Development and validation of a new, simplified endoscopic activity score for Crohn's disease: the SES-CD

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Background: **Healing of mucosal lesions appears to offer significant benefit and is an important end point in clinical trials of treatment for Crohn's disease. The only validated endoscopic activity score at present is the Crohn's Disease Endoscopic Index of Severity, which is complicated and time consuming and, hence, is unsuitable for routine use. The aim of this study was to develop and to prospectively validate a simpler endoscopic score of disease activity, the Simple Endoscopic Score for Crohn's Disease.**

Methods: **Selected endoscopic parameters (ulcer size, ulcerated and affected surfaces, stenosis) were scored from 0 to 3. Reproducibility for scoring of these parameters was evaluated through 71 examinations in which the endoscopist was paired with an observer. The simplest score (Simple Endoscopic Score for Crohn's Disease) that was highly correlated with both the Crohn's Disease Endoscopic Index of Severity and Crohn's Disease Activity Index was derived for 70 patients and then was prospectively validated in 121 different patients with Crohn's disease.**

Results: **The interobserver agreement for all selected endoscopic variables was excellent (kappa coefficient 0.791-1.000). Based on multiple linear regression, the Simple Endoscopic Score for Crohn's Disease resulted in the sum of the scores for ulcer size, ulcerated surface, affected surface, and luminal narrowing. In the validation phase of the study, a strong correlation was demonstrated for the Simple Endoscopic Score for Crohn's Disease with Crohn's Disease Endoscopic Index of Severity (r = 0.920). In addition, the Simple Endoscopic Score for Crohn's Disease was correlated to clinical parameters and serum C-reactive protein level.**

Conclusions: **Simple Endoscopic Score for Crohn's Disease is a simple, reproducible, and easy-to-use endoscopic scoring system for Crohn's disease. (Gastrointest Endosc 2004;60:505-12.)**

Endoscopy has become extremely valuable in the diagnosis, assessment, and management of inflammatory bowel diseases, e.g., Crohn's disease. The endoscopic lesions typical of Crohn's disease are described in numerous studies and comprise aphthoid ulcerations, "punched-out ulcers," cobblestoning, and stenosis. In patients with chronic colitis, endoscopic evaluation correctly differentiates between ulcerative colitis and Crohn's disease in 89% of cases.[1] The management of Crohn's disease largely depends on the location and the severity of the inflammation. However, the severity and the extent of inflammatory lesions in Crohn's disease observed colonoscopically are difficult to score. The Groupe d'Etudes Thérapeutiques des Affections Inflammatoires Digestives (GETAID) in France developed and validated an endoscopic score, the Crohn's Disease Endoscopic Index of Severity (CDEIS).[2] They demonstrated that this score is reproducible, although the correlation between the CDEIS and the established "clinical" Crohn's Disease Activity Index (CDAI) is poor.[3,4] The CDEIS is based upon the presence or the absence of 4 types of lesions: superficial ulcers, deep ulcers, ulcerated stenosis, or nonulcerated stenosis, all of which are recorded in 5

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Preliminary data of this study were presented as posters at Digestive Diseases Week, May 19-23, 2002, San Francisco, California (Gastroenterology 2002;122:S1376), and Digestive Diseases Week, May 18-21, 2003, Orlando, Florida, and as an oral presentation at United European Gastroenterology Week 2002, October, 2002, Geneva, Switzerland (Gut 2002;51(Suppl III):A56).

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	Rectum	Sigmoid and left colon	Transverse colon	Right colon	Ileum	Total	
Deep ulceration (12 present, 0 absent)	0	0	0	12	--	12	Total 1
Superficial ulceration (6 present, 0 absent)	6	6	6	6	--	24	Total 2
Surface involved by the disease (/10cm)*	4.7	4.2	3.7	5.6	--	18.2	Total 3
Ulcerated surface (/10 cm)*	0.6	0.5	0.4	0.9	--	2.4	Total 4
					Total 1 + Total 2 + Total 3 + Total 4 =	56.6	Total A
					Number (n) of segments totally or partially explored (1-5)	4	n
					Total A divided by n	14.15	Total B
					Quote 3 if ulcerated stenosis anywhere, 0 if not	3	C
					Quote 3 if non ulcerated stenosis anywhere, 0 if not	0	D
					Total B + C + D =	17.15	**CDEIS**

* Analogue scales to be converted into numeric values

Figure 1. Example of CDEIS scoring form (same case scored with SES-CD in Fig. 2).

different segments: terminal ileum, ascending colon, transverse colon, descending and sigmoid colon, and the rectum. In addition, for these 5 segments, the percentage of ulcerated colonic surface and the percentage of surface "affected by any Crohn's disease lesion" are indicated on a 10-cm visual analogue scale; an example is shown in Figure 1. The combination of values allows calculation of the severity score, which generally ranges between 0 and 30. In a further study, the GETAID demonstrated that the use of endoscopy and the CDEIS to "guide" therapeutic decisions with regard to corticosteroid therapy was not helpful clinically.[5] However, with other and newer agents, such as infliximab, natalizumab, and adalimumab, significant healing has been observed with high correlation between clinical improvement and the disappearance of endoscopic lesions.[6-8] Moreover, patients with endoscopic healing after treatment with infliximab, enjoyed a longer duration of remission and required fewer hospitalizations compared with those without healing.[7,9] Consequently, endoscopic healing has become an important therapeutic end point; indeed, many ongoing trials of new biologic agents include endoscopic evaluations. Although the CDEIS is a valuable modality for such trials, the scoring system is time consuming, complicated, and not user friendly. Furthermore, it is impractical for use in routine clinical practice. Thus, the Simplified Endoscopic Activity Score for Crohn's Disease (SES-CD) was developed and validated in the current study as a simpler, more rapid endoscopic scoring system for Crohn's disease. The characteristics of the SES-CD were compared with those of the CDEIS.

PATIENTS AND METHODS

The study was divided into 4 parts. In the first part, the most relevant endoscopic variables were selected and their reproducibility level was evaluated in an interobserver variation study. For the second part, the development phase, an endoscopic score was derived from the selected endoscopic variables and further simplified (the SES-CD) to obtain a score that was still highly correlated to the CDEIS but was simpler and easier to calculate. In the third part, the validation phase, a set of different patients was used to validate the SES-CD. In the fourth part, the reliability of SES-CD and CDEIS was evaluated by using the entire patient set and was correlated with relevant clinical and biochemical parameters.

Patients and examinations

For the development phase of the study, 70 consecutive patients, with an established diagnosis of Crohn's disease, who were to undergo colonoscopy were enrolled at 5 gastroenterology departments in Belgium, France, and Italy between February and May, 2002. In the validation phase, 121 additional consecutive patients were enrolled between July 2002 and February 2003 at the same centers. In both phases, the endoscopist completed an endoscopic scoring sheet immediately after colonoscopy. A second investigator endoscopist observed the colonoscopy on the television monitor in 35 and 36 examinations performed in the development and validation phases of the study, respectively. The endoscopist and the observer did not communicate during the colonoscopic examination, and they completed the endoscopic scoring sheets independently. These 71 paired examinations were used to assess the reproducibility of the endoscopic variables. On the day of the colonoscopy, current and former treatments, age at diagnosis, duration of Crohn's disease, disease behavior and location, number and type of surgical interventions, smoking habits, family history, body mass index (BMI), CDAI, and quality of life (IBDQ) were recorded. In addition, serum C-reactive protein (CRP) level, albumin level, and hematocrit were determined.

Endoscopic data collection

The endoscopic variables were evaluated in 5 predefined ileocolonic segments. The ileum was scored for the full extent to which it was examined. The score for the ileum did not include the ileocecal valve or an ileocolonic anastomosis. The right colon segment included the ileocecal valve, the cecum, and the ascending colon to the hepatic flexure; Crohn's disease isolated to the ileocecal valve was scored as belonging to this segment. The transverse colon was defined as the segment between the hepatic and the splenic flexures. The left colon segment included the descending colon (from the splenic flexure) and the sigmoid colon to the rectosigmoid junction. The rectum segment was defined as that portion distal to the rectosigmoid junction.

For the SES-CD, the 4 endoscopic variables selected were ulcers, proportion of the surface covered by ulcers, proportion of the surface with any other lesions, and stenosis. Each variable was scored from 0 to 3 in each segment (Table 1): ulcers were scored according to size (diameter 0.1-0.5 cm, 0.5-2 cm, or >2cm); proportion of ulcerated surface according to extent (<10%, 10%-30%, or

Table 1. Definitions of Simple Endoscopic Score for Crohn's Disease

	Simple Endoscopic Score for Crohn's Disease values			
Variable	0	1	2	3
Size of ulcers	None	Aphthous ulcers (∅ 0.1 to 0.5 cm)	Large ulcers (∅ 0.5 to 2 cm)	Very large ulcers (∅ >2 cm)
Ulcerated surface	None	<10%	10-30%	>30%
Affected surface	Unaffected segment	<50%	50-75%	>75%
Presence of narrowings	None	Single, can be passed	Multiple, can be passed	Cannot be passed

∅, Diameter.

>30%); proportion of affected surface according to extent (<50%, 50%-75%, or >75%); and stenosis as single or multiple, and whether the colonoscope could be passed through the narrowed lumen. For the CDEIS, the endoscopic variables were as originally defined: deep ulcers and superficial ulcers (presence or absence), ulcerated surface and affected surface (evaluated on a 10-cm linear analogue scale), and ulcerated and nonulcerated narrowings.[2]

Construction of the SES-CD score and statistical methods

Interobserver variation study (71 patients). Agreement between paired evaluations of endoscopic findings was evaluated through kappa statistics (a coefficient of interobserver agreement over and above the agreement that would be expected to occur by chance alone). Kappa values range from negative (disagreement) to +1 (total agreement); a value of 0 indicates agreement equal to that expected by pure chance. Values below 0.4 are classified as poor agreement, 0.41 to 0.60 as moderate agreement, 0.61 to 0.80 as good agreement, and values above 0.80 as very good agreement.[10] The reproducibility level of endoscopic scores (SES-CD and CDEIS) was evaluated through intraclass correlation coefficient.[11]

Construction of SES-CD (70 patients). For development of the SES-CD, multiple linear regression was used on data from the development phase, with CDEIS as a dependent variable, and with the sums of the different endoscopic variables across all explored segments, the number of affected segments, and the number of explored segments as independent variables. For the 35 colonoscopies performed by an endoscopist/observer pair, data provided by one of these two investigators were randomly selected. Then, all possible scores resulting from the different combinations of the selected endoscopic variables were assessed, with the final choice being based on a balance between a score easy to calculate and a score highly correlated with CDEIS and also with the CDAI.

Validation of SES-CD (121 patients). Validation was based on testing the correlation between SES-CD and CDEIS through the Pearson product-moment correlation coefficient and the Spearman rank coefficient for patients in the validation phase.

Score characteristics in the whole data set (191 patients). Differences in the clinical characteristics between patients enrolled in the development and the validation phases were tested with chi-square, Fisher exact, Student *t*, or Mann-Whitney tests, as appropriate. Correlations between the SES-CD or the CDEIS with clinical characteristics, such as CDAI and IBDQ, and biochemical markers of disease activity (serum CRP and albumin) were measured by the Spearman rank coefficient.

Data were analyzed with statistical software (SPSS for Windows, version 11.0, SPSS Inc., Chicago, Ill.). A p value <0.05 was considered statistically significant. For important estimates, 95% confidence intervals are provided. It is recognized that there was multiple testing of outcome data arising from individual patients; however, it is noted that because of the extremely high levels of significance found and the strong correlations noted among the important variables, correction of p values would not have removed significance from any finding. Thus, all p values and confidence intervals are presented uncorrected for multiple testing.

All patients gave informed consent for participation in the study, which was approved by the ethics committee of the University of Leuven.

RESULTS

Patient characteristics

The clinical characteristics of the patients are described in Table 2 for patients included in the development phase, those of the validation set, and for the entire sample. There was no significant difference in clinical characteristics among the patients by center or between patients in both phases of the study.

Selection of parameters and reproducibility levels

The items included in the SES-CD were the result of a careful review of the GETAID studies with regard to the importance and the reproducibility of the most relevant endoscopic characteristics of Crohn's disease.[12] Only characteristics that were considered as contributing to clinical symptomatology and that have shown good reproducibility in the GETAID studies were considered for the SES-CD. Agreement between the scores for the endoscopist/observer pairs was very good in all segments for all variables included in SES-CD (Table 3). When

Table 2. Clinical characteristics of 191 patients enrolled in study

Variable	Development	Validation	Total series
No. patients	70	121	191
Location (colon/ileocolon/small bowel/upper GI)	14/47/5/4	20/78/20/3	34/125/25/7
Behavior (fistulizing/stenosing/non-fistulizing-non-stenosing)	21/24/25	45/33/43	66/57/68
Age at diagnosis (<40 y/≥40 y)	63/7	106/15	169/22
Gender (female/male)	44/26	79/42	123/68
Duration of disease, y			
median (range)	10 (0.5-37)	8 (0.5-34)	9 (0.5-37)
BMI, kg/m^2			
median (range)	21.8 (16.4-43.5)	22.2 (15-41)	22.1 (15-43.5)
Prior surgery (no/yes)	41/29	68/53	109/82
Smoking habits (no/ex/active smoker)	38/4/28	69/17/35	107/21/63
Familial history (no/yes)	66/4	99/22	165/26
CDAI			
median (range)	214 (0-417)	233 (−6 to 573)	227 (−6 to 573)
IBDQ			
median (range)	141 (25-214)	144 (39-213)	142 (25-214)
CRP, mg/L			
median (range)	10.5 (0-104)	11.5 (0-220)	11.1 (0-220)
Remission (no/yes)	48/22	85/36	133/58

BMI, Body mass index; *CDAI,* Crohn's Disease Activity Index; *IBDQ,* quality of life; *CRP,* C-reactive protein.

Table 3. Results of interobserver variation study: kappa value and intraclass correlation coefficient for comparison between endoscopist and observer scores for Simple Endoscopic Score for Crohn's Disease and Crohn's Disease Endoscopic Index of Severity endoscopic variables in each ileocolonic segment are given (n = 71 patients)

	Ileum	Right colon	Transverse colon	Left colon	Rectum
SES-CD					
Ulcers	0.884	0.919	0.972	0.857	0.819
Ulcerated surface	0.882	0.811	0.942	0.878	0.857
Affected surface	0.811	0.791	0.841	0.909	0.838
Stenosis	1.000	1.000	1.000	1.000	NA
CDEIS					
Deep ulcers	0.683	0.811	1.000	0.900	0.666
Superficial ulcers	0.701	0.727	0.738	0.628	0.767

	ICC	95% CI
Sum of all SES-CD variables	0.9815	0.9705-0.9884
CDEIS	0.9090	0.8580-0.9423

SES-CD, Simple Endoscopic Score for Crohn's Disease; *NA,* not applicable; *CDEIS,* Crohn's Disease Endoscopic Index of Severity; *ICC,* intraclass correlation coefficient; *CI,* confidence interval.

considering the CDEIS variables, agreement for the definition of deep ulcer was good to very good in the different ileocolonic segments but weaker for superficial ulcers. The intraclass correlation coefficients for average ulcerated surface and average affected surface were 0.863 and 0.894, respectively.

SES-CD development phase

During the first 70 colonoscopies, 322 ileocolonic segments were examined; the mean number of explored segments per procedure was 4.6 (range 3-5). Of the 28 unexamined segments, 12 had been resected surgically, 13 could not be reached because of the presence of a stenosis through which the colonoscope could not be passed, and 3 could not be explored because of technical problems. The terminal or neoterminal ileum was explored in 60 of 70 procedures. The rectum was affected by Crohn's disease in 39% of cases.

The multiple regression with CDEIS set as the dependent variable was highly significant ($p < 0.0001$) in this group of 70 patients, with an ex-

Table 4. Characteristics of different endoscopic scores elaborated and tested: coefficient of multiple linear regression, multiple correlation R and the Spearman rank correlation coefficients to Crohn's Disease Endoscopic Index of Severity and Crohn's Disease Activity Index are reported

	All items	Without number of explored segments	Without number of explored and of affected segments	SES-CD complex	SES-CD	SES-CD simplified
Coefficients of endoscopic variables						
Ulcers	1.612	1.666	1.155	1.007	0.760	1.025
Narrowings	0.921	1.119	1.392	1.007	0.760	1.025
Affected surface	0.638	0.633	0.352	1.007	0.760	1.025
Ulcerated surface	0.820	0.799	0.773	1.007	0.760	—
Number of affected segments	−1.563	−1.664	—	−1.556	—	—
Number of explored segments	−0.885	—	—	—	—	—
Multiple correlation R	0.920	0.916	0.895	0.910	0.880	0.877
Spearman's correlation with:						
CDEIS	0.903	0.903	0.894	0.913	0.883	0.883
CDAI	0.233	0.219	0.232	0.228	0.215	0.206

SES-CD, Simple Endoscopic Score for Crohn's Disease; *CDEIS,* Crohn's Disease Endoscopic Index of Severity; *CDAI*, Crohn's disease activity index.

tremely high multiple correlation coefficient (0.920: 95% CI[0.8740, 0.9497]).

During the simplification procedure, the best "model" obtained was the sum of the 4 variables multiplied by 1.007 minus the number of affected segments multiplied by 1.556. However, the simple sum of the 4 variables correlated equally well with the CDEIS and the CDAI (Table 4), and was much simpler to calculate. As a consequence, the following formula was selected as the SES-CD: SES-CD = sum over all explored segments (score for ulcers size + score for ulcerated surface + score for total affected surface + score for stenosis).

The sum of the scores for each endoscopic variable ranges from 0 to 15, except for stenosis, where it varies between 0 and 11, because 3 represents a stenosis through which a colonoscope cannot be passed and, therefore, that can be observed only once.

An example of a scoring form for SES-CD is shown in Figure 2. A SES-CD value can be converted into a CDEIS value by using the following formula: CDEIS = 0.76 SES-CD + 0.29.

SES-CD validation phase

In the validation phase, 121 procedures were carried out at which 559 ileocolonic segments were explored; the mean number of explored segments per colonoscopy was 4.6 (range 3-5). Twenty-six segments had been removed surgically, 15 could not be reached because of a stenosis, and 5 could not be reached because of technical problems. The terminal or neoterminal ileum was explored in 106 of the 121 procedures. The rectum was affected by Crohn's disease in 35% cases.

The Pearson and the Spearman rank correlation coefficients between SES-CD and CDEIS were 0.887: 95% CI[0.8418, 0.9199] and 0.910: 95% CI[0.8734, 0.9364] ($p < 0.001$), respectively.

SES-CD characteristics

When all 71 paired examinations scored are considered, the intraclass correlation coefficient between the first and the second observer score was 0.9815 for the SES-CD and 0.9090 for the CDEIS (Table 3).

A scatter plot of CDEIS vs. SES-CD for the complete series of 191 patients is shown in Figure 3 (includes data from development and validation phases). Correlations between SES-CD or CDEIS and a number of important clinical parameters are shown in Table 5. Correlation of SES-CD with CRP (0.472) and CDAI (0.390) were highly significant and relatively close, whereas correlations to IBDQ, serum albumin, and BMI were lower than 0.300 but still significant.

DISCUSSION

The assessment of mucosal involvement in patients with Crohn's disease in an objective and a reliable way is an important issue for clinicians who care for patients with this disease. Endoscopy is by far the best and the most widely used modality for assessment of the extent and the severity of Crohn's disease in the terminal ileum and the colon; it is markedly superiority to barium contrast radiography.[13] Although earlier studies have clearly demonstrated that mucosal healing is not predictive

	Ileum	Right colon	Transverse colon	Left colon	Rectum	Total
Presence and size of ulcers (0-3)	--	2	1	1	1	**5**
Extent of ulcerated surface (0-3)	--	1	1	1	1	**4**
Extent of affected surface (0-3)	--	2	1	1	1	**5**
Presence and type of narrowings (0-3)	--	3	0	0	0	**3**
					SES-CD =	**17**

Figure 2. Example of SES-CD scoring form (same case scored with CDEIS in Fig. 1).

of response to orally administered corticosteroids and that healing does not correlate with clinical improvement in response to this therapy,[3-5] newer and more potent therapies for Crohn's disease have now been shown to induce significant mucosal healing. With infliximab, for instance, impressive healing was observed as early as 4 weeks after a single infusion of 5 or 10 mg/kg.[6] Healing also was documented in patients with Crohn's disease in remission who were being treated with azathioprine[14] and to a lesser extent with methotrexate.[15] In the studies of infliximab, moreover, endoscopically demonstrated improvement correlated with clinical improvement and also was paralleled by an important reduction in the number of inflammatory cells in biopsy specimens.[6] In addition, for patients with complete healing at endoscopy after a number of infliximab infusions in the Accent-1 trial, the interval of time between the last infusion and relapse was significantly prolonged,[9] and patients shown to be in remission endoscopically had significantly fewer hospitalizations and surgical procedures than those without endoscopic evidence of healing.[7] All of these results and observations have led to the inclusion of endoscopic end points in trials of new therapeutic agents for Crohn's disease.

The new SES-CD score was developed to meet the clinical need for a reliable, easy-to-use endoscopic scoring instrument for Crohn's disease, one that by contrast would be less complex than the CDEIS. Any new score would need to be as reproducible as the CDEIS and to correlate with clinical parameters at least as closely. By using the classic approach (with development and validation phases) to the creation of a new score, a rapid and reliable score was obtained. Only characteristics that are considered to be major contributors to the clinical symptomatology and which had good reproducibility in the GETAID studies[2,12] were considered for the SES-CD. Nevertheless, there are some relevant differences between the endoscopic variables used for CDEIS and for SES-CD. In the CDEIS, ulcers are divided into deep and superficial. Because it is difficult to reliably make this distinction visually, this variable is a potential source of variability: in the SES-CD, ulcers are classified according to size, an accurate parameter that frequently is used with reference to polyps.[16] The results of the current study confirm that agreement for the definition of deep ulcers is good to very good but is weaker for superficial ulcers. The visual analogue scale for percentages of surface involved by ulcers and by any lesions of Crohn's disease are extremely important in the CDEIS, but they also represent the most time-consuming step in the calculation of the CDEIS. To avoid these measurements and conversions, the parameter "percentage of a given segment affected by ulcerations" was included in the SES-CD, but it is scored by selection of one number from 0 to 3. A score of 3 (>30% ulcerated) represents the worst possible score, because higher percentages probably have little additional effect on the severity of the symptoms. The classification of stenosis in the present study is not only descriptive but also functional, because it differentiates the degree of luminal narrowing based on whether the colonoscope can be passed through the stenosis. Although stenosis is an uncommon finding (3%-4% of cases),[2] its presence is highly relevant clinically.

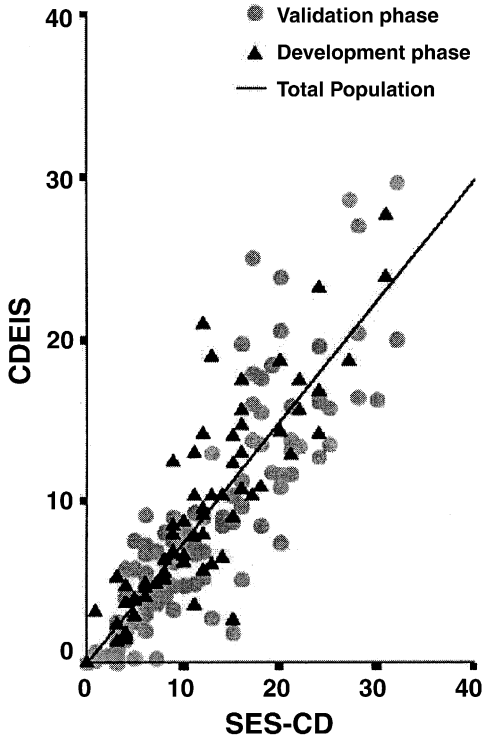

Figure 3. Scatter diagram of correlation between SES-CD and CDEIS (191 colonoscopic examinations).

As a consequence of the choices outlined above, the SES-CD score appeared to be easier to calculate than the CDEIS score. Indeed, to calculate CDEIS, it is necessary to convert data points on a 10-cm visual analogue scale into numbers for two variables (percentage of surface ulcerated, percentage of surface affected) in each of the specified 5 segments. In addition, 10 calculations (sums, divisions, and multiplications) are required. This process is reduced to only 4 categorical variables and, at most, 6 simple mathematical calculations (i.e., additions) in the SES-CD. This is the consequence of the simplification procedure, during which a slightly smaller correlation with the CDEIS was accepted in exchange for a balance between the easiest possible score to calculate and a satisfactory correlation with both the CDEIS and the CDAI.

The intraclass correlation between observers of the same colonoscopy procedures was, at least in the current study, better for the SES-CD than for the CDEIS. This could be explained by the elimination of the analogue scales. Moreover, agreement was extremely good for all of the selected endoscopic variables independently, whereas agreement for CDEIS superficial ulcerations never exceeded a level of 0.80.

The GETAID studies demonstrate a poor correlation between the CDAI and the CDEIS. In the present study, the correlation of the CDAI with the SES-CD was statistically significant and somewhat better than for the CDEIS, although still far from optimal. A possible explanation for suboptimal correlations between endoscopic appearance and symptomatology could lie in the many systemic manifestations of the inflammatory process that result in symptoms but are not necessarily reflected in the appearance of the mucosa. Another possible explanation could be a difference between the time necessary for observation of the clinical evolution of the disease and that needed to observe endoscopic healing. Some discordances between the SES-CD (or the CDEIS) and clinical indices could also relate to the possibility of involvement of more proximal segments of the gut by the disease that are not observable at colonoscopy.

Possible pitfalls of the SES-CD index of activity could be the presence of fistulas (for which endoscopy is not the best diagnostic modality), the underestimation of stenoses (the more functional classification that stresses the ability to traverse the lumen with the colonoscope is an attempt to avoid this problem), and the overestimation of non-specific lesions because of inexperience with endoscopy in patients with inflammatory bowel disease (e.g., overlap between aphthoid ulcers and aphthae related to bowel cleansing). The relative importance of these potential problems will probably be clarified by broader experience with the application of the SES-CD in clinical practice.

Table 5. Correlation between endoscopic scores (Simple Endoscopic Score for Crohn's Disease and Crohn's Disease Endoscopic Index of Severity) and clinical variables in complete series of patients (n = 191 patients)

	SES-CD		CDEIS	
	Spearman's r	p	Spearman's r	p
CRP	0.472	<0.001	0.449	<0.001
CDAI	0.390	<0.001	0.357	<0.001
IBDQ	−0.295	<0.001	−0.300	<0.001
Albumin	−0.279	<0.001	−0.268	0.001
BMI	−0.221	0.002	−0.212	0.003
Disease duration	−0.147	0.042	−0.084	0.251

SES-CD, Simple Endoscopic Score for Crohn's Disease; *CDEIS,* Crohn's Disease Endoscopic Index of Severity; *CRP,* C-reactive protein; *CDAI,* Crohn's disease activity index; *IBDQ,* quality of life; *BMI,* body mass index.

The present study comprises both the development and the formal validation of the SES-CD when using two different and independent cohorts of patients in 5 different European referral centers for the treatment of Crohn's disease. However, a broader validation of the score will be possible when the SES-CD is used in clinical trials and in practice.

In conclusion, the SES-CD is a new and practical instrument that can be used by clinicians for the objective assessment of mucosal lesions in Crohn's disease. The simplicity of this score, its excellent reproducibility, and its correlation with biochemical and clinical disease markers make it an attractive alternative to the CDEIS, at least for clinical trials in which mucosal healing must be assessed. Until the SES-CD is further validated by other investigators in prospective clinical trials, it should be used in parallel with the CDEIS.

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