-1	NA
Shape of Mesial Papilla	NA	NA	0-1-2
Shape of the Distal Papilla	NA	NA	0-1-2
Alveolar process Deficiency	NA	NA	0-1-2
Maximum Score	35	10	14

Supplemental Table B. Inter-centre agreement (kappa values) based on the scoring systems according to the examiner status. BASS, Before-After Scoring System. PES, Pink Esthetic Score. RES, Root coverage Esthetic Score.

		BASS	RES	PES
Between teachers	Poor	0	0	0
	Slight	0	0	2
	Fair	23	15	37
	Moderate	58	64	50
	Substantial	10	12	2
	Almost perfect	0	0	0
Between students	Poor	0	0	0
	Slight	3	1	0
	Fair	25	17	32
	Moderate	54	71	59
	Substantial	9	2	0
	Almost perfect	0	0	0



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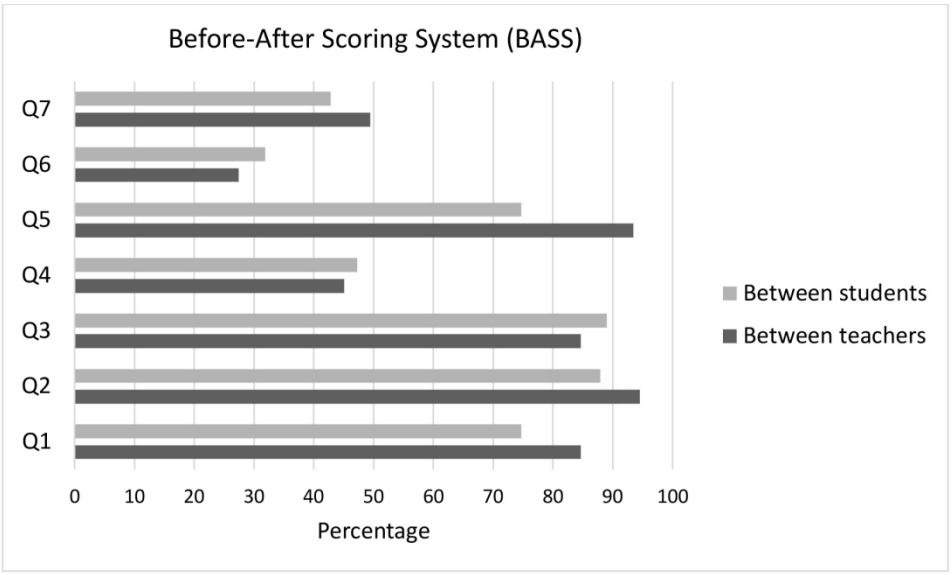

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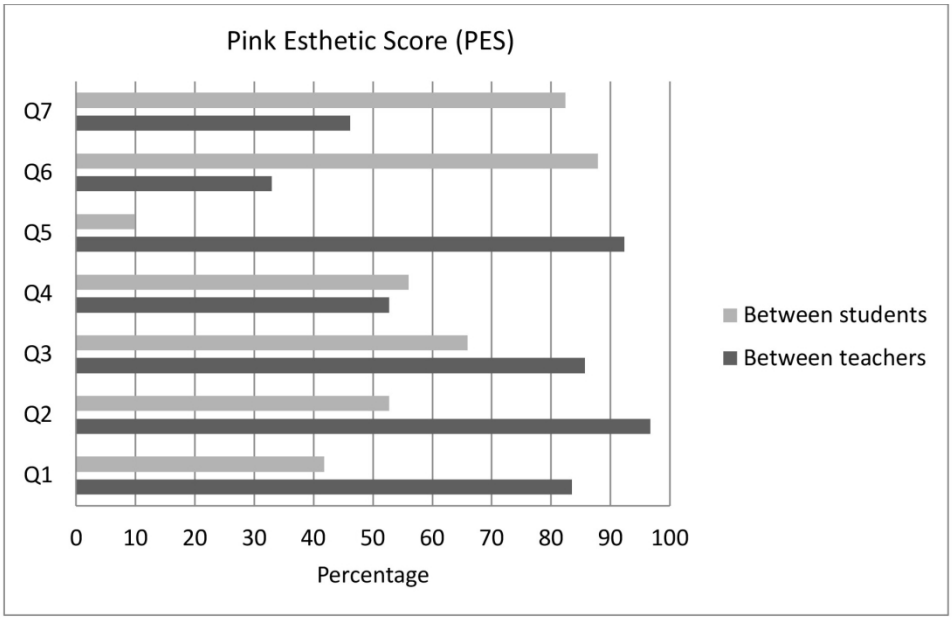

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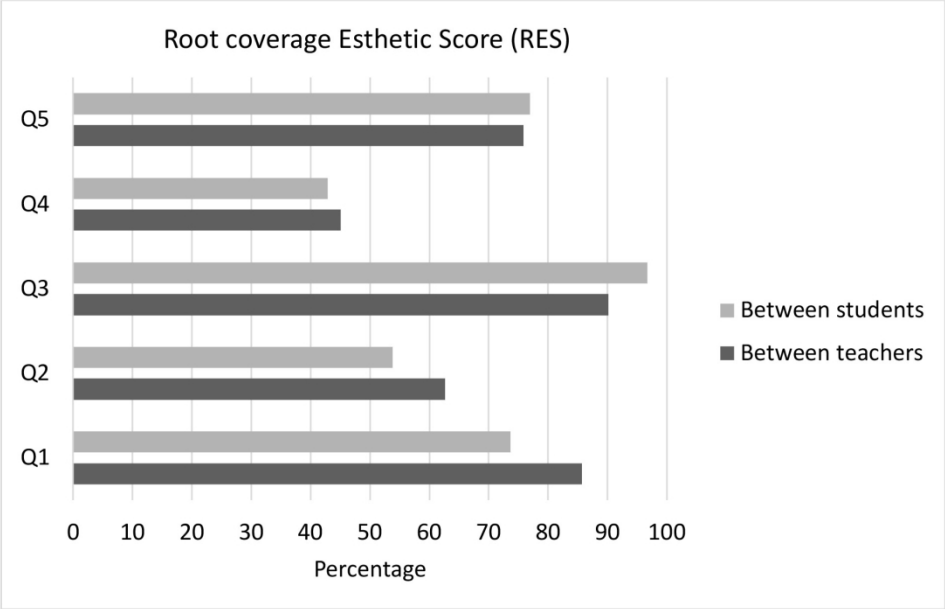

Figure 4. Percentages of kappa ≥ 0.41 for each question according to the examiner status. Q1/ Lack of scar or keloid formation. Q2/ Normal colour and integration with the adjacent soft tissue. Q3/ Gingival margin follows the CEJ. Q4/ Mucogingival line (MGJ) aligned with the MGJ of adjacent teeth. Q5 / coverage: complete (6 points) / partial (3 points) / failure (0 point).

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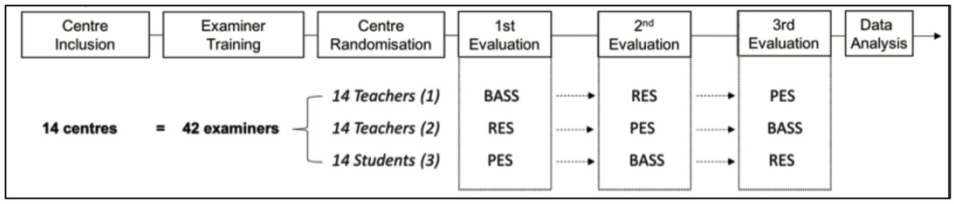

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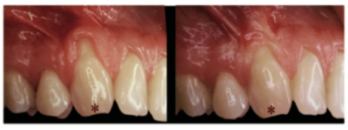
(1) BASS scoring system.

	POOR	MEDIUM	GOOD
Soft Tissue Level	○	X	○
Soft tissue Color	○	○	X
Soft tissue Texture	○	X	○
Soft tissue Contour	X	○	○
Shape of Mesial Papilla	○	X	○
Shape of the Distal Papilla	○	○	X
Alveolar Process deficiency	X	○	○

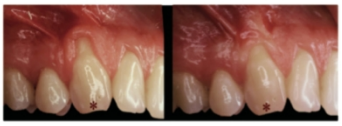
Photograph 1
Before / after treatment



(2) PES scoring system.

	1	2	3	4	5
Degree of Root Coverage	○	○	X	○	○
Color match	○	X	○	○	○
Texture match	○	○	○	X	○
Gingival contour	○	○	○	○	X
Volume match	○	X	○	○	○
Existing Keratinized Tissue	○	○	○	X	○
Lack of Hypertrophic Scars	○	○	X	○	○

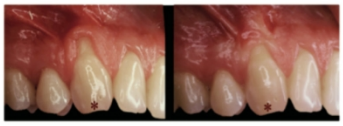
Photograph 1
Before / after treatment



(3) RES scoring system.

	COMPLETE	PARTIAL	FAILURE
Level of gingival margin	○	X	○
Gingival Color	X Yes	○ No	
Scar / Keloidlike appearance	○	X	
Marginal tissue Contour	X	○	
Mucogingival Junction alignment	○	X	

Photograph 1
Before / after treatment



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