

Research Paper  
Cleft Lip and PalateQuantitative assessment of the  
learning curve for cleft lip repair  
using LC-CUSUME. Segna<sup>1</sup>, J.-B. Caruhel<sup>2</sup>, P. Corre<sup>3</sup>,  
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**Abstract.** The first step in cleft lip repair is the precise positioning of anatomical landmarks and tracing of the incisions on the patient's lip at the beginning of the procedure. The aim of this study was to evaluate progress made in learning cleft lip repair tracing using a quantitative assessment of learning curves: LC-CUSUM (learning curve – cumulative sum). Eight surgical residents were enrolled and asked to trace lip repair incisions on five cases of unilateral left cleft lip over 5 consecutive weeks. Results were compared to a reference tracing based on the positioning of nine anatomical landmarks and assessed using LC-CUSUM. Competence was defined as the accurate positioning of the nine landmarks (less than 1.4 mm deviation from the reference positions, with an accepted 15% failure rate). After five tracing sessions, competence was not achieved evenly for all trainees, or for all landmarks, underlining differences in inter-individual learning ability even with similar training. However, despite an initial marked lack of theoretical and practical training in lip repair techniques, repeated drawings of cleft lip incisions allowed a satisfactory level of competence to be reached for most landmarks and most trainees. Nevertheless it was found that not all landmarks are understood by students with similar ease, and that landmark positioning reveals significant inter-individual differences. This approach allowed a global assessment of the teaching of cleft repair and will help to focus training on specific problematic points for which competence was not obtained according to the LC-CUSUM test.

**Key words:** cleft lip; plastic surgery; learning curve.

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The first step in primary cleft lip closure is the positioning of anatomical landmarks and the drawing of the incisions on the patient's lip once under general anaesthesia. An adequate drawing is crucial in cleft lip surgery, but landmarking can sometimes be difficult due to inter-individual

variations in cleft anatomy and to the large panel of available repair techniques.

No formal teaching method for lip drawing has been proposed and assessed so far, in practice or in the literature. Individual and objective evaluation is a necessary step towards the improvement

of patient care<sup>1</sup>. Such an evaluation will ensure that those who have finished their training are competent to perform the procedure in question. This approach will help direct the use of teaching resources in the most efficient way by only training those who are still in need.

This study was performed to evaluate the efficiency of a simple teaching method based on repeated drawing of the modified Talmant incision by a group of residents and the use of the LC-CUSUM (learning curve – cumulative sum) statistical tool in order to assess their learning curve<sup>2</sup>. The study was conducted at a French cleft reference centre within a tertiary care centre. The method used for primary cleft lip closure and taught to trainees during procedures in theatre and formal teaching sessions was the ‘modified Talmant primary lip repair’, based on Delaire’s design<sup>3</sup>.

## Materials and methods

Eight surgical trainees were involved in the study. All participants had completed at least half of their specialty training (2.5 years of a 5-year programme) in plastic surgery, oral and maxillofacial surgery, or ear, nose, and throat surgery in France. Their training programmes were all required to include some level of theoretical teaching on cleft repair. The level of the trainees was assessed using five yes/no questions: (1) practical training in theatre (yes/no), (2) practical training on paper – that is, drawing of incisions on cleft pictures (yes/no), (3) theoretical teaching of the Millard technique (yes/no), (4) theoretical teaching of the Talmant technique<sup>4,5</sup> (yes/no), (5) theoretical teaching of other techniques (yes/no and name of the technique). All trainees had been working in the cleft centre for 4 months at the time the study was started in July 2016, and had been first scrubs on several cleft repair procedures (at least five) in theatre.

Five frontal lip pictures from cases of left unilateral cleft lip were chosen and printed in A4 format (Fig. 1), corresponding to 5× magnification. Reference drawings for the procedures were provided by an experienced cleft surgeon (PC).

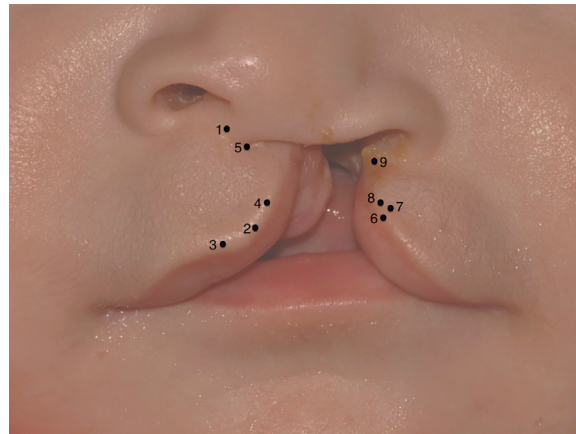


Fig. 2. Landmarks used for the assessment of the superimposition, as compared between the tracings of the surgical trainees and the reference tracings. 1: sub-nasal point; 2: midpoint of Cupid's bow; 3: lower end of the right philtral crest; 4: lower end of the left philtral crest; 5: upper end of the left philtral crest; 6–7–8: design of the A-triangle (lengthening triangle); 9: starting point of the back-cut over the orbicularis muscle.

Students were asked to draw the incisions for the five cleft lip cases once a week for 5 consecutive weeks (starting after 4 months of their rotation in the cleft centre) using tracing paper, for a total of five sessions. The first session was performed without specific preliminary instructions and the students were not aware that their knowledge of cleft lip surgery would be assessed. Students were then instructed to read about the modified Talmant technique during the period between the first two sessions. After the completion of the second session, students were handed the reference tracings for each of the five cases and were allowed to keep these tracings until the end of the protocol (sessions 3, 4, and 5).

Nine landmarks (Fig. 2) were selected for superimposition of the student tracings with the reference tracings: (1) sub-nasal point; (2) midpoint of Cupid's bow; (3) lower end of the right philtral crest; (4) lower end of the left philtral crest; (5) upper end of the left philtral crest;

(6)–(7)–(8) design of the A-triangle (lengthening triangle); and (9) starting point of the back-cut over the orbicularis muscle. A Cartesian coordinate system was defined on each tracing based on two perpendicular lines drawn on each cleft picture, and the distance between the student and reference landmarks was measured in millimetres by three investigators (ES, JBC, RHK). Each of the five sessions provided a dataset of 45 distances per student (nine landmarks for five different cleft cases). The total dataset comprised 225 distances per participant (five sessions with 45 distances measured per session).

The learning curves were computed using R software (2008; R Foundation for Statistical Computing, Vienna, Austria) according to a previously published protocol based on the LC-CUSUM method<sup>1,2,6</sup>. More precisely, in order to determine if, and when, a trainee reached competency, the LC-CUSUM test was used; this method sequentially tests the

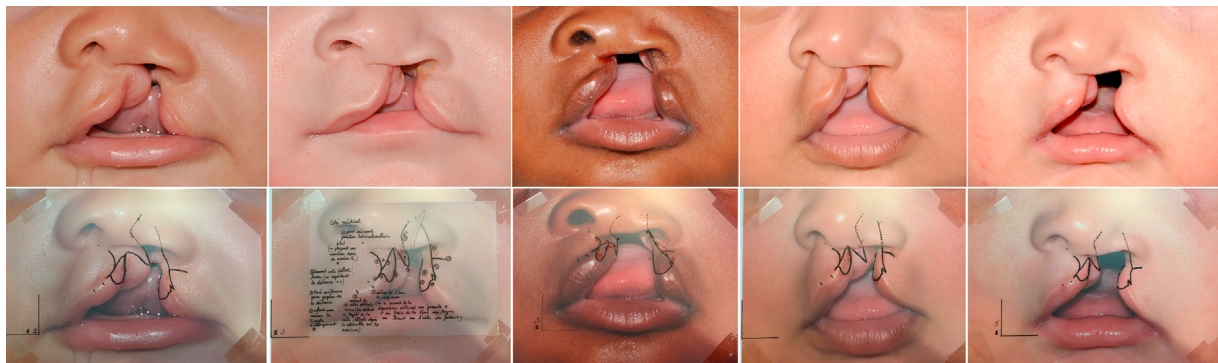


Fig. 1. Five cases of left unilateral cleft lip (first row) with the corresponding reference tracing (second row) used to assess the tracings of the surgical trainees.

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