

## Relationship Between Presence of Non-Functional Chewing Units and Number of Occluding Teeth in Masticatory Efficiency in Children with Cerebral Palsy

**Bakarcic Danko, Ivancic Jokic Natasa, Sandra Hrvatin and Ana-Marija Pavletić\***

*Department of Pediatric Dentistry, School of Medicine, University of Rijeka, Clinical Hospital Centre, Kresimirova, Rijeka, Croatia*

**\*Corresponding Author:** Ana-Marija Pavletić, Department of Pediatric Dentistry, School of Medicine, University of Rijeka, Clinical Hospital Centre, Kresimirova, Rijeka, Croatia.

**Received:** July 13, 2017; **Published:** August 08, 2017

### Abstract

Aim of this study is to examine the influence of presence of non-functional chewing units and number of occluding teeth on masticatory efficiency in children with cerebral palsy.

Forty-three dentate children suffering from cerebral palsy and different levels of cognitive impairment (aged 6 - 16 years) were evaluated with regard to their masticatory efficiency using a sieving test. An evaluation of cognitive abilities was obtained by standardized psychometric tests for use on children. Children were divided in two groups, children with severe and profound mental retardation were assigned to group of children that can't develop the skill for chewing food. Children with average cognitive abilities, and moderate mental retardation were assigned to group of children that can develop the skill for chewing food. The results showed that masticatory efficiency values were lower in children from first group, compared with the children from second group. It is concluded that the mental retardation level plays one of the significant roles in performing adequate chewing efficiency.

**Keywords:** *Chewing; Cerebral Palsy; Sieving Test; Psychometric Tests*

### Introduction

Cerebral palsy (CP) is a chronic non-progressive disorder that results from an injury in the developing brain. It is the most common cause of physical and mental disability in childhood. The severity ranges from subtle motor impairment to involvement of the whole body [1,2]. The characteristic signs are spasticity, movement disorders, muscle weakness, ataxia, and rigidity. Level of physical disability varies among children affected by cerebral palsy [2]. Children with cerebral palsy (CP) may have severe difficulties in achievement of satisfactory level of oral health, due to their physical and/or mental impairment. Altered function of masticatory system, lips and tongue movements which causes the food retention and low level of self-cleaning of oral cavity, are the most common problems in feeding process. All these conditions cause long-term mushy food consumption which finally leads to increased caries development [3,4].

Manifestations of CP depend on the magnitude, extent, and location of the insult to the brain or brainstem or spinal cord [1]. Masticatory efficiency of CP patients in infancy become retarded during the period of growth and maturation of their dentition, skeletal and neuromotor systems [4].

Development of oral-motor function in children with disabilities not only lags behind intellectual development, but also follows an aberrant pathway. In particular, specific aspects of tongue and jaw function were impaired together with problems initiating and maintaining a smooth sequence of feeding actions [5].

So, the correlation between central nervous system damage in children with cerebral palsy, including cognitive abilities, and masticatory efficiency remains uncertain. This is reason for deciding on investigating the correlation between cognitive abilities and masticatory efficiency.

To investigate influence of mental condition on masticatory efficiency, in our study were included only children without any of variables which might influence masticatory efficiency except mental condition.

## **Materials and Methods**

Children with cerebral palsy were submitted to a clinical examination prior to psychometric evaluation and those children without oro-facial factors which might influence masticatory efficiency were included in the study. Thus, any children with oro-facial factors which might influence masticatory efficiency such as: orthodontic anomalies, temporomandibular disorders (TMD) and muscular disorders of chewing muscles as well as children with non-functional masticatory units (teeth with deep caries lesion and/or out of occlusion with antagonists) were excluded from the study. To exclude influence of motor disability due to cerebral palsy all children included in this study were children with cerebral palsy. Many of these children were in 'mixed dentition' and is presumed that reduced occlusal contact may influence chewing efficiency. According to Wilding occlusal contact have no influence on chewing efficiency [6].

There were 43 children with CP, 28 boys and 15 girls from six to 16 years of age. All of them suffered from quadriplegic CP. All of the children lived within their families. During the parents working hours, they are residents of day-care centres for disabled children or special schools, but there they don't receive any rehabilitation services that might influence chewing skills.

Clinical examination and psychometric tests evaluation was performed with parents and/or caregivers informed consent. The research was reviewed and approved by Ethical Committee of the University of Rijeka, Faculty of Medicine, Croatia.

Participants were separated in two groups according to the level of mental retardation (MR).

Cognitive abilities of our examinees were evaluated by implementation of standardized psychometric tests for use on children. Testing was conducted by specialized clinical psychologists for children in Department of Paediatrics of University Hospital Centre, Rijeka, Croatia. The level of mental retardation (MR) was established according to Diagnostic and statistical manual of mental disorders (DSM-IV) criteria: mild (IQ 50 - 70), moderate (IQ 35 - 50), severe (IQ 20 - 35) and profound (IQ 0 - 20) MR [7]. In the particular case there was a group of children without MR, named "average cognitive abilities". IQ score ranges and their corresponding qualitative diagnostic categories was established by classification according to Wechsler [8].

The children were assigned to one of the two main groups defined according to mental retardation level, particularly the ability to develop the skill necessary for chewing food. Group A consisted of 24 children (mean age 13,42; SD 4,096) with low ability to comprehend and develop the skill necessary for chewing food, and group B consisted of 19 children (mean age 12,26; SD 3,229) with normal ability to comprehend and develop the skill necessary for chewing food [1,2,7,9,10]. There was no statistically significant difference between groups regarding age difference. Children with severe and profound MR were assigned to group A. Children with average cognitive abilities, and mild mental retardation were assigned to group B. There were no examinees with moderate mental retardation.

For evaluation of masticatory efficiency, the size of particles masticated by children with cerebral palsy were measured.

Subjects have masticated one bolus substitute for 10 masticatory strokes. Bolus substitutes were almonds sealed in the impermeable latex envelope (thickness 0,25 mm). This envelope was used to avoid substantial loss of particles. Almond as brittle food seems to be the best choice when food comminution is evaluated [6,11]. Particles were separated by a sieve system consisted of 12 varied sieves with apertures within a range of 0.6 mm to 7.2 mm [12,13]. Furthermore, piles of sieved particles were weight by electronic scale (Ohaus -Explorer, Pine Brook, New Jersey, USA) to obtain weight value for each sieve. Weights of piles obtained in that manner were calculated as

percent of whole mass of chewed almond per sieve for each examinee [14]. To compare the quality of mastication between examinees the value of masticatory efficiency is determined by the grade of masticatory efficiency. Grade was assigned using the number of sieve through which passed 50% of whole mass of chewed bolus substitute.

Sieve with smallest aperture width (0,6 mm) is marked with number 1, and respectively the one with largest aperture width (7,2 mm) with number 12. Thus mark/grade of masticatory efficiency was within the range between 1 to 12. Smaller mark/grade number showed higher masticatory efficiency level.

**Statistical Analysis**

The statistical parameters were calculated by personal computer using statistical program SPSS ver. 10 (SPSS Inc. Chicago, USA).

The data were presented using median value and comparison of numerical data is calculated using Mann-Witney U test.

**Results**

Table 1 Comparison of grade of masticatory efficiency in children with cerebral palsy regarding possibility to develop of the skill necessary for chewing food.

Development of the skill necessary for chewing food	N	Mark/grade of masticatory efficiency	Statistics	
		Median	Z	P
Possible	19	8 (3 - 12)	92,50	0,000
Impossible	24	12 (4 - 12)		

**Table 1:** Comparison of mark/grade of masticatory efficiency in children with CP regarding possibility to develop of the skill necessary for chewing food during feeding process showed statistically significant difference between two groups ( $Z = 92,50$ ;  $P < 0,001$ ).

**Discussion**

Mental retardation level also depends on severity of CNS damage. Intra-oral food management is a major sensorimotor task [15]. Patients with cerebral palsy frequently manifest oral-ingestive problems ranging from mild to severe. Drooling, rejection of solid foods, choking, coughing and spillage during eating may contribute to these problems [10]. Furthermore, it has been established that CP patients have problems with mastication due to the altered harmony of muscular movements of various muscles in the face and jaws, just as they do with their limb movements [4,16]. According to recent scientific findings, variables responsible for masticatory efficiency are: number of functional masticatory units, orthodontic anomalies, temporomandibular disorders, muscular disorders [14], and mental condition that influence ability of performing oral - motor movements necessary for mastication [9].

In children with cerebral palsy, the role of cognitive abilities and genuine brain damage in masticatory efficiency is dubious.

To investigate influence of different level of mental development on masticatory efficiency in our investigation were included only children without any of variables responsible for masticatory efficiency except mental condition.

Our results show that examinees with greater mental impairment have statistically significant lower level of masticatory efficiency. Since there is no many investigations on this subject reported in last 10 years, only findings reported by Nakajima and Ogura [4,17] report comparison between healthy children and with children cerebral palsy but this is related to influence of cerebral palsy itself not by mental condition. Studies that can be compared to this were reported by Hennequin, *et al.* and Gisel, *et al.* but they have used as examined group children with Down syndrome (DS) and mental retardation. All this author claims that children with DS have difficulties regarding chewing and consecutively feeding process [18,19]. This is in accordance to our findings.

## **Conclusion**

- Children with cerebral palsy and cognitive abilities on the level at which they can't develop the skill necessary for chewing food had a statistically significant lower masticatory efficiency (higher grade) than children on the level at which they can develop that skill.
- This investigation statistically confirms empirically based fact that level of mental retardation plays a role in the level of masticatory efficiency.
- As a recommendation to further investigations it will be challenging to correlate the chewing performance with: presence or absence of cerebral palsy, several aspects of retardation, body size, age, sex, number of occluding teeth, degree of malocclusion, jaw muscle strength, and temporomandibular disorders. This may lead to discover and rate the influence of certain parameters on masticatory efficiency.

## **Bibliography**

1. Koman AL., *et al.* "Cerebral palsy". *The Lancet* 363.9421 (2004): 1619-1631.
2. Kuban KC and Leviton A. "Cerebral palsy". *New England Journal of Medicine* 330.24 (1994): 188-195.
3. Koch G and Poulsen S. "Pediatric dentistry - a clinical approach". Copenhagen (Denmark): Munksgaard (2001).
4. Nakajima I., *et al.* "Relationship between the values of masticatory efficiency and biting pressure in children with cerebral palsy-inter-relationship between the maximum biting pressure, chewing cycle and the value of masticatory efficiency". *Journal of Nihon University School of Dentistry* 30.3 (1988): 244-260.
5. Spender Q., *et al.* "An exploration of feeding difficulties in children with Down syndrome". *Developmental Medicine and Child Neurology* 38.8 (1996): 681-694.
6. Wilding RJ. "The association between chewing efficiency and occlusal contact area in man". *Archives of Oral Biology* 38.7 (1993): 589-596.
7. American Psychiatric Association. "Diagnostic and statistical manual of mental disorders". 4<sup>th</sup> edition, primary care. Washington, D.C: American Psychiatric Association (1995).
8. Wechsler D. "Manual for the Wechsler intelligence scale for children- third edition UK". New York, The Psychological Corporation (1992).
9. Gisel EG., *et al.* "Feeding impairments in children: diagnosis and effective intervention". *International Journal of Orofacial Myology* 24 (1998): 27-33.
10. Yilmaz S., *et al.* "Assessment of feeding performance in patients with cerebral palsy". *International Journal of Rehabilitation Research* 27.4 (2004): 325-329.
11. Paphangkorakit J., *et al.* "Chewing-side determination of three food textures". *Journal of Oral Rehabilitation* 33.1 (2006): 2-7.
12. Van der Bilta., *et al.* "A comparison between sieving and optical scanning for the determination of particle size distributions obtained by mastication in man". *Archives of Oral Biology* 38.2 (1993): 159-163.
13. Mowlana F and Heath R. "Assessment of masticatory efficiency: new methods appropriate for clinical research in dental practice". *European Journal of Prosthodontics and Restorative Dentistry* 1.3 (1993): 121-125.

14. Gaviao MB., *et al.* "Masticatory efficiency in children with primary dentition". *Pediatric Dentistry* 23.6 (2001): 499-505.
15. Kodaira Y., *et al.* "Effect of palate covering on bolus-propulsion time and its contributory factors". *Journal of Oral Rehabilitation* 33.1 (2006): 8-16.
16. Skrinjaric T., *et al.* "Palatal and dental arch morphology in Down syndrome". *Collegium Antropologicum* 28.2 (2004): 841-847.
17. Ogura T. "The masticatory ability of children with cerebral palsy". *Journal of Nihon University School of Dentistry* 58 (1984): 77-84.
18. Hennequin M., *et al.* "Chewing indicators between adults with Down syndrome and controls". *Journal of Dental Research* 84.11 (2005): 1057-1061.
19. Gisel EG., *et al.* "Chewing cycles in 4- and 5-year-old Down's syndrome children: a comparison of eating efficacy with normal". *American Journal of Occupational Therapy* 38.10 (1984): 666-670.

**Volume 13 Issue 2 August 2017**

**© All rights reserved by Ana-Marija Pavletić., *et al.***