Research in Developmental Disabilities 35 (2014) 1551–1561

Contents lists available at ScienceDirect

Research in Developmental Disabilities

Validity and reliability of the Mastication Observation and Evaluation (MOE) instrument

Lianne Remijn [a,b,*], Renée Speyer [c,d], Brenda E. Groen [e], Jacques van Limbeek [f], Maria W.G. Nijhuis-van der Sanden [g]

[a] Department of Child Rehabilitation, Rehabilitation Centre, Sint Maartenskliniek, Postbox 9011, 6500 GM Nijmegen, The Netherlands
[b] Institute of Health Studies, HAN University of Applied Sciences, Postbox 6960, 6503 GL Nijmegen, The Netherlands
[c] School of Public Health, Tropical Medicine and Rehabilitation Sciences, James Cook University, Townsville City, Queensland 4811, Australia
[d] Department of Otorhinolaryngology and Head and Neck Surgery, Leiden University Medical Center, Postbox 9600, 2300 RC Leiden, The Netherlands
[e] Sint Maartenskliniek Research, Postbox 9011, 6500 GM Nijmegen, The Netherlands
[f] Achmea Health Insurance Company, Postbox 1717, 3800 BS Amersfoort, The Netherlands
[g] Radboud University Medical Center, Scientific Institute for Quality of Healthcare, Postbox 9101, 6500 HB Nijmegen, The Netherlands

ARTICLE INFO

Article history:
Received 19 November 2013
Received in revised form 28 February 2014
Accepted 14 March 2014
Available online

Keywords:
Chewing
Observation
Neurologic disorders
Children
Validity
Reliability

ABSTRACT

The Mastication Observation and Evaluation (MOE) instrument was developed to allow objective assessment of a child's mastication process. It contains 14 items and was developed over three Delphi rounds. The present study concerns the further development of the MOE using the COSMIN (Consensus based Standard for the Selection of Measurement Instruments) and investigated the instrument's internal consistency, inter-observer reliability, construct validity and floor and ceiling effects. Consumption of three bites of bread and biscuit was evaluated using the MOE. Data of 59 healthy children (6–48 mths) and 38 children (bread) and 37 children (biscuit) with cerebral palsy (24–72 mths) were used.

Four items were excluded before analysis due to zero variance. Principal Components Analysis showed one factor with 8 items. Internal consistency was >0.70 (Chronbach's alpha) for both food consistencies and for both groups of children. Inter-observer reliability varied from 0.51 to 0.98 (weighted Gwet's agreement coefficient). The total MOE scores for both groups showed normal distribution for the population. There were no floor or ceiling effects.

The revised MOE now contains 8 items that (a) have a consistent concept for mastication and can be scored on a 4-point scale with sufficient reliability and (b) are sensitive to stages of chewing development in young children. The removed items are retained as part of a criterion referenced list within the MOE.

* Corresponding author at: Department of Child Rehabilitation, Sint Maartenskliniek, Postbox 9011, 6500 GM Nijmegen, The Netherlands. Tel.: +31 619532736; fax: +31 243528116.
E-mail addresses: l.remijn@maartenskliniek.nl, lianne.remijn@han.nl (L. Remijn).

http://dx.doi.org/10.1016/j.ridd.2014.03.035
0891-4222/

1. Introduction

Intake of solids is the last step in the development of food consumption in children. Learning to consume solid foods begins between 8 and 12 months (Arvedson & Delaney, 2011). At the age of 12 months, children can manage most food structures (Carruth & Skinner, 2002) and can move food from the centre of the tongue to the side of the mouth, chew it and move it back to the centre again when the foods no longer requires chewing (Le Révérend, Edelson, & Loret, 2013). They can also move the bolus to the back of the mouth for swallowing (Steeve, Moore, Green, Reilly, & McMurtrey, 2008). Mastication coordination and strength improves up until 4 years of age and enables children to eat increasingly complex foods (e.g. beef and peanuts) or food with multiple consistencies (e.g. grapes) (Green et al., 1997). Not all children develop this process smoothly or quickly (e.g. children with neurological disorders, such as cerebral palsy) and these children may experience unpleasant and dangerous situations such as gagging or choking (Blair, Watson, Badawi, & Stanley, 2001; Gisel & Alphonce, 1995; Sjögreen, 2011). Oromotor feeding problems are an issue in approximately 90% of children with cerebral palsy (CP), but no data are available for mastication (Benfer, Weir, & Boyd, 2012; Briesemeister, Schmidt, & Ries, 2013). A dysfunctional mastication system can result in an altered digestive process and in respiratory (Benfer et al., 2012) and dental health problems (Rodrigues dos Santos, Masiero, Novo, & Simionato, 2003). It is also associated with an increase in mortality (Yilmaz, Basar, & Gisel, 2004). Identifying (developmental) chewing difficulties is necessary to prevent such outcomes.

Clinical analysis of chewing can be assessed in a spontaneous mealtime context to indicate the proficiency of mastication (what the child does) and can be assessed in a clinical setting under optimal conditions (what the child can) (Bilt, 2011). Speech Language Therapists (SLTs) require a structured observational instrument that (a) is child friendly and easy to implement and (b) can be used to guide therapy goal-setting and/or indicate whether further assessment of the oral or oral-pharyngeal phase of the swallow is required.

Benfer et al. (2012) evaluated nine oral-pharyngeal dysphagia observation instruments and concluded that only two instruments, the Schedule for Oral Motor Assessment (SOMA) (Reilly, Skuse, & Wolke, 1995) and Functional Feeding Assessment modified (FFAm) (Gisel, Alphonce, & Ramsay, 2000), had suitably strong psychometric properties. The SOMA includes 22 items concerning chewing capacity to be scored on a dichotomous scale. Items in the SOMA do not have detailed descriptions for all items and does not include an item on lateral tongue movement. However, the FFAm, which is scored on a 5-point scale, evaluates a broad range of oral motor skills and does not provide enough detail for a chewing evaluation. In addition to these drawbacks, there is no Dutch version of the SOMA and FFAm nor training possibilities for clinicians in the use of these scales. For these reasons, we developed the Mastication Observation and Evaluation (MOE) for the assessment of chewing in healthy infants and children with CP (Remijn et al., 2013). In our original study we developed the 14 MOE items over three Delphi rounds with 15 experts. Although we advocated removing the item 'chewing duration' because of low reliability, we decided to change the answer option for this item and we included this item for the present study to recheck its reliability.

The results from our first content validity study were of a level to warrant further development of the instrument. In the present study we used a consensus-based approach for the selection of measurement instruments, called COSMIN (Mokkink et al., 2010; Terwee et al., 2007, 2012). Only four measurement properties were relevant for the validation of the MOE instrument. The measurement properties that were not relevant or could not be assessed were measurement error (not assessed due to use of an ordinal scale), criterion validity (not assessed as there is no golden standard for assessing mastication) and responsiveness (we did not evaluate changes over time).

The goal of this study was to establish the internal consistency, inter-observer reliability and construct validity of the MOE and identify any floor and ceiling effects based on the chewing performance of a group of healthy children and a group of children with CP. As part of the analysis of the instrument's construct validity, associations between MOE scores and age MOE scores and gross motor function of the children with CP were also investigated.

2. Methods

2.1. Participants

In this study 80 healthy children aged 6–48 months (healthy group) and 44 children with CP (CP group) aged 24–72 months with classification II–IV gross motor function according to the Gross Motor Function Classification Scale (GMFCS) took part in this study. Children with food allergies were excluded from the study.

Children in the healthy group were recruited from childcare centres in the Nijmegen and surrounding areas (Kinder Opvang Nijmegen (KION)). Children in the CP group were recruited from four rehabilitation centres and affiliated schools in the Netherlands. All parents received written information about the study and provided written informed consent. The Slotervaart Hospital's Medical Ethics Committee and READE in Amsterdam approved the study (study number NL40472.048.12).

2.2. Procedure

The testing procedure was similar to that described in Remijn et al. (2013). While sitting in a suitable chair in a quiet environment, participants were offered a total of five pieces of wheat bread with chocolate spread (1.5 cm^2) and five pieces of