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Two years after epilepsy surgery in children: Recognition of emotions expressed by faces

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ABSTRACT

Objectives: The purpose of this study was to determine whether children with epilepsy surgery in their history are able to recognize emotions expressed by faces and whether this recognition is associated with demographic variables [age, sex, and verbal intelligence (VIQ)] and/or epilepsy variables (epilepsy duration, side of the surgery, surgery area, resection of the amygdala, etiology, antiepileptic drug use, and seizure freedom).
Methods: Two years after epilepsy surgery, the Facial Expression of Emotion: Stimuli and Tests (FEEST) was administered to 41 patients (age: 4–20 years, mean: 13.5 years, 24 girls) and 82 age- and sex-matched healthy controls. Data obtained longitudinally (before surgery and 6, 12, and 24 months after surgery) in a small subset (11 patients and 22 matched controls) were explored to obtain clues about the course of REEF from before surgery.
Results: Corrected for VIQ, REEF scored significantly lower in the 41 surgically treated patients than in matched control children. No significant relationship was found between REEF and any epilepsy variable. Only age at assessment predicted REEF score in both patients and controls.
The longitudinal data revealed a 'dip' in emotion recognition at the first postsurgical assessment in the six younger patients (age: <12.1 years). The older patients (age: 13–17 years) showed a continuous increase in REEF scores that was similar to that in controls. Two years after surgery, REEF of the younger patients recovered to, but did not exceed, the presurgical level.
Conclusion: Neither poor REEF present two years after childhood epilepsy surgery, nor the aberrant course of REEF in younger patients (age: <12.1 years) was explained by epilepsy variables or poor verbal intelligence. Disentangling the mechanism of the abnormality is urgently needed, as recognizing emotional expressions is a key component in the development of more complex social perception skills.

1. Introduction

Recognizing emotions expressed by faces (REEF) provides the perceiver information about another person's thoughts and feelings and is a key component in the development of more complex social perception skills [1,2]. Recognizing emotions expressed by faces appears to be at risk in both children and adults with epilepsy [3–6]. However, consensus has not yet been reached with respect to the variables that are related to deficits in REEF. A lateralization effect has been suggested, but it has also been questioned [6]. The usually reported larger REEF deficit in adults with right-hemisphere epileptogenic foci than in those with left-hemisphere epileptogenic foci [4,5] has, for some emotions, been contradicted by the finding of lower REEF scores after left- than after right-sided surgery [7]. Localization of the epileptic foci may also play a role. In school-age children, a relationship was found between particular cerebral epileptogenic areas and specific facially expressed emotions. Whereas left and right temporal lobe epilepsies were associated with poor recognition of fear and disgust, respectively, frontocentral epilepsy was associated with poor recognition of happiness [5]. In the same study, Golouboff et al. found an association

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Table 1
Demographic and epilepsy characteristics of patients (n = 41), assessed two years after epilepsy surgery.

		Left/right
Sex (n)		
Girls	24	17/7
Boys	17	8/9
Age (years) at assessment [mean (sd)]	13.5 (4.4) (range: 4.2–20 years)	13.6 (4.0)/13.4 (5.1)
Age (years) at epilepsy onset [mean (sd)]	5.9 (4.2)	5.9 (4.1)/5.7 (4.6)
Duration of epilepsy (years) [mean (sd)]	5.6 (4.3)	5.6 (3.7)/5.6 (5.1)
VIQ [mean (sd)]	84 (19.9)	85 (21)/83 (18)
Etiology (n)		
Tumor	17[a]	11/6
MCD	12	8/4
Hippocampal sclerosis	5	2/3
Other	7[b]	4/3
Area and side of surgery (n)		
Temporal	17	12/5
Frontal	14	8/6
Central/parietal	8	4/4
Hemispherotomy	2	1/1
Amygdala (n)		
In situ	26	15/11
Resected	15	10/5

Abbreviations: n = number; sd = standard deviation; VIQ = verbal intelligence quotient; MCD = malformation of cortical development.
[a] Ganglioglioma (n = 10); astrocytoma (n = 1); oligodendroglioma (n = 1); dysembryoplastic neuroepithelial tumor (DNET) (n = 4); teratoma (n = 1).
[b] Tuberous sclerosis complex (TSC) (n = 2); traumatic brain injury (n = 1); DNET + dysplasia (n = 1); Rasmussen encephalitis (n = 1); cerebral infarction (n = 1); cavernoma (n = 1).

between early epilepsy onset and REEF deficits [5]. Associations between REEF and intelligence [6] or behavioral problems [5] have also been reported in patients with epilepsy.

Epilepsy surgery is increasingly performed in children, but the effect of epilepsy surgery on REEF in children is as yet unknown. In adults with temporal lobe epilepsy, the REEF deficit that was already present prior to epilepsy surgery did not change thereafter [6].

In order to counsel parents and children appropriately, not only on epilepsy and cognition after surgery but also on the recognition of emotions, we studied REEF. We hypothesized that REEF is deficient in children after epilepsy surgery, and we explored associations of REEF with demographic variables (age at assessment, intelligence, and sex) and epilepsy variables (epilepsy duration, side of the surgery, surgery area, resection of the amygdala, etiology, antiepileptic drug use, and seizure freedom). We report on a controlled study of REEF two years after epilepsy surgery at a time when, presumably, the patients have adapted to their new life conditions. In addition, we tried to find a tentative answer to the question whether the deficit is incurred by the intervention or is already present before surgery. To this end, we report on the course of REEF from prior to epilepsy surgery up to two years after the surgery in the subset of patients and matched control children of whom longitudinal data were available.

2. Methods

The controlled study with consecutive inclusion of patients was part of a countrywide project addressing cognitive, affective, and psychosocial functioning of children and adolescents after epilepsy surgery [8–10]. The Institutional Review Board of the University Medical Center Utrecht approved the study. Parents of all children and also all children above the age of 12 years provided written informed consent.

2.1. Subjects

Two years after their epilepsy surgery, 41 children performed the test of recognizing facially expressed emotions (see Table 1 for demographic and epilepsy variables, as extracted from the medical records).

For every patient, two age- and sex-matched control children without a neurological history were included. The 82 control children [mean age at assessment = 13.5 (sd = 4.4) years; 48 girls; mean VIQ = 112 (sd = 15.9)] were recruited from regular schools that were located in different neighborhoods with diverse socioeconomic backgrounds of a medium-sized nonuniversity town.

Longitudinal data on REEF were available for 11 of the 41 patients (see Table 2 for demographic and epilepsy data) [mean age at baseline = 11.9 (sd = 4.1) years; mean VIQ = 80 (sd = 14.0)] and for 22 matched healthy controls [mean age at last assessment = 11.9 (sd = 4.0) years; mean VIQ = 113 (sd = 15.1)]. Patients were assessed shortly before surgery (baseline) and 6, 12, and 24 months after surgery. The controls were assessed at similar intervals as their matching patient.

2.2. Instruments

2.2.1. Facial Expression of Emotion: Stimuli and Tests (FEEST)

The FEEST [11] assesses the recognition of facial expressions. The 60 black-and-white photographs of faces, taken from the 'Pictures of Facial Affect' series [12], express the six so-called 'primary' or 'basic' emotions: happiness, anger, sadness, fear, surprise, and disgust. The faces were presented on a computer screen for 3 s each. The six textual emotion labels remained on the screen throughout the task. The child was asked to choose the emotion label that he thought the face expressed. The order of presentation of the faces was randomized. Validity of the FEEST is satisfactory [11].

For children under the age of 12 years and/or children with lower cognitive abilities and/or a lower attention span, a shortened version was used (FEEST-36), consisting of a selection of 36 pictures from the original FEEST with six faces expressing the six emotions [13]. Upon

Table 2
Demographic and illness features of patients (n = 11), assessed before epilepsy surgery and 6, 12, and 24 months thereafter.

	Patient 1	Patient 2	Patient 3	Patient 4	Patient 5	Patient 6	Patient 7	Patient 8	Patient 9	Patient 10	Patient 11
Sex	Boy	Boy	Boy	Boy	Girl	Girl	Girl	Girl	Girl	Girl	Girl
Age (years) at baseline	17.2	17.0	16.3	14.1	13.7	12.1	12.0	8.4	6.7	6.6	6.5
Age (years) at epilepsy onset	6	1	12	5	8	5	6	5	1	4	4
Epilepsy duration (years)	11	16	4	9	5	7	6	3	5	2	2
VIQ at baseline	97	81	77	67	74	83	69	69	73	82	110
Side of surgery	Right	Right	Right	Left	Left	Left	Left	Left	Left	Right	Left
Surgery area	Frontal	Temporal	Parietal	Temporal	Frontal	Temporal	Temporal	Frontal	Temporal	Frontal	Temporal
Amygdala	In situ	Resected	In situ	Resected	In situ	Resected	Resected	In situ	Resected	In situ	In situ
Etiology	Mature cystic teratoma	Ganglioglioma	Ganglioglioma	Protoplasmic astrocytoma	MCD	MTS	MCD	MCD	MTS	MCD	Ganglioglioma

Abbreviations: VIQ = verbal intelligence quotient, MCD = malformation of cortical development, MTS = mesial temporal sclerosis.