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Critical Review: Validity, Efficacy and Responsiveness of NOMAS in Identification of Oral Feeding and an Oral Motor Dysfunctional System in Infant Population

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ABSTRACT:

Background: *Most infants must reach oral feeding proficiency before being released from neonatal care. It is a complicated developmental activity that demands the integration of several sensory inputs, the maturity of the central nervous system, muscular coordination, and respiratory stability. While ensuring oral feeding safety is crucial to lowering morbidities, we also need to take advantage of developmental windows to hasten the maturation of feeding. Therefore, numerous assessment methods are being implemented to evaluate oral feeding performance in neonates. For this purpose, we will investigate the validity, efficacy and responsiveness of an analytical instrument which is Neonatal Oral-Motor Assessment Scale (NOMAS), which is considered the primary and most commonly available non-invasive neonatal screening tool that is used to assess non-nutritive sucking (NNS) and nutritive sucking (NS) skills of infants up to approximately eight weeks post-term.*

Objective: *For clinicians to appropriately incorporate the results of the evidence-based assessment scale, this paper's primary goal is to critically evaluate the literature on NOMAS psychometrical measures. The secondary goal is to make recommendations for clinical treatment and future research based on the best available data.*

Method: *Articles were investigated by Google Scholar, Medline, CINHAL, PsycINFO, PubMed, SCI-HUB and other computerized internet databases. All indicated articles' reference pages were examined as well.*

Conclusion: *The NOMAS solely assesses a newborn's oral-motor development and has only shown moderate validity and responsiveness with inconsistent and inadequate reliability. At the same time, limited research evidence is available on the efficacy of NOMAS, which is crucial in identifying infant oral feeding issues. Therefore, clinicians should remain cautious in solely relying on this equipment and use a tool with objective measures in combination with NOMAS for assessing neonates with oral feeding problems.*

Keywords: *Neonatal Oral Motor Assessment Scale (NOMAS), Nutritive Sucking (NS), Non-Nutritive Sucking (NNS), Normal, Disorganized, Dysfunctional, Psychometrical measures, Efficacy, Validity, Reliability, Responsiveness*

I. Introduction

Speech Language Pathologists frequently work in a complex field of practice while evaluating and treating feeding complications, particularly in premature infants. Infants consume edible products through a sucking mechanism, a multifaceted motor skill requiring strong oral motor abilities and advanced breathing and swallowing coordination. A dysfunction or disorganized feeding pattern can lead to difficulty establishing complete oral feeding, failure to thrive or a delay in oral-motor development (Arvedson, 2008). A higher level of technical and observational medical care is needed for preterm infants in the neonatal intensive care unit. When considering initiating preterm children on oral feeding, caregivers commonly ponder whether the newborns have established oral readiness or exhibit a lack of oral feeding competency (Lau & Smith, 2011). The beginning of oral feeding is frequently mandated by attending physicians, occasionally delegating the decision

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to nurses, as there is no Gold-Standard instrument available to establish whether a newborn is "ready" to wean from tube feeding (Lau & Smith, 2011). Therefore, a psychometrically sound assessment tool should be created that will enable the clinicians and researchers to recognize, monitor, and treat feeding issues that arise in the early infant phase and accurately predict whether an infant has or will develop feeding difficulties in future (Howe et al., 2007). This instrument might help decide whether interventions are necessary to make sucking and swallowing secure. An evaluation apparatus must show its validity, efficacy, responsiveness or the degree to which it achieves its intended goals. Making decisions about an assessment tool's potential use for future study and prospective usage in clinical settings requires consideration of its reliability and validity.

Neonatal Oral-Motor Assessment Scale (NOMAS), which has been considered the primary and frequently available observational method that is exercised to analyze non-nutritive sucking (NNS) and nutritive sucking (NS) competence of a preterm and a full-term neonate up to 8 weeks post-term. This non-invasive screening device was designed in 1986 by Marjorie Meyer Palmer to distinguish and measure typical and varying degrees of oral sensorimotor characteristics in preterm or full-term infants who receive food through breastfeeding or bottle feeding. Its modified version is practiced in current days, composed by Palmer, Crawley and Bianco in 1993 (Cori Zarem, 2013).

It is a visual observational checklist which comprises 28 items. The sub-scores cited in the NOMAS system include 12 binary evaluations of rhythm in reflexive nutritive sucking and eight assessments of the function of reflexive nutritive sucking including lip seal, tongue and jaw mobility. A preterm or full-term infant's oral motor patterns are categorized into normal, disorganized, or dysfunctional sucking patterns during breastfeeding or bottle feeding. However, the scoring process of NOMAS comprises of a severity rating scale for the differential diagnosis of categories for disorganized and dysfunctional sucking structure, which includes; 1=mild, 2-3=moderate and 4=severe.

The procedure is performed during the first 2 minutes of an infant’s sucking behavior, either through immediate observations or video recordings observed by more than one certified NOMAS practitioner. An 80% agreement is compulsory on all 28 items per recording. During the statement by the NOMAS personnel, the infant is not allowed to be touched, nor is it attached to any measuring apparatus. Infant preferences are considered, and under any non-favorable conditions, the attempt to feed the infant is rescheduled to the next feeding time. The quantity of sucking mobility during one sucking episode is quantified, and the prolongation of the pauses between the sucking bursts is recorded. The degree and periodicity of oral motor patterns, i.e. Mobility of jaw and tongue, are investigated according to the 20 items and documented on the directory of NOMAS. Each episode of an infant’s sucking behavior is documented and stored on a digital video disc. Each video recording is assessed by more than one NOMAS consultant and numbered to distinguish the sucking characteristics in neonates (Palmer, 2002). For each episode, the infant’s jaw and tongue movements are graded concerning normal, disorganized and dysfunctional oral motor structures.

The signs of normal oral motor functioning within the NOMAS system are explained as a demonstration of coordinated suck-swallow-breathe response on non-nutritive sucking and reflexive nutritive sucking, with the ratio of 1:1:1 and 10 to 30 sucks in a burst is considered as the normal development of oral feeding (da Costa SP, 2008).

The signs of oral motor dysfunction within the NOMAS system are defined as abnormal movement, and an interference in the oral feeding process leads to a dysfunctional oral motor system classification. The signs of oral motor or suck dysfunction are specified, which indicates an oral motor pathology, i.e., abnormities of oral-facial tonicity, such as hypertonicity; constriction or restricted mobility of the mandible, increased deviation of the mandible or hypo-tonicity; glossoptosis (downward displacement or retraction of the tongue). As pathological indications, these relatively uncommon symptoms of suck dysfunction should be more stable throughout development.

The signs of a disorganized oral motor function within the NOMAS system are determined as difficulty in coordination of suck–swallow–breathe response accompanied by an immature mobilization interrupting the feeding process, which leads to a categorization of a disorganized oral feeding pattern (Braun MA, 1985). The indications proposed in the NOMAS system for a disorganized sucking system includes; absence of habituation (the extent to which the episode of sucking bursts is sustained), time availed for the succession of sucking outbreaks, uniformity and variability in the number of sucking shots. The behavioral signs of sloppy nutritive sucking includes; nasal flaring as an indication of respiratory distress, rotation of the head and increased

movement of the upper and lower extremities while escalated respiratory rate, abnormalities in oxygen saturation or color changes, which appears in a neonate who demonstrates irregular nutritive sucking patterns, weather breastfed or bottle fed.

In this principle, a disorganized oral motor framework which is entertained as a measurement of oral-motor maturation, or deterioration, is appraised as a criterion that indicates a pathology in oral motor development that could be a valuable marker for investigating difficulty in oral feeding within the neonates who will demand extended tube feeding (Palmer, 2002).

This screening tool is not commercially available. It is a 3-day certified course training that demands re-certification after every two years to practice the test effectively. It is a mandatory criterion for the candidates to complete their neonatal observations in the NICU and classify the sucking behavior of neonates accurately through five videotaped feedings as 'Normal', 'Disorganized', or 'Dysfunctional'. Then they receive certification and attain eligibility for the administration of NOMAS at the end of the course.

However, NOMAS is frequently used as the superior technique to evaluate an infant's feeding competency in studies that examine various therapies for infant feeding complications (Howe et al., 2008). Nevertheless, there has been some evidence to suggest that it may not be a viable or trustworthy instrument and may even be outdated in its assessment methods due to the improvement of knowledge and research relevant to infant swallowing and feeding since its conception (Howe et al., 2008).

Furthermore, the oral-motor behaviors were scrutinized according to their frequency of occurrence (Case-Smith, 1988), while the reliability of the NOMAS was inspected by using a revised scale and adding severity ratings for the disorganized and dysfunctional categories, and the number of behaviors used were marked under each category (Palmer et al., 1993). The associations between the NOMAS scores and the developmental outcomes at 12 and 24 months were analyzed to determine the predictive validity. According to the findings, a typical feeding pattern was predictive of normal development, whereas a prediction of dysfunctional feeding from the NOMAS was substantially connected with developmental delay (Palmer & Heyman, 1999). However, the standard and disorganized categories of the NOMAS between 32 and 36 weeks manifested moderate responsiveness to changes in oral motor abilities within every 2-week interval (typical response means > 0.5) (Howe et al., 2007).

Therefore, to rigorously measure the oral feeding competency in the neonatal population, clinicians should be trained and exercise multiple subjective and objective neonatal clinical feeding evaluating instruments in combination with NOMAS, such as; The Early Feeding Skills (EFS) Scale (Thoyre, Shaker, & Pridham, 2005), Infant Breastfeeding Assessment Tool (IBFAT) (Matthews, 1988), LATCH (Jensen, Wallace, & Kelsay, 1994), Mother-Baby Assessment (MBA) (Mulford, 1992), Preterm Infant Breastfeeding Behavior Scale (PIBBS) (Nyqvist, Rubertsson, E, Shrago & Bocar, 1990) and Systematic Assessment of the Infant at Breast (SAIB) (Shrago & Bocar, 1990) for more significant scientific evidence, qualitative interpretation and quantitative scoring system which is essential for assessing and providing therapeutic intervention to infants with oral feeding impediments. Overall, the authors conclude that no test had sufficient psychometric qualities; however, they noted that NOMAS has undergone greater inspection and has produced more reliable results than the other six instruments.

II. Discussion

The ability of the newborns to finish their feedings safely and at the correct rate of transition to autonomous oral feedings are the two challenges that carers must deal with while treating oral feeding issues (Lau & Smith, 2011). Due to a lack of specious outcomes and a reliable psychometric assessment measure, evaluating newborns' oral feeding capabilities has been challenging. Because of its subjective character and absence of a direct measurement of particular consequences, research has questioned the validity, efficacy and responsiveness of the Neonatal Oral Motor Assessment Scale (NOMAS).

NOMAS is considered the most convenient, precise, and user-friendly assessment tool that distinguishes oral motor patterns during non-nutritive sucking (NNS) and reflexive nutritive sucking (NS) as per the certified NOMAS experts. Moreover, it is time-effective as its application requires two minutes only (Kathleen D, 2012). It contains assessments relating to both maturational aspects (the disorganization sub-score) and pathologic indicators. In addition, NOMAS also incorporates an oral feeding experiment that integrates essential oral motor abilities (the dysfunction sub-score). Therefore, it is considered the only extensively practiced screening

instrument for assessing and anticipating feeding difficulties in newborns. It also guides judgment, particularly in the NICU for preterm infants, who are ready to be fed orally or weaned off the feeding tube. Furthermore, NOMAS is also applied to newborns needing early intervention for immediate decision-making to encourage the short-term and long-term care of preterm infants. This assists early identification of "problem feeders" and promotes the transition from tube feeding as well as physiological cues (Palmer MM, 1993).

However, it still does not predict feeding development at two years of age, as well as motor, speech, and language delays, and neurobehavioral developmental delays. Additionally, the dysfunctional category of the NOMAS needs to be sufficiently examined in most of the research. Conversely, NOMAS demands training, certification, and purchasing of the tool, which makes it costly. It also fails to identify and analyze the infant-maternal interaction and the infant's behavioral state during oral feeding as it is exclusively designed to assess biomechanical components for successful feeding (Howe et al., 2008). The instrument surveys no objective verification of actual suck-swallow-breathe dysfunction. Breastfeeding newborns are not included in the trials of the NOMAS as it causes stress when conducted on breastfed infants. Most studies do not correspond to the assessed "neonatal phase" feeding patterns as they were done on neonates who were under three days old. Therefore, studies lacking accuracy and sample size, it does not reflect the entire target population that may have limited explanatory information and generalization skills (Kim, Williamson, & Lyles, 2005).

III. Conclusion

The research findings indicate that there is still a need for empirical validation of a psychometrically sound neonatal feeding assessment tool which needs to be improved by small sample size and narrow age ranges. Although efforts have been made to identify newborns who may have oral feeding difficulties, this practice still has a problem with the accuracy of the instruments currently available for precisely identifying newborns who are likely to face subsequent complications in oral readiness. The fact that neonatal feeding assessment validity must be confirmed before they are used regularly is a long-standing issue (Riordan, Koehn, 1997 & Riordan. et al., 2005).

However, the research evidence by the 'Psychometrics of NOMAS' suggests inconsistent and inadequate reliability and validity of NOMAS and has a moderate significance in identifying oral feeding difficulties in premature infants (Kathleen Dzelme, 2012). Limited research has been administered to date to determine the efficacy of NOMAS. Furthermore, research studies and the available evidence describes that NOMAS is the only one of the seven tools that examine internal consistency and responsiveness, is crucial for quantitative measurements of item homogeneity and intends to track clinical alterations over time, which is eminent for the clinicians to explore the neonates feeding proficiency over time and to analyze the undergoing therapeutic intervention delivered to the infant.

Therefore, clinicians should be cautious when interpreting assessment results because there is limited data to support the psychometric soundness of the NOMAS when used for clinical and research purposes (Howe et al., 2008). It is suggested to implement numerous clinical oral feeding assessment supplies with objective measurements in combination with NOMAS to empirically construct and validate a comprehensive diagnostic investigation and to assign a neonate with a psychometrically defined evidence-based therapeutic intervention to encounter oral feeding problems.

IV. Future Recommendations

A summary of the specific areas where study should be concentrated in the future is provided below; (1) The foundation for content and construct validity is identifying the essential elements for successful feeding. (2) Establish predictive validity for identifying developmental and clinical changes based on pertinent criteria and responsiveness of assessment methods. (3) To strengthen the study's external validity, include sizable representative samples, particularly for infants who fall into the NOMAS 'dysfunctional' category (Howe et al., 2008 & Bingham et al., 2012).

Additionally, related research domains will assist clinical recommendations for this population: (1) Since feeding outcomes of infants discharged from neonatal intensive care are minimal, this aspect must be formally studied, and the antecedent risk factors must be considered. Long-term feeding problems contribute to nutritional problems with failure to thrive and present significant practical and emotional issues to families. (2)

The evaluation of the advantages of early interventions, which may avoid feeding issues (Hawdon et al., 2000 & Howe et al., 2007) and (3) A comprehensive instrumental tool should consider an infant's interaction with the mother, as well as a behavioral state, in addition to assessing oral-motor performance.

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