

Utilization of the Inkling™ for the Rey - Osterrieth Complex Figure test

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The Rey - Osterrieth Complex Figure (ROCF) test assess visual-construction ability, visual memory and executive function. Three different methods are traditionally used to track and to record the strokes during the production of the complex figure: single pen, switching felt pens and flowcharts. The Inkling™ is an instrument which attributes are to track, to record and to save the information of every stroke depicted in a standard piece of paper. The purpose of the study is to examine the advantages and disadvantages of using the Inkling™ in the ROCF test. 66 ROCF performances were analyzed from subjects aged 6 to 86 years old. Each subject performed the ROCF test twice; first with pen switching method without flowcharts and later with the Inkling™ or viceversa. The comparison of the performances evidenced 5 characteristics: Four subjects distracted by the color of the felt pens, three subjects interfered by the switching of the felt pens, three subjects which performance was facilitated by the colors of the felt pens, nine subjects with unclear score for Fragmentation and fourteen subjects with unclear score for Planning. The advantages that the Inkling™ showed were compensation for the process of flowcharts, avoid interference, and reduce the burden of unclear scoring for Fragmentation and Planning.

Keywords : Rey-Osterrieth Complex Figure test, cognitive assessment, executive function, switching felt pens method, Inkling™ .

Introduction

The Rey Osterrieth Complex Figure (ROCF) test was developed by Rey in 1941 and standardized in 1944 by Osterrieth. This test was created with the purpose to investigate perceptual organization and visual memory [1]. Nowadays, the ROCF test is considered to have a wider scope of cognitive assessment; yielding information about visual-construction ability, executive function, as well as visual memory.

A good administration of the ROCF test is important for an accurate interpretation of the

subject's condition. The main tasks of the examiner during the administration are tracking and recording the performance of the examinee while drawing the complex figure. The purpose of this activity is visualize the sequence of production, the quality of organization and analyze the strategy of the examinee. Three traditional methods are often used for the administration of the ROCF test: single pen, colored pen changed and flowcharts.

The single pen method consists of giving the examinee one pen to draw the whole complex figure. This method is used when the tester plans to

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calculate only accuracy scores and uses a quantitative point-based system. The second method, colored pen changed method (also known as switching felt pens method) is used when the examiner's purpose is to use a qualitative scoring system. For this method two kinds of applications are mostly practiced: fixed time intervals and completion criteria. Finally, in flowchart method the examinee is given one pen that is used to make the reproduction of the entire figure while the examiner (sitting in front of the examinee) reproduces the respondent's draw stroke by stroke in a different sheet. This method is also used when the purpose of the examiner is a qualitative assessment [2].

In the present study, the utilization of a tool named "Inkling™" for the administration procedure of the ROCF test is described. The Inkling™ is a digital ballpoint pen developed by the company Wacom. The Inkling™'s attributes are tracking, recording and saving the information of every stroke depicted by a person while drawing a figure on a standard piece of paper. After the utilization of this tool, the information saved in the memory device of the pen can be transferred to a computer and the analysis of the content is possible as many times as the user requires it [3].

Tracking and recording the examinee's performance is a fundamental stage for an adequate and reliable interpretation of the complex figure test. Therefore, the goal of this study is to examine the advantages and disadvantages using the Inkling™ in comparison with the switching felt pens method and to determine whether it could be an optional tool for tracking and recording the ROCF test.

Subjects and Method

The performances of 66 subjects assessed with Rey - Osterrieth Complex Figure test were analyzed. The subjects were children and adults aged 6 years old to 86 years old without any neurologic or psychiatric disorder.

Only the copy condition of the ROCF test was administered. Immediate recall and delay recall conditions were not applied due to the goal of the study is to observe the efficiency of the Inkling™ on the ROCF test but not to inquire the subject's memory skills.

The instructions of the Boston Qualitative Score

System – BQSS manual [4] were applied for the administration of the copy condition. Each subject was asked to perform the ROCF test twice; first with the switching felt pens – completion criteria method and later with the Inkling™ or viceversa. For switching felt pens method, six colored felt pens were used. The color of the felt pens were changed in fixed order (black, red, blue, orange, green and yellow) while the examinee was drawing the complex figure. For the Inkling™ trial, only the ballpoint pen was used in the copy process while the memory device was holding the paper from the top to track and to save the procedure of drawing of the subject. Informed consent was obtained from parents in the case of children and from the own subjects in the case of adults. In all the cases the time of completion of the complex figure was taken. The time interval between the trials was eight hours and five days. Furthermore, the impression of every examinee about comparison between pen switching method and the Inkling™ was surveyed.

Within the two trials of the ROCF test for the same subject; every complex figure was scored, analyzed and compared to note the quality of the draw and the performance for both trials. The comments of the subjects during the performance of the ROCF test were also analyzed, as well as the observation of the behavior of the subjects.

For the scoring process, the normative data of the BQSS manual was used for adults (18 – 94 years old). In the case of children the normative data developed by one of the authors of this study was utilized for ages from 6 to 16 [5]. The indexes taken into account for this study were Copy Presence and Accuracy (CPA) and Organization (ORG). CPA represents a global measure of the respondent's visuoperceptual accuracy and overall visuo-constructional ability. ORG is the arithmetic sum of the Copy condition Fragmentation and Planning scores. These scores are meant to examine the respondent's organizational approach when reproducing the figure [4].

Results

After comparing and analyze the ROCF performances of each subject, the following characteristics were found.

Subjects distracted by the color of the felt pens

In drawings performed with the switching felt pens method, 4 subjects out of 66 were distracted by the color of the felt pens. These subjects were more focused to follow a sequence or to create a pattern with the colors while drawing the ROCF rather than to build a strategy to complete the complex figure. Comparing the final scores of these 4 subjects with their own drawings performed with the Inkling™, two of the cases got a lower score in copy presence and accuracy (CPA), and all the cases got a lower score in organization (ORG). Additionally, the ROCF trial under the felt pen switching method was administered in the second meeting in all the 4 cases. The subjects commented that the colors of felt pens distracted them.

Subjects interfered by the switching of the felt pens

Three subjects were interfered by the switching of the felt pens. After the examiner switched one or more felt pens, it was observed that the examinee decided not to continue drawing the stroke or the item of the complex figure that was intended to draw before the switch. 3 out of 66 were interfered by the switching of the felt pens. The final scores for the ROCF test made with switching felt pens method compared with their drawings made with the Inkling™, showed that two out of the three cases obtained lower scores for CPA and all the cases obtained lower scores for ORG. For two cases the ROCF test with the Inkling™ was administrated first, leaving the switching felt pens method as a second trial while for one case the switching felt pen method trial was the first to administrate. The

subjects commented that they felt more comfortable and not interrupted when they were drawing the ROCF with the Inkling™.

The color of the felt pens acted as a facilitator

Three subjects out of 66 showed that color of the felt pens acted as a facilitator at the time they performed the ROCF test with the switching felt pens method. In these cases the ROCF test made with the switching felt pens method look more structured and integrated. In all the cases the trial with switching felt pens method was administered first and the Inkling™ trial was second.

The table below describes the cases: subjects distracted by the color of the felt pen, subjects interfered by the switching of the felt pens and subjects' performance facilitated by the colors of the felt pens.

Unclear Score for Fragmentation

For the ROCFs made under the switching felt pens method, 9 cases out of 66 showed unclear scoring for Fragmentation. In these cases, the examiner had two criteria to score the same item (see Figure). This kind of scenario created doubts in the examiner, taking more amount of time for the scoring process.

Unclear score for Planning

14 out of 66 showed unclear scoring for Planning in the ROCF drawings carried out with the pen switching method. Similar like in the case before, the examiner had two criteria for the scoring. These doubts were time consuming.

Table. Scores of the cases distracted by the colors of the felt pens, interfered by the switching of the felt pens and facilitated by the colors of the felt pens.

Subejcts	Age(yrs)	Sex	Switching felt pen method		Inkling™	
			CPA Score	ORG Score	CPA Score	ORG Score
Distracted	61	F	20	5	*20	*7
Distracted	18	F	20	6	*20	*8
Distracted	12	F	18	2	*20	*5
Distracted	7	M	17	5	*18	*4
Interfered	49	M	20	5	*20	*7
Interfered	47	M	*19	*2	20	7
Interfered	12	F	18	1	*19	*2
Facilitated	9	F	*12	*3	15	3
Facilitated	9	F	*19	*7	19	5
Facilitated	9	M	*19	*4	16	2

(*)ROCF test administered in the first trial

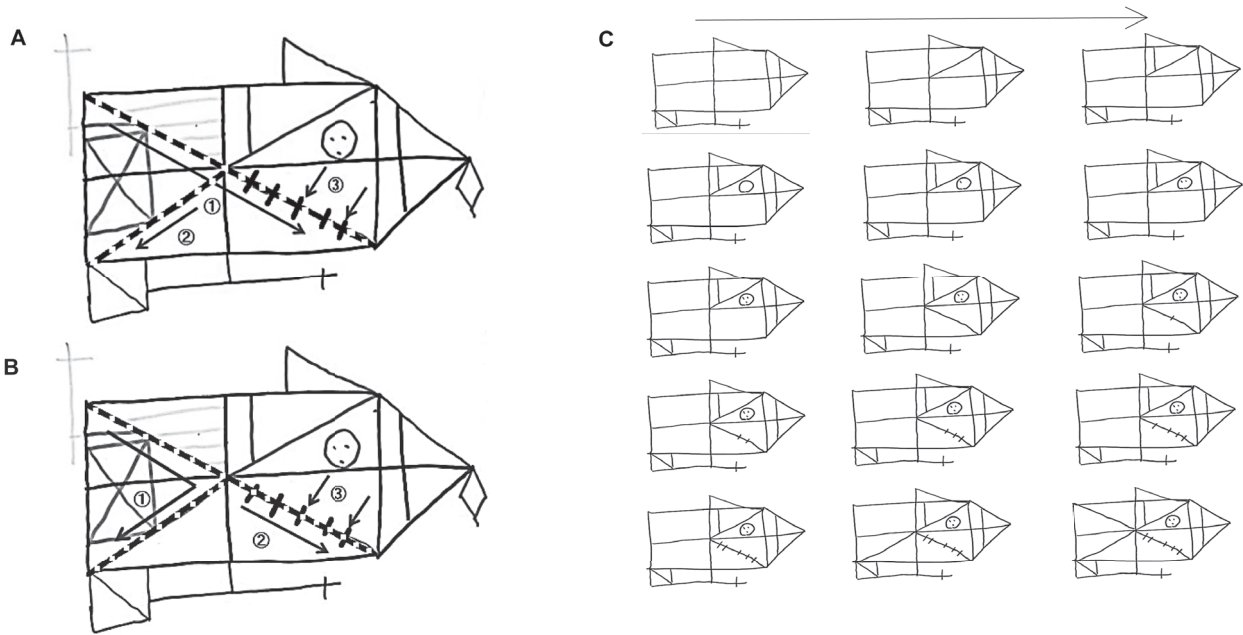


Figure. Example of unclear scoring for Fragmentation. (A) and (B) are two possible ways to score the item known as diagonal D (according to the BQSS manual). Dotted lines indicate lines were drawn with the same color of felt pen. If the examiner interprets the pattern of the dotted line like in figure A, the diagonal D is considered as unfragmented. However, if the examiner interprets the qualification of the same element as figure B, the configural diagonal D is considered as fragmented. Figure C presents a part of the recording made by the Inkling™, in which the tester clearly could see the Fragmentation of diagonal D.

Discussion

The Rey-Osterrieth Complex Figure test is one of the most popular tests for visuo-constructional ability and visual memory. Nevertheless, this test also assess planning and organization, core components of executive functioning [6]. The Rey-Osterrieth Complex Figure test is usually considered among the set of neuropsychological tests in the assessment for adults or children. The importance of this test rests on its simplicity and sensitivity for difficulties on visual-motor-spatial organization and construction, planning, strategy and sustained attention [7].

The traditional administration methods of the ROCF test give the examiner the option to choose for one or two methods simultaneously. The main goal of these methods is to track and to record the performance of the examinee while drawing the complex figure.

However, some disadvantages concern with the administration methods has been reported. Meyers & Meyers [8] based on their clinical experience; considered that switching felt pens method may be

overly distracting some patients. The study of Stern and colleagues [9] pointed out that flowchart method may help to reduce the risk of bias or distraction but could be difficult to keep track of the production of the complex figure.

In this study, a total of 34 subjects out of 66 showed some kind of difficulty described in the part of results and classified in five characteristics. These characteristics mainly involved the performance of the examinee during the drawing procedure and the performance of the examiner during the scoring procedure.

The performance of the examinees during the drawing procedure showed differences when using the felt pen method compared to the Inkling™. A total of 7 subjects out of 66 manifested being distracted by the colors of the felt pens or interrupted by the switching of the felt pens when they were drawing the ROCF. We could corroborate those statements when comparing their final scores.

A different aspect of the differences between the switching felt pen method and the Inkling™ during the subjects' performance of the ROCF test was: the

colors of the felt pens as a facilitator. The colors could have given a reference for the spatial location of the items at the moment to draw the complex figure under the switching felt pens method. Two cases showed a better score for ORG. This finding could be explained by a compensation process of the magnocellular stream and parvocellular stream explained in detail in the studies of Nakamura [10]. The magnocellular stream plays a role at the moment to face visuospatial tasks and the parvocellular stream is related to the analysis of the form and color of an object [11]. Therefore, these cases could have compensated slight difficulties in the dorsal stream. However, considering that the sample in this study is free of neurologic or psychiatric disorders, we are open to the possibility that the examiners could have misled an interpretation of the cognitive condition of the examinee.

The performance of the examiner during the scoring procedure of the ROCF test showed differences between the drawings made by switching felt pens method compared to the Inkling™. When scoring the ROCF drawings made under the switching felt pens method, the examiner faced doubts to score Fragmentation and Planning in many cases. In order to give a precise score, the examiner had to trace the strokes carefully. This process was time-consuming to the examiner.

To score the ROCF drawings administered with the Inkling™ did not present any difficulty. The examiner could analyze the drawings in the paper and trace the strokes in a computer. Doubts at scoring were clarified by watching the record of the strokes made by Inkling™.

Conclusion

The Inkling™ could be considered as an optional method for the administration of the ROCF test. The Inkling™ could compensate the process of flowcharts and avoid interferences in the performance of the examinee while drawing the ROCF. Also, the Inkling™ could reduce the burden of scoring when doubts rise during the scoring of Fragmentation and Planning. These advantages should be corroborated in further studies, using the Inkling™ in clinical population.

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