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# PREVELANCE OF OROFACIAL DYSFUNCTION IN CEREBRAL PALSY PATIENTS AND ITS ASSOCIATION WITH ORAL HEALTH STATUS AND QUALITY OF LIFE

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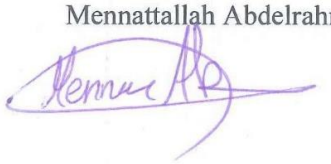

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## II. CONTENTS

## III. Abbreviations and Symbols

- **CMV**: Cytomegalovirus
- **CP**: Cerebral palsy
- **CSHCN**: children with special needs in health care
- **GA**: General anesthia
- **GERD**: Gastroesophageal reflux disease
- **GMFCS**: The Gross Motor Function Classification System
- **IVH**: Intraventricular hemorrhage
- **LBW**: low birth weight
- **MACS:** Manual ability classification system
- **MGI:** Modified Gingival Index
- **MRI**: magnetic resonance imaging
- **NOT-S**: Nordic Orofacial Test screening
- **OFD:** Orofacial dysfunction
- **OHI-S** Simplified Oral Hygiene Index
- **OHRQoL:** Oral health-related quality of life
- **POQL:** Pediatric Oral Health-Related Quality of Life
- **QOL**: Quality of life
- **WHO**: World Health Organization
- **Rh**: Rhesus factor
- **TORCH:** Toxoplasmosis, Other (syphilis, varicella-zoster, parvovirus B19), Rubella, Cytomegalovirus (CMV), and Herpes infections.
- **Ses:** socioeconomic status

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### i. Figures List

## i. Tables List

# 1. ÖZET

**Serebral palsi tanısı konmuş çocuklarda orofasiyal disfonksiyon sıklığı, oral sağlık durumu ve yaşam kalitesi ilişkisinin değerlendirilmesi**

**Öğrencinin adı**: Mennattallah Abdelrhman, **Danışmanı**: Prof.Dr. İlknur Tanboğa, Pedodonti Anabilim Dalı

**Amaç**: Serebral Palsi hastalarının orofasiyal disfonksiyon prevalansını saptamak, ağız sağlığı ve hayat kalitesi ilişkisini değerlendirmek amaçlanmaktadir.

**Gereç ve Yöntem**: Bu kesitsel çalışma Marmara Üniversitesi Tıp Fakültesi Fizik Tedavi ve Rehabilitasyon bölümünde gerçekleştirildi. 3-16 yaş arası serebral palsi tanısı konmuş 102 çocuk çalışmaya dahil edilerek; orofasiyal disfonksiyon (OFD) ve ağız ve diş sağlığı muayeneleri yapıldı. Nordic orofasiyal test taraması (NOT-S), çürük, eksik, dolgulu diş sayıs basitleştirilmiş ağız hijyeni indeksi, modifiye diş eti indeksi ve ağız hijyenine bağlı yaşam kalitesi indeksleri değerlendirildi. Çocuklarda serebral palsi tipi belirlenerek, kaba motor beceri ve manuel yetenek becerileri değerlendirildi.

**Bulgular**: OFD'nun, çalışmaya katılan serabral palsi tanısı konmuş çocukların %78,4'ünde en az bir fonksiyonda meydana geldiği ve bu disfonksiyonun kaba motor becerileri düzeyleri (GMFCS) ve manual yetenek (MACS) seviyelerinde de mevcut olduğu tespit edildi. Ortalama NOT-S değeri 3±2,36 olup, bu değerin oral hijyen indeksi değeri (0,46±0,83) ve modifiye gingival index değeri (0,72±0,81) istatiksel olaral anlamlıdır (P=0,003)(P=0,001). Çocukların %70,4'ünde çürük tespit edildi (dmft+DMFT>0). Ayrıca, diş çürüğünün şiddeti ve aile geliri, ve ağız hijyenine bağlı yaşam kalitesi indeksleri üzerinde olumsuz bir etkiye sahiptir.

**Sonuç:** OFD, serebral palsili çocuklarda yaygındır. Buyüzden ağız ve diş sağlığı için koruyucu uygulamaları sağlamak, ve yaşam kalitelerini artıracak ağız hijyeni alışkanlıklarını kazandırmak için çaba gösterilmelidir.

**Anahtar Kelimeler**: Serebral palsi, Orofasiyal işlev bozukluğu, GMFCS, Ağız sağlığı, Yaşam kalitesi

# 2. Summary

**Prevelance of orofacial dysfunction in cerebral palsy patients and its association with oral health status and quality of life**

Mennattallah Abdelrhman, Supervisor: Prof.Dr. İlknur Tanboğa, Department of Pediatric Dentistry

**Aim:** to assess the prevalence of orofacial dysfunction in Turkish children with Cerebral Palsy and evaluate its association with oral health status and quality of life.

**Material and Method**: a cross section study was conducted at Marmara University School of Medicine Department of Physical Medicine and Rehabilitation in İstanbul, Turkey. Assessment of orofacial dysfunction and oral examination for 102 child and adolescents with cerebral palsy between the age ranges 3-16 were performed. Nordic orofacial test screening (NOT-S), decay missing filling-tooth (dmft, DMFT), simplified oral hygiene index (OHI-S), modified gingival index (MGI) and the oral hygiene related quality (POQL) of life indices were charted. Children's cerebral palsy type, gross motor skill (GMFCS) and manual ability skills (MACS) were determined.

**Results**: OFD occurred in at least one NOT-S domain in 78,4% of the individuals and was present in the sub diagnoses, GMFCS levels, and MACS levels. The mean NOT-S was 3±2,36. The NOT-S scores was associated with OHI-S(P=0,001) and MGI (P=0,003). 70,4% experienced caries (dmft+DMFT>0). Also, the severity of dental caries, and family income are associated with a negative impact on OHRQoL of children with CP.

**Conclusion:** OFD is common in CP. The use of OFD screening in dental clinics would assist early detection of areas in need of further evaluation. Efforts should be made to improve preventive dental care and modifying oral hygiene behavior which will impact the quality of life of individuals with CP.

**Key Words:** Cerebral palsy, Orofacial dysfunction, GMFCS, Oral health, Quality of life.

## 3. INTRODUCTION

The Maternal and Child Health Bureau (MCHB) defines children with special needs in health care (CSHCN) as those who have or are at increased risk for a chronic physical, developmental, behavioral, or emotional condition and who also require health and related services of a type or amount beyond that required by children generally (McPherson et al., 1998).

According to estimates by World Health Organization, the percentage of those with disabilities in developed countries reaches 10% of the overall population compared to a percentage of 12% in developing countries. Applying the numbers on Turkey finds an estimated 9 million with disabilities and special needs (Baykan Z et al., 2003; Aytaç S et al., 2000)

Oral health is an integral part of general health and is, therefore, vital to the general well-being and quality of life (Petersen, 2003). Particular circumstances, however, may render oral health not quite an important part of general health, as in individuals with mental and neuromotor deficiencies. It should be noted, though, that the evidence behind this assumption is not quite strong regardless of the several studies that report individuals with disabilities having poor oral health (Hennequin et al., 2008). It is of vital importance to encourage and support cross-sectional and epidemiological studies concerning the types and prevalence of the conditions of oral health in those having neurodevelopment disabilities and others with special needs of health care amongst groups of ages ranging from infants to adolescents in the institutional and community environments. It is also of equal importance to consider observational studies of pediatric groups with special needs of health care, keep track of important health standards including oral evaluations, immunizations, and dental referrals (Mouradian et al., 2001).

Children with special care need (CSHCN) are more susceptible to dental diseases than the others. Alterations or defects, for example, in facial and skeletal structures, eruption pattern, the number and morphology of teeth, and malocclusion can all be caused by genetic, neuromuscular, or acquired disorders. However, medications required by the Children with Special Health Care Needs services program (CSHCN) can cause some

undesirable side effects, such as xerostomia, gingival enlargement, and extrinsic and intrinsic tooth discoloration. The occurrence of caries has also been shown to increase by those medications that contain sweeteners. Generally, it is agreed that the group of the pediatric population with special needs holds higher rates of periodontitis, gingivitis, and poor oral hygiene (Ohmori et al., 1981; Boraz, 1989; Mitsea et al., 2001; Ciamponi and Guare Rde, 2003).

Children with Cerebral Palsy (CP) are a very important focus from the more general group of children with special needs of health care. Only the third after autism and mental retardation, the syndrome is one of the most common major developmental disabilities. (Cooley, 2004). The syndrome is typically caused by an injury, a non-progressive brain lesion, or a deformity occurring in the first two years of life or during pregnancy, and it, therefore, manifests in a range of non-progressive sub-syndromes of motor and postural impairments. In general, the causes of this syndrome can be genetic, congenital, anoxic, inflammatory, toxic, traumatic, and metabolic. (Cooley, 2004).

The gravity and severity of CP is not limited to its particular symptoms, but is rather extended to several health problems associated with CP, including – but not limited to – neuromuscular disorders, disorders in the development of posture and movement, and disturbances to the central nervous system leading to intellectual disability, hearing and visual impairments and, in many cases, seizures (du et al., 2010). The presence of uncontrolled perioral and oral muscles also contributes to difficulties in swallowing, mastication and accumulated debris in the oral cavity. (Weddell et al., 2004).

The incidence of CP is, by estimation, 1.0 per 1,000 school children in England and 2.1 per 1,000 of the same group in Scandinavia with the rates being between 2 – 2.5 per 1,000 live births in the United States, according to Mundkur and Sankar, 2005 compared to 4.4 in every 1,000 live birth in Turkey (Mutch L et al., 1992; Hagberg B et al.,.1996; Serdaroglu A et al., 2006). Circumstantial factors, such as prematurity, low birth weight (LBW), perinatal asphyxia, kernicterus and postnatal cerebral infection, are the most responsible for the syndrome in the developing countries. (Simkiss DE,1995)

Cerebral Palsy in children and adults can contribute to a bigger chance of caries development despite the overall declining of caries prevalence because of the difficulty

these groups find in accessing dental care, their ability to detect painful stimuli, as well as their socio-economic status (Sonis et al., 1997; Freysleben et al., 2000; Santos et al., 2009). Likewise, patients suffering from CP are more likely to develop oral diseases like periodontal disease and caries as they cannot easily control plaque, consume much higher amounts of sugar from food and their prescribed medications, have abnormal and extreme tension of facial muscles and, naturally, poor control of the muscles of the lips and tongue, and have xerostomia. A dysfunction in chewing and swallowing, with noticeably long time between the intake of food and complete swallowing, is also a present symptom. Patients are also more likely to depend on the mouth in breathing in addition to having malocclusions (Rodrigues et al., 2003).

The difficulty that CP patients have in performing normal day-to-day practices leaves oral hygiene quite a critical point for them being so hard to fulfill and yet so important and necessary to maintain in the optimal state and best possible conditions. However, this doesn't change the fact that current oral hygiene status reported in these individuals is unsatisfactory and that they have increased plaque accumulation (Weddell et al., 2004).

Following the discussion of the importance of oral health to the general health and the relationship between Cerebral Palsy and major oral health problems, this study aims to analyze prevalence of orofacial dysfunction in children with Cerebral Palsy by applying Nordic Orofacial Test screening (NOT-S) and following its association with the oral health status and the quality of life of individuals in Istanbul, Turkey.

# 4. GENERAL INFORMATION

## 4.1. Background

### 4.1.1. Definition of Health

The World Health Organization (WHO) defined health as "a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity" (WHO, 1948). Another definition of health was "a positive concept emphasizing social and personal resources, as well as physical capacities" (WHO Ottawa Charter for Health Promotion, 1986).

### 4.1.2. Oral health and quality of life in special populations

To think that oral health is limited to the status of teeth is a mistake. In fact, the term "oral health" extends to include all the respiratory, sensory digestive, emotional and structural functions of the teeth, as well as oral cavity and contiguous structures that are very essential for the ideal nutrition status, along with speech, pulmonary health, social function and general well-being. Unfortunately, the accurate status of oral health in children having neurodevelopment disabilities and/or other special needs is not currently documented by any database (Horowitz et al., 2001).

Quality of Life is an integral notion to the understanding of health outcomes for patients having chronic conditions and disabilities. The evaluation of the individual's quality of life depends on the perception of one's position in life regarding one's goals, expectations and concerns all in the context of one's own culture. The involvement of medicine and health care in situations where the functions or appearance of the patient is compromised, as in repairing a cleft lip or a broken tooth to improve the patient's social adjustment, are often aimed at improving QOL. It follows that the necessity of understanding the measurements and definition of QOL makes researchers, providers and families all bound to struggle with it, especially for children from whom it's difficult to obtain informed consent (Mouradian et al., 2001).

### 4.1.3. Access to dental care for individuals with special health care needs

The families of CSHCN are particularly advised to maintain preventive visits for dental care as they can contribute to fewer unmet dental needs and a generally good long-term oral health in patients compared to cases where children do not maintain preventive visits. However, providing care for young CSHCN may not always be as easy as it sounds. Various factors, including financial strain, behavioral difficulties, oral aversions and competing for medical care needs, contribute to more difficulty in accessing dental care (Chi et al., 2014; Lewis et al., 2005; Nelson et al., 2011). A family who has a young CSHCN, is motivated to maintain dental care and financially capable, and does not have any of the mentioned barriers may still find difficulty as a dentist is not always available to see their child (Nelson et al., 2011; Cuvoet al., 2007; Norwood & Slayton, 2012).

## 4.2. Cerebral Palsy (CP)

### 4.2.1. Definition and epidemiology

At this point, we can metaphorically call cerebral palsy (CP) an ‘umbrella term’ in that it covers a set of often-changing motor disorders, though non-progressive, that occur in the early stages of life resulting from damage to the brain. The onset of this syndrome can take place either before birth, in that it is congenital, or after birth, in that it is acquired by one of the various possible reasons, and the preliminary symptoms often manifest perinatally. Despite the fact the manifestation of the syndrome differs from an individual to another and can change over time in the one patient, there is a shared area of symptoms among most patients that involves difficulties with delicate motor tasks, imbalance, involuntary movements and walking inability (Mutch et al.,1992).

Cerebral palsy was first described as a developmental disability in the 19th century by William Little. This condition presents considerable challenges in diagnosing and treating it alike and this can range from mild to severe with the number of disabilities and morbid conditions increasing along with the degree of severity. Cerebral Palsy causes considerable suffering to those individuals affected and their families, a negative influence matched by the only two more common life-long developmental disabilities; mental

retardation and autism (Bax et al., 2005). The prevalence of CP is 0.6-7 for every 1,000 live birth (Beaty & Canale, 2012).

Epidemiological studies in many countries report the rate of prevalence in Europe to be 1.51-2.2/1000 (Bialik & Givon, 2009, Baxter et al., 2007, Durkin et al., 2016), in the USA to be 1.7-2.0/1000 and in China to be 1,28-1,92/1000 (Winter et al., 2006). Unfortunately, the Republic of Turkey is short on adequate and reliable statistics about the CP patients, but it is reported that the prevalence rate of the syndrome is 2-8/1000 in the entire society of the country (Arslan et al., 2017; Aybar & Parmaksizoglu, 2012; Serdaroğlu et al., 2006). The rates of incidence of cerebral palsy have increased over time, which is believed to have been a result of the medical and technical advances that contributed to a bigger number of survivals of premature infants and low birth weight. There was also a correlation witnessed between the incidence of the syndrome and the low socioeconomic status, with no specific ethnic and racial predilection (Lee et al., 2010).

**4.2.2. Pathogenesis of cerebral palsy**

Clinical diagnosis of the syndrome finds a varying etiology that is also often unknown. Although many factors are recognized to be frequent causes of CP, such as hypoxia–ischemia, prenatal infection, prematurity and placental insufficiency, the cause of the syndrome remains quite vague in certain cases, especially when a child is born at term and/or the etiology is unclear that magnetic resonance imaging (MRI) fails to identify it. Nevertheless, the (MRI) in particular, and neuroimaging techniques in general, remains one of the best ways to identify physio-pathogenesis for all types of cerebral palsy. Epidemiological studies based on human population are the only other approach to match the same level of efficiency.

The pathogenesis of CP starts from the beginning of pregnancy and its stages are observed over two pregnancy phases, with the second starting in the $25^{th}$ week. In the first phase, cortical neurogenesis starts happening, in which neuronal precursor cells proliferate, migrate and get organized, then the same goes for neurons. At this stage, the presence of acquired impairments (viral or toxic) or genetic deficits may cause an alteration to the process of cortical neurogenesis, leading to rare malformations such as agyria-pachygyria

or lissencephaly, schizencephaly, polymicrogyria, nodular heterotopias, and cortical dysplasia.

In the second pregnancy phase, the predominant developments are events of growth and differentiation (synapse formation, myelination, and axonal and dendrite growth), stabilization processes (redundant synapse elimination, neurite regression, neural cell apoptosis) and specialization of circuitry. These developments continue after birth and keep a maximum activity until two years of the newborn's life. At this stage of brain development, CP can occur if hypoxia ischemia, among other environmental factors, is involved. These factors can have a level of severity as to cause destructive injuries detectable by standard imaging, often taking place in the white matter of infants born prematurely and in the brainstem nuclei and gray matter of full-term infants. Moreover, these factors occur at a stage where the brain is still immature and, therefore, can cause an alteration to the long series of developmental events.

It follows that CP is, in short, the result of developmental and destructive mechanisms. Brain asphyxia and insufficient supply of oxygen to the fetus were considered as the main causal factors behind later CP. Birth asphyxia and birth injury that are clinically defined, however, are the causes for a small portion of cases of CP. In addition to that, a good number of non-ischemic factors are now officially recognized as causes as a result of experimental studies on animals and epidemiological studies on humans. CP is rarely either the result of a brain deformity secondary caused by genetic deficit or the result of an acquired perinatal damage caused by an event of acute asphyxia. However, causal factors in most cases of CP do not contribute to the syndrome by acting in isolation, but rather, by being a part of a synergy that creates the disturbance. In other words, a group of predisposing prenatal factors, acute or subacute perinatal events, and aggravating postnatal factors act in synergy to harm the brain of the newborn or the fetus in its developing stage altering the maturation of the brain and leading to CP (Nelson, 2008).

### 4.2.3. Etiology and risk factors of cerebral palsy

All results of this study so far lead to the simple conclusion that we cannot attribute cerebral palsy to one single cause. It has been established that the syndrome can be either congenital or acquired. Congenital CP is present at birth. It can be caused by infections, such as toxoplasmosis or rubella, Rh incompatibility (which, ultimately, destroys neurons as a result of jaundice caused by hyperbilirubinemia), events causing severe lack of oxygen (a difficult delivery for instance), or stroke (Garnier and Berger, 1999), (Badawi and Lawson, 2003). The most common cause of congenital CP is damage to the periventricular white matter (Volpe, 2003).

Acquired CP is the result of brain damage in the first few years of a child's life. This also includes infections, such as viral encephalitis or bacterial meningitis, in addition to head injuries, such as a fall, a car accident, or injuries caused by abuse.

Predisposing prenatal factors include different environmental, genetic and epigenetic factors:

#### 4.2.3.1. Congenital abnormalities

It is consistently observed that those children who have CP have a bigger number of congenital abnormalities (gut atresias, hypospadias, cleft lip and palate …etc.) than those who don't (Pharoh, 2007).

#### 4.2.3.2. Genetic factors

They can contribute to a higher chance of having CP together with the series of events leading to the syndrome. An example of this was witnessed in some families in a national database in Sweden (Hemminki et al., 2007). Genetic factors also share the responsibility of some cases of thrombophilia leading to secondary CP and perinatal strokes (Kirton and de Veber, 2009).

It was suggested, however, that most cases of thrombophilia cause vascular thrombosis only in the involvement of another event such as bacterial or viral infection (Gibson et al., 2003).

The genetic polymorphisms contained in gene-encoding proteins of vascular endothelium or coagulation or inflammation of the placenta are partially responsible for cerebral palsy in some cases (Nelson, 2008).

#### 4.2.3.3. Infections

The congenital infections known together as TORCH are all responsible for brain damage throughout pregnancy with Cytomegalovirus (CMV) being the most frequent one. The others are: Herpes simplex virus, Toxoplasma,

Rubella, and other (varicellazoster, syphilis, parvovirusB19). Arenavirus, lymphocytic choriomeningitis virus and congenital enterovirus infections are exceptional. In addition to that, it was shown that cerebral palsy, along with preterm delivery, can be partially attributed to the perinatal exposure of the fetus or the newborn to neurotropic viruses and that hypertensive pregnancy disorders can also be partially attributed to the exposure of the fetus to an array of viruses. (Gibson et al., 2003)

#### 4.2.3.4. Toxic factors

Alcohol is a major frequent toxic factor that can lead to maldevelopment of the brain throughout the whole period of pregnancy and, when the malformation is severe as in lissencephaly, it can later lead to CP. (Guerri, 2002). In studies conducted on animals, researchers observed that alcohol aggravates damage caused by an acute excitotoxic or ischemic event (Adde-Michel et al., 2005). On the other hand, it seems that maternal drug abuse of other types, such as cocaine, does not contribute to CP as much as it was previously thought it does (Bauer et al., 2005). A growing number of drugs the mother takes during pregnancy, including valproic acid and others, appear to interfere with the transport of monocarboxylic acids, brain energy, and lipid and carbohydrate metabolisms. This interference may not lead to a transitory alteration but can result in a permanent impairment in the neuronal function in the fetus and may contribute to neurological disease afterbirth, including cerebral palsy (Bolanos and Medina, 1997).

#### 4.2.3.5. Multiple gestation

It has been observed that two main factors are responsible for the higher risk of the syndrome in this population: The significant number of premature deliveries and the deaths of co-twins, whatever the sex of any of the co-twins is. However, identical twins have a strong connection with one another that one of two scenarios occur if one twin dies, either the survivor’s vascular collapses or the dead twin’s circulation causes an embolism that, in

turn, leads to encephalomalacia or porencephaly together with secondary CP in the survivor (Scher et al., 2002).

#### 4.2.3.6. Vascular disease of pregnancy

Several epidemiological studies presented a demonstration that intrauterine growth restriction and preeclampsia are associated with neonatal encephalopathy and subsequent CP in full-term newborns (Badawi et al., 1998).

#### 4.2.3.7. Preterm birth

Depriving the fetus of his natural environment for the final few weeks of gestation can cause alterations to the brain's development (Livinec et al., 2005). It is worth mentioning that some placental or maternal factors in animal models, like vasointestinal peptide, demonstrated a behavior where they stimulate the development of the neural axis of the fetus by acting early on them (Gressens et al., 1993).

#### 4.2.3.8. Post-term birth

The additional time the fetus spends in the uterus beyond the maximum expected period of pregnancy causes placental involution, which increases the brain’s sensitivity to damage (Badawi et al., 1998).

#### 4.2.3.9. Sex

It was recently established that the gender of an individual can act as an independent factor that influences the pathogenesis of developmental injuries of the brain. It was shown, then, that cerebral palsy occurs more in males than it does in females. Regarding the gray matter and white matter in the brain, these areas were affected according to the timing of birth, as follows; The white matter was significantly less in males who were born prematurely than it was in full-term males, while female groups witnessed no difference whatsoever in white matter. The comparison was reversed in gray matter in that it was less in females who had suffered from intraventricular hemorrhage (IVH) than those females who didn’t, but the gray matter was the same in males whether or not they had suffered from IVH (Hagberg and Johnston, 2007).

#### 4.2.3.10. Maternal factors

It has been found that maternal thyroid disease is attributed to cerebral palsy and neonatal encephalopathy in full-term newborns in addition to other factors, such as diabetes or lengthy maternal menstrual period (Nelson, 2008).

#### 4.2.3.11. Acute perinatal events

Birth asphyxia is a serious event that can lead to severe consequences as it causes spastic diplegia in infants who were born extremely early and mental retardation along with quadriparetic CP for those born after 34 weeks' gestation period.

According to the American Academy of Pediatrics and the American College of Obstetricians and Gynecologists, intrapartum hypoxia can be seen as partially responsible for neonatal encephalopathy and later cerebral palsy in full-term infants, but only by specific criteria, and it goes as follows:

a. The umbilical arterial has to have a pH of 7 the child has neonatal encephalopathy of a mild to severe degree; c. The child suffers from later dyskinetic or quadriparetic CP; and d. No other causes are present whatsoever (Strijbis et al., 2006). It is quite seldom, however, to have an intrapartum event preceding CP. A study on the subject in the English language found that CP associated with an event occurring during childbirth forms only 14.5% of all CP cases (Graham et al., 2008).

Urinary tract infection, maternal fever resulting from chorioamnionitis, or inflammation are now confirmed to be acute or subacute factors that are often partially responsible for CP risk and for neonatal encephalopathy upon giving birth in many studies concerning preterm, near-term, or full-term newborns (Bax et al., 2006; Wu et al., 2003; Grether and Nelson,1997). Chorioamnionitis was also found to be partially responsible for spastic quadriplegia in 38% of full-term infants with CP on whom a study was conducted, with viral and genetic pathogenic causes were taken out of consideration (Wu et al., 2003). An association between hypoxicischemic insults and perinatal infections was also observed in many studies. Inflammation/Infection can lead to grave consequences as it may induce hypoxicischemic insults to the brain and turn a subthreshold insult into a seriously damaging event. However, the proposition that reduced blood flow in infection is the

responsible for brain damage was not supported by a study conucted in animals (Girard et al., 2009; Duncan et al., 2002).

**4.2.3.12. Postnatal additional factors**

These factors are mostly seen in preterm newborns whose brains after birth are subject to early influences different from the influences of the materno-placental unit. Many of these factors can have a dramatic alteration on the development of the brain, such as nutrition and extrauterine growth retardation, drugs, enterocolitis, or nosocomial infections, stress and separation of mother/baby.

The Newborn Individualized Developmental Care and Assessment Program (NIDCAP), which is particularly concerned about parent and child stress, Is quite beneficial in the short term in that it encourages the mother to leave the hospital in the soonest time possible (Als et al., 2003). The early use of glucocorticoids after birth in pre-term newborns, postnatal infections, as well as enterocolitis have each been proven to be associated injury in the white matter and later CP (Halliday et al., 2009; Shah et al., 2008; Glass et al., 2008).

**4.2.3.13. Socioeconomic status**

There is some inconsistent evidence in the literature of the subject concerning the socioeconomic differences in the families whose children develop cerebral palsy, but a clear relationship between socioeconomic indicators and CP is suggested by most recent studies. A Swedish study shows a linear relationship between the occurrence of CP and the socioeconomic status (SES) of the household of the mother, which is after excluding head injuries, brain malformations, and chromosomal aberrations. Low SES versus high SES adjusted odds ratio 1.36. (Thorngren-Jerneck and Hjern, 2008). Finally, a considerable number of children having CP was observed not to have experienced any of the causal factors that the previous study had excluded while observing the mentioned relationship

### 4.2.4. Classification of Cerebral Palsy

The cerebral lesions do not actually form a basis for CP classification, but rather, the tonus changes, the number of affected extremities, and the type of movement disorder are, together, what the classification is based on. This anatomic and clinical classification is mainly used by therapists. Seeing how clinical symptoms associated with cerebral palsy can vary greatly in each patient, it was not practically possible to assign every patient to a specific table. Moreover, different motor activity patterns are exhibited by many patients that it's difficult to fit these patterns completely in any single category. It follows that an individualized and customized attitude is needed for every patient. (Lusardi & Bower, 2012).

The topographic classification of cerebral palsy is monoplegia, diplegia, hemiplegia and quadriplegia; triplegia and monoplegia are relatively uncommon. There is a significant overlap of the damaged areas. Most studies showed that diplegia is the most common form of CP, with a proportion ranging from 30% to 40%, followed by hemiplegia, 20% to 30%, and, as the least common, quadriplegia accounts for 10% - 15%. After analyzing 1000 cases of cerebral palsy from India, it was found that diplegia constituted 22% of case, preceded by a proportion of 61% in spastic quadriplegia.

### 4.2.4. Classifications of cerebral palsy

#### 4.2.4.1. Spastic cerebral palsy

The most prevalent form of the syndrome as it covers a proportion of 70%–80% of all cases. The muscles affected by the syndrome are contracted and stiff. Based on the affected limbs, spastic cerebral palsy can often include three different subtypes:

(a) **Spastic diplegia**: describes the case where spastic cerebral palsy manifests mainly in the patient's legs and the severity is relatively low in his face and arms. Upon the influence applied on the legs, the spasticity here leads to a spasm of the adductor muscles in the thigh, which leads to the legs getting turned in and crossed at the knees. This peculiar positioning of the legs gives patients with spastic diplegia the look of a "scissors gait" as they walk. The language and the intelligence of the patient are unimpaired in most cases. This subtype of spastic cerebral palsy is also called Little's Disease (Rapin, 2000).

**(**b) **Spastic hemiplegia** describes the case where spastic cerebral palsy affects all of the limbs, but on only one side of the body. We may think of it as a "vertical" version of spastic diplegia. However, the severity of CP is not the same in all affected limbs, as the syndrome usually manifests more heavily in the arm than it does in the leg. The presence of the hemiplegia is often observed only after the child tries to hold objects. The side of the body that remains unaffected displays noticeable handedness compared to noticeable failure of usage displayed by the affected side. Although this subtype of the syndrome does not affect the ability of speech, the child may still experience slow and delayed development. Some neuropsychological variations propose that whether or not intelligence is affected depends on whether the legion is on the right or left side of the brain. What is generally established, however, is that spastic hemiplegia does not always affect intelligence (Rapin, 2000).

(c) **Spastic quadriplegia** describes the case where the severity of spastic cerebral palsy is the highest as it affects the four limbs altogether. Children affected with this subtype of the syndrome are unable to walk in most cases and suffer from mental deficiencies of moderate to high severity (Rapin, 2000).

**4.2.4.2. Dyskinetic cerebral palsy**

The second most prevalent form of the syndrome and it covers only 10%–20% of all cases.This subtype of the syndrome manifests in abnormal movements such as dystonia and athetosis resulting from lesions in the basal ganglia. This abnormal movement can extend to all extremities in addition to the face and tongue. This form of cerebral palsy is usually preceded by severe anoxia and neonatal hyperbilirubinemia (Rapin, 2000).

**4.2.4.3. Ataxic cerebral palsy**

A quite rare form of cerebral palsy and it covers as little as 5%–10% of all cases. This subtype of the syndrome manifests in severe ataxia and poor coordination in the trunk and gait and it is a direct result of developmental abnormalities occurring in the cerebellum or in the pathways associated with it (Rapin, 2000).

**4.2.4.4. Mixed cerebral palsy**

This special case of cerebral palsy is a combination of spastic, dyskinetic, and ataxic subtypes of the syndrome (Rapin, 2000). It was classified as a separate subtype to include

those patients whose symptoms can not fit any of the other subtypes. This classification covers 5%–10% of all cases of the syndrome.

### 4.2.5. The Gross Motor Function Classification System (GMFCS)

In 1997, (Palisano et al., 1997) published a hallmark paper in which he came up with a new system to classify gross motor function for children having cerebral palsy, which was eventually recognized as "the gross motor function classification system (GMFCS)." This system categorizes gross motor function by an ordinal scale of five points corresponding five age groups and a description of skills for each. The groups are divided as follows: less than 2, 2 – 4, 4 – 6, 6 – 12, and 12 – 18 years.

The World Health Organization (WHO) developed the international classification of functioning, disability and health, which was recognized shortly as (ICF), and was given the recognition and endorsement of the World Health Assembly in May 2001. This classification treats the level of functioning in a person as a concept of dynamic interaction between their health conditions, personal and environmental factors.

According to the international classification, only a dysfunction at any of the levels listed below qualifies as a disability:

- Impairment of functions (psychological or physiologic) or body structure (limbs or organs)
- Limitations in activities (the failure of an individual to execute simple actions or tasks) and restriction of participation (involvement in life situations).

### 4.2.6. Other disorders accompanying cerebral palsy

Three out of every four people having cerebral palsy are likely to have other disabilities along with CP, such as seizures, retardation, communication disorders, or visual and auditory impairments (UCP, 1998, 2005). Seizures, for example, are found in around 25 – 35% of children with CP and with much higher numbers in those with spastic CP. Retardation is even more common as it is found in around 50 to 60% of children with CP. However, it has been difficult to diagnose mental retardation because intelligence tests were customized so that they are taken by children with sufficient language, speech, and motor abilities. Strabismus also occurs in around 30 – 34% of individuals having cerebral palsy. Damages to the sight can also be associated with cerebral palsy as nearsightedness

occurs in those with spastic CP and farsightedness in those with athetotic CP. In addition to that, a reduction in the visual field can also be associated with some types of CP (Capute, 1978). When it comes to speech and language, the abilities of cerebral-palsied persons can be anywhere between normal speech and reception processing and expression to the lack of ability in any of those.

Speech problems in individuals with CP have been characterized according to the two main types of the syndrome, by Berry and Eisenson (1956), as follows:

a. spastic speech, manifesting in breathy or guttural quality of voice, lack of vocal inflection, uncontrolled volume, slow, labored rate, and, most importantly, serious articulatory problems that manifest in failure to maintain simultaneous movement of the lips, tongue and jaw.

b. athetoid speech, manifesting in a pattern of noisy, shallow, and irregular breathing in varying gradations; hoarse or whispered phonation, and articulatory problems that range from a slight awkwardness in lingual movement to impaired articulation manifesting in the extremes of complete mutism of extreme dysarthria.

Speech disorders are among the most common of associated disorders with CP and are found in 70% of children with cerebral palsy. Moreover, reports show that speech defects are present in 52% of those with spastic cerebral palsy, 85% of individuals with ataxia, and 88% of those with athetosis. Naturally, speech problems are mostly due to difficulties to control the muscles involved in making the speech sounds.

### 4.2.7. Orofacial dysfunction

#### 4.2.7.1. Definition and prevalence of orofacial dysfunction

Cerebral palsy can be defined as a group of neuro-developmental processes which are marked by motor disorders, whereby orofacial functions like talking, controlling saliva and eating are mostly affected (Novak et al., 2012). Impaired eating is related to the poor growth (Brooks et al., 2011; Dahlseng et al., 2012), and the problems associated with swallowing and chewing may pose threats to respiration (Reid et al., 2012; Westbom et al., 2011). It is worth noting that common causes of mortality in young CP individuals are

known to be secondary respiratory diseases (Reid et al., 2012; Westbom et al., 2011). Therefore, dysfunction in tongue, face, throat and palate, generically termed as orofacial dysfunction (OFD), has a strong effect on health of CP individuals. (De Jersey,1975).

High prevalence in OFD has been reported in population-based studies of children who have Cerebral Palsy. For example, 39% to 85% of the children with CP have difficulties with eating (Reid et al., 2012; Benfer et al., 2013) 53% to 59% have problems in talking (Dahlseng et al., 2012; Nordberg et al., 2013; Reid et al., 2012) and 22% to 40% have difficulties with controlling saliva (Reid et al., 2012; Parkes et al., 2010) At all stages of gross motor function, difficulties related to eating, talking and controlling saliva are present in children with Cerebral Palsy (Benfer et al., 2013; Parkes et al., 2010; Dahlseng et al., 2012) and difficulties associated with eating are present across all stages of manual ability. (Benfer et al., 2013) The OFD prevalence increases with the decrease of manual ability and gross motor function. (Benfer et al., 2013; Parkes et al., 2010; Dahlseng et al., 2012).

Contrary to the occurrence of difficulties in controlling saliva, talking and eating, the occurrence of other OFD aspects, like difficulties in facial expressions, oral sensory functions or breathing are not well known in children who have CP. This broader range of orofacial dysfunction aspects is assessed customarily in CP with separate tests in order to describe the OFD aspects' presence. NOT-S (Nordic Orofacial Test-Screening) has been developed for evaluating a broad number of orofacial dysfunction aspects (Bakke et al.,2007) A mutual language is established by NOT-S in multi-professional setting which is needed in diagnostics of OFD aspects in research and clinically for individuals at the age of 3 and older that includes adults, regardless of diagnosis(Bakke et al.,2007). According to the recent review of conducted studies using NOT-S in order to identify the occurrence of OFD aspects in various diagnoses, no diagnosis-specific studies have included subjects with CP (Bergendal et al., 2014).

**4.2.7.2. Orofacial dysfunction effect**

Orofacial function comprises of significant actions such as swallowing, breathing and chewing, and muscle posture such as tongue and mouth posture (Grabowski et al., 2007) .Thus, lays the foundation of social interaction with regard to emotional communication, speech, appearance and facial expression. (Bakke et al., 2007) Orofacial

dysfunctions (OFD) may compromise OHRQoL and well-being from childhood. And there has been an evidence of the significance of understanding the individual and the surrounding factors which effect the relationship between health/ QoL and orofacial function. Children get affected by various orofacial and oral disorders such as dental caries, cleft lip, malocclusion and palate, and all of the afore-mentioned disorders have the potential to affect the functioning, OHRQoL and well-being of the individuals.

### 4.3. Dental manifestations of cerebral palsy

#### 4.3.1. Malocclusion

It has been reported that malocclusion has a prevalence rate between 59 and 92% of cerebral palsy cases, with most cases of malocclusion categorized as Angles Class II, along with increased overbite and overjet. An increased severity of malocclusion is associated with many risk factors; the main of which are mouth breathing, a long face, lip incompetence and cerebral palsy. Also, their chance to develop anterior open bite is three times bigger. It was found that the older the patient; the less likely they are to have open bite. In contrast, the occurrence of open bite increases in spastic patients. The high rates of occurrence of anterior open bite and Class II malocclusion can be a result of hypotonia in the orofacial muscles, which results in forward tongue posture, frequent mouth breathing, and a weak swallow reflex. (Rosenbaum et al.,1966; Miamoto et al.,2010).

#### 4.3.2. Traumatic Dental Injuries

Class II malocclusion is also highly prevalent in individuals with CP, with difficulty in ambulation, incompetent lips, prominent maxillary incisors, and increased occurrence of seizures. The presence of all these symptoms together predisposes the individual affected to dental trauma. According to (Holan et al., 2005) the occurrence of dental trauma was found to be greatly increased in CP population with a rate of 57%, but other studies report a much lower rate of 9.2 – 20% Resulting injuries were, most commonly, fracture of dentine and enamel. Traumatic dental injuries were suggested by some studies to have a similar prevalence in persons with CP who are also maintaining a rehabilitation treatment

as that in individuals with no disabilities, who, naturally, had less treatment. (Holan et al., 2005; Al-Banji et al., 2009).

### 4.3.3. Bruxism

Individuals with CP are generally likely to experience a continual grinding of teeth known as bruxism. Flat biting surfaces and tooth abrasion are possible results of bruxism in extreme cases. Several articles have indeed reported a high rate of occurrence of bruxism in CP-affected individuals. Bruxism was also found to be associated with other habits like finger-sucking, pacifier-sucking, the habits of tongue interposition and biting objects (Ortega et al., 2007). Minear WL proposed that it's not local factors, like malocclusion, that regulate bruxism habits in this population, but rather, it's problems with the functioning of dopamine that have the direct effect. Abnormal dental wear was also shown to be more closely attributed to a poor mental development and less so to the level of severity of cerebral palsy. The lack of proprioception in the periodontium is regarded as one of the possible causes of bruxism. (Lindqvist et al., 1974; Ortega el al., 2007; Jan, 2000).

### 4.3.4. Dental Caries

Generally, dental caries development is attributed to many factors including cultural, economic, biological, social and environmental factors. Cerebral palsy increases the risk to develop dental caries, negatively influencing the patients' quality of life. The risk is even greater in the presence of a neurological insult of higher severity. The developing of dental caries becomes more likely with a higher degree of motor and cognitive deficits, and vice versa. Cognitive deficits lead to more difficulty in maintaining efficient oral care and severe motor incoordination restricts the ability to achieve satisfactory oral hygiene (Beck et al., 2014; Cardoso et al., 2014). It is important for this population to have rehabilitation, the intervention of experts and prevention of possible complications at an early stage. (Santos et al., 2009; Dourado et al., 2013; Subasi et al., 2007)

### 4.3.5. Periodontal disease

It was shown by several studies that cerebral palsy in children increases the frequency at which gingival hyperplasia occurs, along with associated bleeding. The relationship between CP and this increase in frequency can be attributed to the same factors

that predispose to dental caries, leading then to biofilm buildup. Specifically, these factors mainly include intraoral sensitivity, difficulties in performing oral hygiene routine, as well as orofacial motor dysfunction. In addition to that, using antiepileptic drugs, phenytoin in particular, is also an important contributing factor. Gingival hyperplasia is the predictive of periodontal diseases. It is more likely to occur in children having spastic quadriplegic cerebral palsy, especially at an advanced age. Periodontal disease can also occur in children with choreoathetoid CP as it involves moving the head continuously and uncontrollably, which makes oral hygiene practices more difficult to fulfill. (Graham et al., 2004; Gunel et al., 2009; Jan, 2005).

#### 4.3.6. Sialorrhea

It appears that drooling of saliva is the direct result of a failure in the mechanism of swallowing, which leads to the saliva being excessively pooled in the frontal part of the mouth and, subsequently, uncontrollably lost and emerged from the mouth. This drooling of saliva can very negatively influence the physical health of the patients and their quality of life, particularly in those patients having chronic neurological disabilities. It is reported that sialorrhea in children with cerebral palsy has prevalence rates of 10–58%. (Toder, 2000; Ohito et al., 1992).

#### 4.3.7. Oral Hygiene

Naturally, poor oral hygiene contributes to a worse status of oral health in CP-affected individuals. (Santos MT et al., 2003) reached the conclusion that the severity of neurological damage is directly proportional to the frequency at which the biting reflex is present, which is, in turn, directly proportional to the chance of having oral diseases as the biting reflex makes it difficult to achieve effective oral hygiene (Santos MT et al., 2003).

#### 4.3.8. Dental Erosion

Erosion of teeth is what happens when a patient continuously loses hard dental tissues as a negative effect of a chemical (nonbacterial) process. Dental erosion seen in as much as 55% of patients is most commonly attributed to gastroesophageal reflux disease. A study showed that in a group of children having reflux on a non-stopping esophageal pH monitoring, 75% of them were found to have moderate to severe erosion. Another study showed that of those cerebral palsy patients who had dental erosions, 73% have had GERD

in the past, and it was concluded that individuals with cerebral palsy who are experiencing early signs of GERD are also likely to develop dental erosions. The first sign of GERD is thought to be enamel erosion influencing the posterior dentition. The posterior dentition, however, is not the only affected area, as erosions affect the upper incisors, upper molars, and lower molars that is in both permanent and primary teeth. Recurrent chest infections and swallowing difficulties have also been associated with developing dental erosion in a different study. Additionally, frequent chemical exposure can slowly result in extending these erosions. (Goncalves el al., 2008; Shaw et al., 1998).

It is highly important to treat GERD early and effectıvely to prevent irreparable dental damage. In order to avoid permanent damage, it is generally necessary to maintain preventive procedures, identify symptoms at an early stage, and intervene for treatment at the proper time. (Vakil et al., 2006).

**4.3.9. Enamel Defects**

The majority of enamel defects was located in the first molars and primary incisors in a symmetrical manner. The proportion of preterm newborns in children having enamel defects was approximately 42.4%, which shows a clear correlation between the two conditions. A conclusion was reached that children with cerebral palsy had a high rate of occurrence of developmental enamel defects. However, this rate was dependent on tooth type and was associated with the period of gestation of the children. (Lin et al., 2011)

**4.3.10. TMJ Disorders**

Male gender, the presence of cerebral palsy, mixed dentition, severe malocclusion, and mouth breathing were determined to be harbingers of symptoms and signs of temporomandibular disorders. It follows that children with cerebral palsy have a remarkably greater chance to develop symptoms and signs of temporomandibular disorders. (Miamoto et al., 2011).

### 4.4. Dental Management

#### 4.4.1. Dental Access

There are some common minimal requirements that are needed to have dental access. In the dental chamber where the area of floor circulation is small, the aisle passage which is situated in operatory area ought to be designed according to the dimensions. When seeing the aforementioned children who come over for dental treatment or examination, the dentist has to keep the problems that can arise regarding adjustment of the approach in his mind (Mc Donald,2011). Those problems are as follows:

1) Apprehension: Most of these infants are not accustomed to see strangers.

2) Communication difficulty: Chairside communication has to be modified properly in case an auditory, speech or visual defect occurs.

3) Low intelligence level: This may contribute in coping with the difficulty faced in cooperation.

4) Poor concentration: This might be an inherent factor of cerebral dysfunction and insignificant things may lead to distraction of attention.

5) Convulsions: Convulsions are not very common in dental surgery due to the reason that the child will be getting medications in order to control episodes like these.

6) Posture: Ataxic patients must have the chair balanced well to acquire the required support and stability, while the athetoid and spastic patients may require further manual control and support in the dental chair.

7) Cooperation ability: If the patient is able to sit in the dental chair and open wide his/her mouth, then he/she can receive a treatment as a normal patient. A further help or support is needed for the children who have less physical control. However, in some children, relaxation and confidence may overcome this problem ( Parkin et al., 1970).

First ever dental visit: The dentist may establish a very good relationship with the patient by giving the appointment at an earlier time of the day and spending sufficient time to have a conversation with parents/guardian and the patient prior to initiating any type of dental

care. (Mc Donald,2011). The first visit has to be primarily used by the dentist to get acquainted with the patient and for establishing the mutual confidence (Parkin et al., 1970). Radiographic examination: In order to take the films, assistance from the dental auxiliaries and parents, and the aid of immobilization devices can be necessary, occasionally. Once a hole is made in the tab, a floss of 46 cm (18") length is attached through it, to make it easier for the dentist to retrieve the film in case the film falls towards pharynx (Parkin et al., 1970).

**4.4.2. Positioning of patient**

The chair has to be adjusted with great care and most of the patients are treated best by keeping the dental chair tipped back well to attain a secure position, especially for the patients with ataxia. The spastic patients, who have fairly severe neck and head involvement, need more support and control, and they may be positioned on the knees of an assistant or the parent, keeping him/her intact with right shoulder (Parkin et al., 1970). The techniques through which postural maintenance and assistive stabilization can be achieved are as follows: (Santos et al., 2007)

1) The head position should be maintained in midline with the help of a dental staff and a head support, which is a positioning device, should be placed at occipital level.

2) Juxtaposed and bent upper members should be sustained in the midline, using Velcro straps.

3) Bent lower members which decrease the angle of hip to 120º should be maintained relatively with the trunk which uses soft foam rolls to make them function as the positioning devices, i.e. for under-knee support.

4) Mouth props should be used to maintain an open mouth. In spastic patient, muscle spasms may be precipitated by sudden actions, therefore, the recommended action ought to be made clear to the patient and he/she should be persuaded to relax first. Then, the dentist should open the mouth with rather a slow pressure, and it should take no time for the fingers to be allowed to fit between the teeth of the patient to avoid clenching. The dentist may use a finger guard and a simple finger guard is one with steel thimble having a chain or a cord that passes through a hole, which is drilled close to the edge for preventing the loss inside the mouth. Steel mirror should be used because it does not shatter.

Furthermore, while using sharp instruments, the dentist must handle them with delicacy to prevent any type of harm to the soft tissues (Parkin et al., 1970).

For maintenance, the mouth prop is generally important, and it must be placed firmly and not left inside the mouth for any time as the muscle of the child gets tired quickly and rest periods are needed frequently. Local anesthesia can be used provided it is given safely. As the patient may not rinse adequately during the treatment, suction device of some type and a water spray are essential. A tongue retractor may be of great importance. While placing the filling, keeping the field dry may be difficult, but this can be assisted with the use of a clamp to keep cotton-wool rolls intact, and its advantages include being removed and placed quickly. It must be used along with a mouth prop only.

Apparatus, either prosthetic or orthodontic, are recommended only in the cases with sight disability or in the case where there is no breakage danger and it ought to be robust. The preferred treatment plan has to be within the toleration limits of the patient and has to be simple as well. .( Parkin et al., 1970)

**4.4.3. Oral health practice at home**

Home dental care ought to begin at a very young age (infancy); cleansing the incisors daily using infant toothbrush or a soft cloth should be taught to the parents by the dentist. For the children who are older and unable or unwilling to cooperate physically, the dentist has to teach the guardian or parent the proper techniques of tooth brushing that may restrain the child safely when needed. Some positions that are mostly used for infants who require assistance in oral care are following:

1) The sitting or standing child is put in the lap of the adult and the adult may cradle the head of the child using one hand and brush the teeth using the other hand.

2) The child leans on a bed or a sofa with his/her head angled backward so that it may be placed on parent's lap. The head of the child is stabilized using one hand, and the teeth is brushed using the other hand.

3) The parents sit in such a position that they face each other, and their knees are touching. The buttocks of the child are placed on the lap of the parent, and the child faces that parent, while the shoulders and the head of the child lie on the knees of other parent; this lets the parent (first one) brush the teeth properly.

4) The patient, who is extremely difficult, is isolated in rather an open area and is reclined in lap of the brusher. The patient is kept immobilized with the help of an extra person while the brusher applies a proper oral care. If the patient cannot be sufficiently immobilized with one person, then in that case both parents and the siblings perhaps may be asked to assist in completion of the dental care processes at home.

5) The resistive and standing child is put right in front of caregiver and in this way the caregiver can use his or her legs to wrap the child so that the torso may be supported. Doing this he/she may use the hands to balance the head properly and also brush the teeth (Parkin et al., 1970).

The method, which is often suggested, is horizontal scrub method, because this technique is very easy to perform and also can yield fine results. Electric toothbrushes are also used efficiently by children who have disabilities (Parkin et al., 1970). Besides the head control, there is another obstacle while performing oral cleansing and dental care, called hand interference (patient holds the dental provider's or caregiver's hands). Stabilizing the patient's elbows may aid in oral cleansing, provide safety and security for the caregiver and as well as the patient, and enable the personnel to limit the movement of the child (Ferguson et al., 2009).

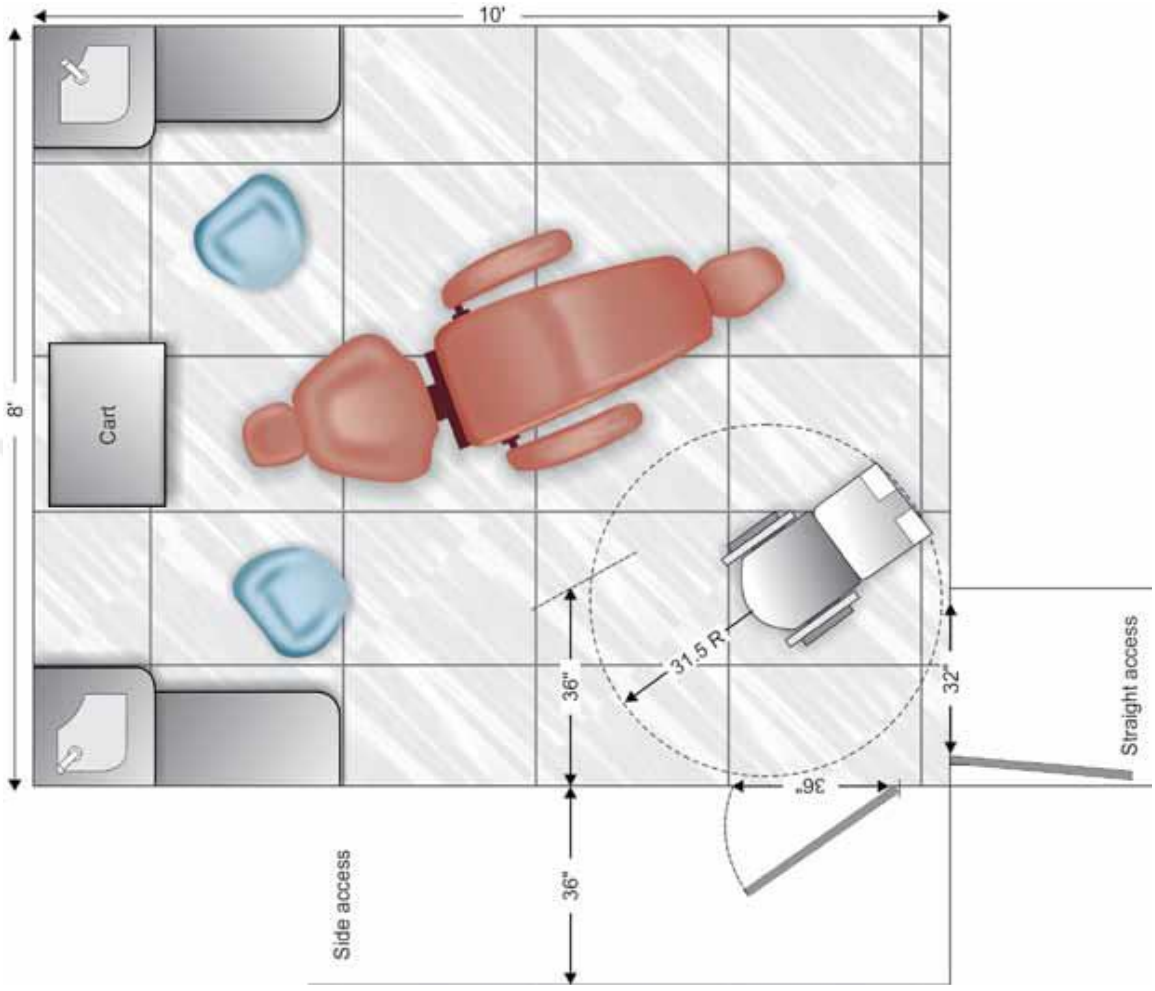



**Fig.1.** An accessible dental operatory floor plan designed for either a straight or side access doorway

### 4.5. Anesthetic procedure in CP (cerebral palsy) patients

Children having Cerebral Palsy, undergo surgery due to a vast number of reasons which range from medical interventions to surgical conditions. These types of procedures are applied to a larger number of patients and are known to help improve the ease of care and mobility in agreement with broader the aims to manage the infants who have CP (Wongprasartsuk et al., 2002).

Medical Record: It is necessary to have a precise medical record of the patient. Before performing any kind of therapeutic procedures, pre-existing medical conditions have to be evaluated.

Dental Record: The dental record of the patient is obtained from the parents or guardians who bring the patient up. In order to give the surgeon an idea of how to handle the patient, answers to the questions like what had been done and how was it done (with general anesthesia/sedation or without it) in the past, are very helpful (Solomowitz et al.,2009).

Dental care criteria for patients under anesthesia: The level of assessing the patients, who are with special needs, should be the same as regular patients. Particular documentation regarding non-restorable tooth, impactions, caries and significant calculus helps in time planning of scheduled care during general anesthesia (Voytus, 2009).

Consent: The consent forms concerning sedation may be given to the person who accompanies the patient or may be sent directly via mail to the parent in case the parent or legal guardian are absent on that particular day.

Points that ought to be noted are as follows: What will be the scope of the dentistry which is to be performed? Will the treatment plan of patient be finalized within three visits of 2-hour sedation sessions or will the treatment last longer? Will the patient be manageable and if so to what extent? Will the patient be cooperative to get into chair on his/her own by gentle urging or using a papoose board by the staff, or will the patient be combative and cause physical danger for the staff, you or himself/herself? What will be the physical and medical condition of the subject? Will the patient be obese, and will he/she be able to get into the papoose board? Will the patient be ASA III and not be a subject for IV sedation? (Solomowitz et al.,2009)

Treatment Day: The date of sedation is announced to the legal guardians beforehand and they are requested to be on phone call that morning. Topics related to informed consent and proposed procedures along with other options are discussed.

Intravenous (i.v) medications: Drugs to be used should be suitable for comfort level of practitioner and should match with the procedure being performed, from the perspective of dental treatment and as well as time. Narcotics, benzodiazepines, adjunct drugs like antisialagogue and propofol are some common drug categories that are used for sedation. (Solomowitz et al.,2009)

Conscious sedation: There are some other medications which aid in sedation of the patients such as oxygen given with the help of nasal mask and nitrous oxide. Without IV

medications, the patients with profound and severe mental disability will not in any case tolerate the nasal mask which has to be placed on their faces. The patients with mild to moderate scale of disability may allow the staff to place the nasal mask most of the time, only if it is practically demonstrated and the function is explained properly. If the patient tolerates nasal mask first, oxygen and nitrous oxide may be used to alleviate any anxiety and fear related to the administration of IV catheter. Oxygen raises the saturation of oxygen in the blood which is one of the important signs observed by pulse oximetry which in turn decreases the occurrence of hypoxia.

A significant decrease in motilities was found by Jensen TM, when nitrous oxide (30% pure oxygen, 70% nitrous oxide) was administered to the patient.

Radiographs: Rinn X-ray system (Dentsply Rinn, Elgin, Illinois) is an easy method to take the radiographs when needed. The radiograph is properly put in the mouth of the patient. The tape which is used for securing IV is put right in the middle of the neck, which goes over the chin of the patient vertically and reaches the side portion of the nose.

Maintenance of patent airway: For various reasons, it is vital to protect the airway of patient during sedation. The patient, who is being sedated, is horizontal in the dental chair and this poses a risk of choking due to debris coming from tooth preparation, dental materials used for filling, and calculus that is being scaled or extracted tooth. Saliva may be secreted in large amounts and may flow backwards and cause coughing. The third factor is the usage of water in order to cool the instruments. A throat shield ought to be used as a replacement for rubber dam so that the airway can be protected. It ought to be changed more often when it is full of debris or gets wet. (Solomowitz et al.,2009)

The patient usually recovers in a short period of time by using a postoperative evaluation along with sedative medications, these days. When the special care patients, who lack the ability to respond or obey the verbal commands, are being treated, keeping the patient wrapped in the chair with the papoose board is better until the patient restores the consciousness fully and can ambulate. Most of the patients do not tolerate the attached monitors and as well as having an IV, when they are alert. So, they ought to be removed in advance. Postoperative instructions are handed over in a written form, together with written note regarding the accomplished treatment, the prescribed medications (if any), dental

diagnosis, recommendations for the upcoming appointment for IV sedation in order to continue the treatment, for recall appointments, and recommendations for oral hygiene. (Solomowitz et al.,2009)

(Loyola-Rodriguez et al., 2004) found that GA (general anesthesia) using conscious sedation, propofol and sevoflurane, is an extraordinary way to conduct a dental treatment with no major postoperative complications in patients with CP (Loyola-Rodriguez et al., 2004).

**4.6. Role of Pediatric Dental Prevention**

Hygienic conditions and home dental care have to be promoted at an early stage. Parents should learn how to cleanse the incisors gently using a soft piece of cloth or a soft infant toothbrush on daily basis. For the children who are older and are not willing or are unable to cooperate physically, the pediatric dentists should give a proper guidance of effective brushing techniques to the parents and at the same time show them ways to constrict the child safely when it is necessary. The parent should place the child in his/her lap in order to hold the head using one hand and brush the teeth using the other. If the child is older, he/she may lean on a bed or chair and the parent may angle the head of the child backwards using one hand and brush the teeth using the other. If the child is more difficult to handle, more extreme restraining might be needed by both parents (Ferguson et al., 2009). The hands of the patient have to be held back for an effective oral cleansing by the second or the third person (Ferguson et al., 2009). An electric toothbrush can be used effectively to encourage the independence of the infants with mild disabilities. As a result, as oral health is being progressively recognized as the foundation of general well-being, caregivers for patients with CP ought to be considered the significant part of oral health team. They have to become competent and knowledgeable in oral health practices of home. Practices like these may affect the life quality of the child significantly and may control the dental costs

# 5. MATERIAL AND METHOD

## 5.1. Material

### 5.1.1. Patient selection and inclusion criteria

The Ethics Committee of Marmara University in Istanbul, Turkey approved with date 05.04.2018 and number 2018-168 this project. The study was conducted between April and September 2018 which included children with Cerebral palsy who were receiving physical therapy at Marmara University School of Medicine, Department of Physical Medicine and Rehabilitation, Istanbul, Turkey.

The criteria of selection included children with CP aged between 3-16 years with sufficient information from parents and guardians about individual's medical history, habits and socioeconomic factors. The exclusion criteria were: non cooperative child or insufficient general health data.

## 5.2. Methods

### 5.2.1. Data Collection

The first part of the research contains the Nordic Orofacial Test Screening (NOT-s) which includes a structured interview and a clinical examination of sic domains each. The clinical examination was developed with a picture manual illustrating different tasks.
The second part of the research included recording the detailed medical, dental history and socio-economic factors. To obtain detailed information about the child such as primary diagnose, type of the cerebral palsy, and gross motor function and Manual ability classification.

The dental diagnosis part included performing a clinical examination of the child's oral cavity. Clinical examination was carried out by one examiner using a dental mirror #5 and blunt dental probe in day light according to the criteria of the World Health Organization (WHO) (World Health, 1987).

In the third part of study parents were asked to answer POQL questions to assess the child's oral hygiene related quality of life. POQL was originally published in English, and

was validated and translated to Turkish in order for it to be applicable for use in Turkish society.

### 5.2.2. Nordic orofacial test screening

The presence of orofacial dysfunction was evaluated using the (NOT-S), a consistent and valid instrument and well adapted to Turkish.

It can be applied from 3 years of age, it is easy to perform for health professionals with different background without the use of special equipment.

The presence of orofacial dysfunction was evaluated using the (NOT-S), a consistent and valid instrument and cultural adapted to Turkish.

OFD was assessed with the NOT-S. The content of the NOT-S is based on a survey of literature to establish aspects of orofacial function. Epidemiological and clinical studies as well as common examination questions used in clinics to identify orofacial problems constitute the base for characterization of aspects of OFD. In NOT-S, aspects of OFD are termed domains. Each domain consists of questions or tasks, which are termed items. Each item serves to discriminate between normal function and dysfunction. The domains and items were finally formulated through discussions in the development team. The NOT-S consists of a structured interview, registering everyday orofacial functions, and a basic clinical examination registering intentional sensory–motor control via the cranial nerves.The interview contains six domains: ‘Sensory function’, ‘Breathing’, ‘Habits’, ‘Chewing and swallowing’, ‘Drooling’, and ‘Dryness of the mouth’. The examination contains six domains: ‘Face at rest’, ‘Nose breathing’, ‘Facial expression’, ‘Masticatory muscle and jaw function’, ‘Oral motor function’, and ‘Speech’. Each domain comprises one to five items. Each item is rated with ‘yes’, if the criterion of dysfunction is fulfilled, or ‘no’, if not fulfilled. If one or more items within a domain are assessed with ‘yes’, dysfunction is indicated in the domain. Profiles of OFD aspects can be created in different diagnostic groups based on the NOT-S domains. The number of domains with dysfunction is denominated ‘score’ and can vary between 0 and 6, for the interview and the examination respectively. The NOT-S total score can thus vary between 0 and 12, which display the extent of OFD. The NOT-S total score is significantly correlated with quality of life related to oral health. (Bakke et al.,.2007)

### 5.2.3. Caries status

Caries status was determined by recording the number of decayed (d, D), missing (m, M), and filled (f, F) teeth in the primary and permanent dentition. With the DMFT index for permanent, and dmft index for primary dentition we assess the mean dental caries scores for every individual.

It is thus used to get an estimation illustrating how much the dentition until the day of examination has become affected by dental caries. It is either calculated for 28 (permanent) teeth, excluding 18, 28, 38 and 48 (the "wisdom" teeth) or for 32 teeth (The Third edition of "Oral Health Surveys - Basic methods", Geneva 1987, recommends 32 teeth).

### 5.2.4. Gross Motor Function Classification System

Palisano et al. developed this system to help resolve CP classification difficulties. This is a recently developed system which has been found to be a reliable and valid system that classifies children with cerebral palsy by their age-specific gross motor activity. (Tab.3) The GMFCS describes the functional characteristics in five levels from one to five, first level being the mildest in the following age groups: up to 2 years, 2 - 4 years, 4 - 6 years and between 6 to 12 years. For each level, separate descriptions are predicted. Children in first level usually require orthoses and assisting mobility devices, while children in level two do not require assisting mobility devices after age 4. Children in level three sit independently, have independent floor mobility, and walk with assisting mobility devices. In level four, affected children function in supported sitting but independent mobility is quite limited (Sanger et al., 2010). Children in level five lack independence even in basic antigravity postural control and need power of mobility. The emphasis of this scale is on self-initiated movement and walking or sitting functions.

### 5.2.5. Manual ability classification system:

MACS identifies how children with CP use their hands while holding the objects in daily activities. It was defined by Eliasson et al. in 2006 and the validity and reliability studies of the Turkish version were conducted by Akpınar et al. in 2010. MACS describes five levels. The determination of the levels is based on the child's ability to hold objects on his/her own and the need for help and adaptation in performing hand-related activities of daily living. Those objects are nearby the child, not far away from he or she as like he or she cannot reach. The child is classified according to capability of handling objects in daily activities (eating, dressing, playing, drawing and writing etc.) which are compatible with the child's functional status. In addition, these objects are not beyond the reach of the child, and they are around him/her. MACS is available for children aged 4–18 years, but certain concepts suitable for the child's age should be included. Five levels ranging from 1 to 5 with a gradual limitation of correct functional hand use are determined.

### 5.2.6. Functional levels of GMFCS, MACS

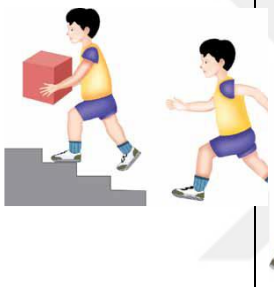
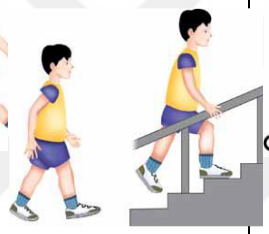
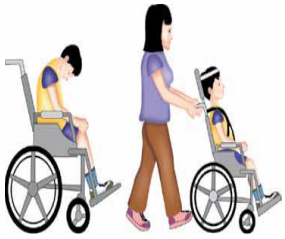
| | Level I | Level II | Level III | Level IV | Level V |
|---|---|---|---|---|---|
| GMFCS | Can walk without limitations  | Walk with limitations  | Walk with assistive mobility device.  | Walking ability severely limited even with assistive devices. Use of power wheelchair  | Transported by manual wheelchair  |
| MACS | Handles objects easily and successfully | Handles most objects but with somewhat reduced quality and/or speed of achievement | Handles objects with difficulty; needs help to prepare and/or modify activities | Handles a limited selection of easily managed objects in adapted situations | Does not handle objects and has severely limited ability to perform even simple actions |

**Fig.2**. Functional levels of GMFCS, MACS

### 5.2.7. Oral Hygiene Indices

Oral hygiene is a basic factor for oral health. Poor oral hygiene leads to dental plaque-collections, which in turn can cause gingivitis eventually leading to periodontal diseases. That is why many clinical studies have been carried out focusing on the role of

oral hygiene in the prevention and control of oral diseases. (J. C. Greene & Vermillion, 1960; O'Leary,Drake, & Naylor, 1972; Silness & Löe, 1964).

Dental plaque is defined as the soft adherent structured deposits, which forms on the tooth surface. It consists of a mixed bacterial flora, sometimes with desquamated epithelial cells and migrated polymorphonuclear leukocytes. It is not and should not be confused with food debris. A number of plaque indices has been developed for assessing individual levels of plaque control and are also been used in several epidemiological studies. Some of the most well - known indices, which have been used in numerous studies, are:

-Oral Hygiene Index (Greene and Vermilion, 1960)

-Simplified Oral Hygiene Index | OHI-S

-Silness-Löe Index

-Quigely Hein Index (modified)

-Plaque Control Record

**Simplified Oral Hygiene Index | OHI-S:**

The Simplified Oral Hygiene Index (OHI-S) differs from the original OHI (The Oral Hygiene Index) in the number of the tooth surfaces scored (6 rather than 12), the method of selecting the surfaces to be scored, and the scores, which can be obtained. The criteria used for assigning scores to the tooth surfaces are the same as those use for the OHI (The Oral Hygiene Index).

The OHI-S, like the OHI, has two components, the Debris Index and the Calculus Index. Each of these indexes, in turn, is based on numerical determinations representing the amount of debris or calculus found on the preselected tooth surfaces. (J. G. Greene & Vermillion, 1964).

**Selection of tooth surfaces:**

The six surfaces examined for the OHI-S are selected from four posterior and two anterior teeth.

- In the posterior portion of the dentition, the first fully erupted tooth distal to the second bicuspid (15), usually the first molar (16) but sometimes the second (17)

or third molar (18), is examined. The buccal surfaces of the selected upper molars and the lingual surfaces of the selected lower molars are inspected.

- In the anterior portion of the mouth, the labial surfaces of the upper right (11) and the lower left central incisors (31) are scored. In the absence of either of this anterior tooth, the central incisor (21 or 41 respectively) on the opposite side of the midline is substitted.

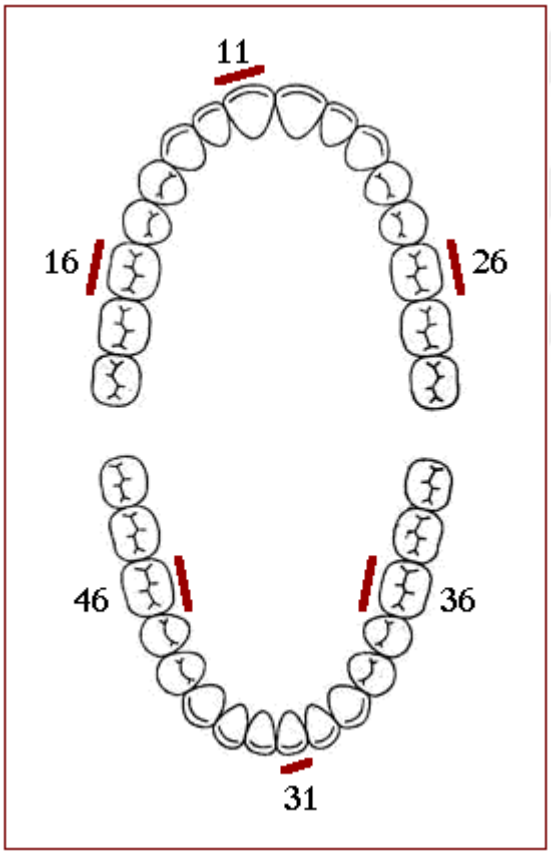



**Fig.3.** Surface selection for OHI-S

**Criteria for classifying debris**

**Table.1.** OHI-S classifying debris criteria

| **Scores** | **Criteria** |
|---|---|
| 0 | No debris or stain present |
| 1 | Soft debris covering not more than one third of the tooth surface, or presence of extrinsic stains without other debris regardless of surface area covered |
| 2 | Soft debris covering more than one third, but not more than two thirds, of the exposed tooth surface. |
| 3 | Soft debris covering more than two thirds of the exposed tooth surface. |

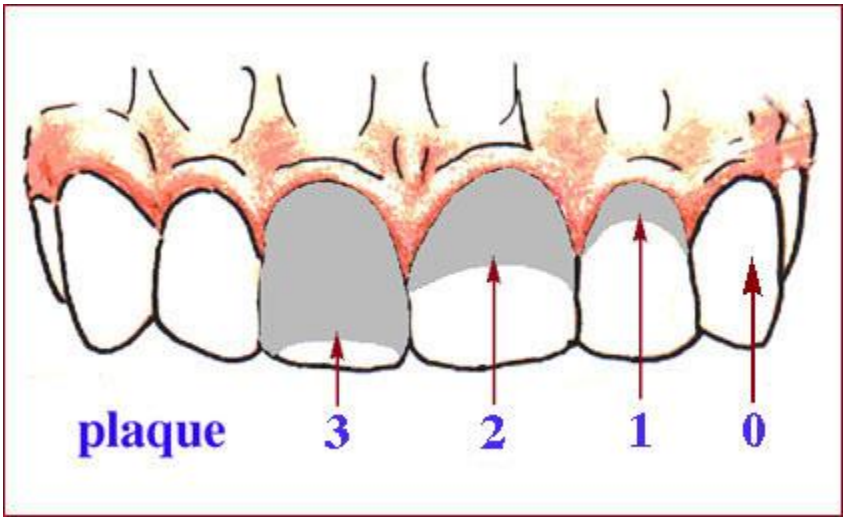



**Fig.4.** OHI-S classifying debris criteria

**Criteria for classifying calculus**

**Table.2.** OHI-S classifying calculus criteria

| **Scores** | **Criteria** |
|---|---|
| 0 | No calculus present |
| 1 | Supragingival calculus covering not more than third of the exposed tooth surface. |
| 2 | Supragingival calculus covering more than one third but not more than two thirds of the exposed tooth surface or the presence of individual flecks of subgingival calculus around the cervical portion of the tooth or both. |
| 3 | Supragingival calculus covering more than two third of the exposed tooth surface or a continuos heavy band of subgingival calculus around the cervical portion of the tooth or both. |

### 5.2.8. Modified Gingival Index (MGI)

The Modified Gingival Index (MGI), devised by Lobene et al. (1986), introduced changes in the criteria of the Gingival Index (Löe and Silness, 1963) through a non-invasive (no probing) and resetting the rating for mild and moderate inflammation. This way, the following criteria are adopted:

0 = absence of inflammation;

1 = mild inflammation or with slight changes in color and texture but not in all portions of gingival marginal or papillary;

2 = mild inflammation, such as the preceding criteria, in all portions of gingival marginal or papillary;

3 = moderate, bright surface inflammation, erythema, edema and/or hypertrophy of gingival marginal or papillary;

4 = severe inflammation: erythema, edema and/or marginal gingival hypertrophy of the unit or spontaneous bleeding, papillary, congestion or ulceration.

Gingival units as well as the calculation of the index follow the same criteria described in GI.

### 5.2.9. Oral Health-Related Quality of Life:

Oral health-related quality of life (OHRQoL) assesses the subjective impact of oral health status on social and psychological well-being and daily functioning.

In this study, the English language was the initial language by which (Huntington et al.,. 2011)has validated and developed the Pediatric Oral Health-Related Quality of Life (POQL), and eventually, (Yazicioğlu et al., 2018) have recently translated and validated it into the Turkish language.

### 5.3. Statistical analysis:

In this study statistical analysis was performed with SPSS statistic software (version21.0, SPSS Inc., Chicago, Illinois, United States).The statistical significance was set at ($p<0.05$).

# 6. RESULTS

**Table.3.** Characteristics of patients and families

| | | N | % |
|---|---|---|---|
| **Age** mean±SD (median) | | 8,6±1,62 | 8 |
| **Age groups** | 3-6 | 35 | 34.3 |
| | 7-11 | 51 | 50 |
| | 12-17 | 16 | 15.7 |
| **Gender** | Male | 41 | 40.2 |
| | Female | 61 | 59.8 |
| **Mother's Age** mean±SD (median) | | 35,29±4,82 | 35 |
| **Father's Age** mean±SD (median) | | 39,21±5,04 | 39 |
| **Education of Mother** | No education | 3 | 2.9 |
| | Primary school | 50 | 49,0 |
| | High school | 39 | 38,2 |
| | University | 10 | 9,8 |
| **Education of Father** | No education | 3 | 2.9 |
| | Primary school | 43 | 42,2 |
| | High school | 48 | 47,1 |
| | University | 8 | 7,8 |
| **Working Mother** | Yes | 9 | 8,8 |
| | No | 93 | 91,2 |
| **Working Father** | Yes | 98 | 96,1 |
| | No | 4 | 3,9 |
| **CP Type** | Spastic quadriplegia | 32 | 31,4 |
| | Spastic diplegia | 32 | 31,4 |
| | Spastic hemiplegia | 31 | 30,4 |
| | Dyskinetic cp | 1 | 0,9 |
| | Mixed cp | 6 | 5,9 |
| **Family Income** | <1000 | 9 | 8,8 |
| | 1000-3000 | 74 | 72,5 |
| | >3000 | 19 | 18,6 |

The mean age of the patients was 8,6±1,62, 59.8% were females and 40.2% were males.

The mean age of mothers was 35,29±4,82 and 39,21±5,04 for fathers.

Only 8,8% of mothers were working.

The majority of mothers 49,0% only finished primary school, 47,1% of fathers finished high school.

31,4% of the patients were diagnosed with Spastic quadriplegia, the same percentage for Spastic diplegia, 30,4% had Spastic hemiplegia.
8,8% of families had monthly income less than 1000 TL, the majority 72,5% had monthly income between 1000-3000 TL.

**Table.4.** Distribution of children according to affected NOT-S Interview domain

| **Domain** | Affected | | | |
|---|---|---|---|---|
| | YES | | NO | |
| **Interview** | n | % | n | % |
| **Sensory function** | 31 | 30,4 | 71 | 69,6 |
| **Breathing** | 18 | 17,6 | 84 | 82,4 |
| **Habits** | 32 | 31,4 | 70 | 68,6 |
| **Chewing and swallowing** | 30 | 29,4 | 72 | 70,6 |
| **Drooling** | 16 | 15,7 | 86 | 84,3 |
| **Dry mouth** | 17 | 16,7 | 85 | 83,3 |

Highest prevalence of OFD was in the “Habits” domain 31,4%, the secondly highest was the “Sensory function” domain 30,4%, and in the third place was “Chewing and swallowing” 29,4%.

**Table.5.** Distribution of children according to answers to questions on NOT-S interview

| Domain | AFFECTED | | | |
|---|---|---|---|---|
| | YES | | NO | |
| **Interview** | n | % | n | % |
| **Sensory function** | | | | |
| Does brushing your teeth elicit a gag reflex? | 23 | 22,5 | 79 | 77,5 |
| Do you put so much food in your mouth that it becomes difficult to chew? | 16 | 15,7 | 86 | 84,3 |
| **Breathing** | | | | |
| Do you use any breathing support? | 101 | 1,0 | 1,0 | 99,0 |
| Do you snore when you sleep? | 17 | 16,7 | 85 | 83,3 |
| **Habits** | | | | |
| Do you bite your nails or suck fingers or other objects every day? | 15 | 14,7 | 87 | 85,3 |
| Do you bite your suck or lips, tongue or cheeks every day? | 6 | 5,9 | 96 | 94,1 |
| Do you bite your teeth hard or grind your teeth during the day | 19 | 18,6 | 83 | 81,4 |
| **Chewing and swallowing** | | | | |
| Does not eat with the mouth (nasogastric tube. gastrostomy. etc.)? | 3 | 2,9 | 99 | 97,1 |
| Do you find it difficult to eat foods with a certain consistency? | 19 | 18,6 | 83 | 81,4 |
| Does it take you 30min or more to eat a main meal? | 15 | 14,7 | 87 | 85,3 |
| Do you swallow large bites without chewing? | 17 | 16,7 | 85 | 83,3 |
| Do you often cough during meals? | 15 | 14,7 | 87 | 85,3 |
| **Drooling** | | | | |
| Do you get saliva in the corner of the mouth or on your chin every day | 16 | 15,7 | 86 | 84,3 |
| **Dryness of mouth** | | | | |
| Do you have to drink to be able to eat a cracker? | 6 | 5,9 | 96 | 94,1 |
| Do you suffer from pain in the mucous membranes in your mouth? | 15 | 14,7 | 87 | 85,3 |

The highest prevalence of OFD in items was in “Does brushing your teeth elicit a gag reflex?” 22,5% and in “Do you grind your teeth or bite them together hard throughout the day?” 18,6%.

**Table.6.** Distribution of children according to affected NOT-S Clinical exam domain

| Domain | Affected | | | |
|---|---|---|---|---|
| | YES | | NO | |
| **Clinical exam** | n | % | n | % |
| **Face at rest** | 17 | 18,9 | 73 | 81,1 |
| **Nose breathing** | 13 | 14,8 | 75 | 85,2 |
| **Facial expression** | 37 | 44,0 | 47 | 56,0 |
| **Chewing and swallowing** | 10 | 11,9 | 74 | 88,1 |
| **Oral motor function** | 41 | 48,2 | 44 | 51,8 |
| **Speech** | 40 | 39,2 | 62 | 60,8 |

The highest prevalence of OFD was in the “Oral motor function” domain 48,2%, with “Facial expression” as the secondly highest 44,0%, then “Speech” 39,2%.

**Table.7.** Distribution of children according to answers to questions on NOT-S clinical exam

| **Domain** | AFFECTED | | | |
|---|---|---|---|---|
| | YES | | NO | |
| **Clinical exam** | n | % | n | % |
| **Face at rest** | | | | ` |
| Asymmetry | 7 | 7,8 | 83 | 92,2 |
| Deviant lip position | 9 | 10,0 | 81 | 90,0 |
| Involuntary movements | 6 | 6,7 | 84 | 93,3 |
| **Nose breathing** | | | | |
| Close your mouth and take 5 deep breaths through your nose | 13 | 14,8 | 75 | 85,2 |
| **Facial expression** | | | | |
| Close your eyes tightly | 24 | 28,9 | 59 | 71,1 |
| Show your teeth | 13 | 15,7 | 70 | 84,3 |
| Try to whistle/blow | 26 | 31,0 | 58 | 69,0 |
| **Masticatory muscles and jaw function** | | | | |
| Bite hard on your back teeth | 9 | 10,7 | 75 | 89,3 |
| Open your mouth as wide as you can | 7 | 8,3 | 77 | 91,7 |
| **Oral motor function** | | | | |
| Stick out your tongue as far as you can | 10 | 11,8 | 75 | 88,2 |
| Lick your lips | 31 | 36,9 | 53 | 63,1 |
| Blow up' your cheeks and hold for at least 3s | 30 | 35,3 | 55 | 64,7 |
| Open your mouth wide and say ah-ah-ah | 8 | 9,5 | 76 | 90,5 |
| **Speech** | | | | |
| Does not speak | 25 | 24,5 | 77 | 75,5 |
| Count out loud to 10 | 18 | 22,8 | 61 | 77,2 |
| Say PATAKA. PATAKA. PATAKA | 11 | 13,9 | 68 | 86,1 |

The highest prevalence of OFD in items was in "Lick your lips" 36,9% , "Blow up your cheeks then hold for 3s at least" 35,3%, both in the domain "Oral motor function", in addition to 'Try to whistle" 31,0% in the domain 'Facial expression"

**Table.8.** Distribution of patients according to GMFCS and MACS levels

| GMFCS Level | n | % | MACS Level | n | % |
|---|---|---|---|---|---|
| **I** | 32 | 31,4 | **I** | 35 | 34,3 |
| **II** | 21 | 20,6 | **II** | 31 | 30,4 |
| **III** | 16 | 15,7 | **III** | 20 | 19,6 |
| **IV** | 17 | 16,7 | **IV** | 8 | 7,8 |
| **V** | 16 | 15,7 | **V** | 8 | 7,8 |

**Table.9.** Occlusion and presence of caries

| | | n | % |
|---|---|---|---|
| **Occlusion** | Class I | 89 | 89,9 |
| | Class II | 5 | 5,1 |
| | Class III | 5 | 5,1 |
| **Open Bite** | Yes | 10 | 9,9 |
| | No | 91 | 90,1 |
| **Crowding** | Yes | 15 | 14,9 |
| | No | 86 | 85,1 |
| **Presence of caries** | Yes | 29 | 29,6 |
| | No | 69 | 70,4 |

**Table.10.** Distribution of children according to CP type and NOT-S score

| | NOT-S score | | |
|---|---|---|---|
| | Mean±SD | Median | Min-Max |
| **Spastic quadriplegia** | 4±2.18 | 4 | 0-8 |
| **Spastic diplegia** | 1.84±1.94 | 1 | 0-6 |
| **Spastic hemiplegia** | 2.35±1.82 | 3 | 0-7 |
| **Dyskinetic cp** | 4±0 | 4 | 4-4 |
| **Mixed cp** | 7±1.67 | 7.5 | 5-9 |
| **Total group** | 3.08±2.49 | 3 | 0-9 |

The mean NOT-S score of the patients was 3.08±2.49
Mixed cp patients had the highest mean of NOT-S 7±1.67

**Table.11**. Prevalence of OFD in relation to GMFCS

| | GMFCS | | | | |
|---|---|---|---|---|---|
| | I (n=32) | **II** (n=21) | **III** (n=16) | **IV** (n=17) | **V** (n=16) |
| **Sensory** | 4 (13) | 5 (24) | 2 (13) | 10 (59) | 10 (63) |
| Item 1 | 4 (13) | 3 (5) | 1 (6) | 8 (47) | 7 (44) |
| Item 2 | 2 (6) | 3 (14) | 1 (6) | 4 (24) | 6 (38) |
| **Breathing** | 6 (19) | 2 (10) | 5 (31) | 4 (24) | 1 (6) |
| Item 1 | 1 (3) | 0 (0) | 0 (0) | 0 (0) | 0 (0) |
| Item 2 | 5 (16) | 2 (10) | 5 (31) | 4 (24) | 1 (6) |
| **Habits** | 11 (34) | 5 (24) | 3 (19) | 8 (47) | 5 (31) |
| Item 1 | 6 (19) | 1 (5) | 3 (19) | 2 (12) | 3 (6) |
| Item 2 | 3 (9) | 1 (5) | 1 (6) | 1 (6) | 0 (0) |
| Item 3 | 7 (22) | 3 (14) | 0 (0) | 5 (29) | 4 (25) |
| **Chewing** | 5 (16) | 4 (19) | 3 (19) | 6 (35) | 12 (75) |
| Item 1 | 1 (3) | 1 (5) | 0 (0) | 0 (0) | 1 (6) |
| Item 2 | 3 (9) | 2 (10) | 2 (13) | 5 (29) | 7 (44) |
| Item 3 | 3 (9) | 2 (10) | 1 (6) | 2 (12) | 7 (44) |
| Item 4 | 1 (3) | 2 (10) | 1 (6) | 4 (24) | 9 (56) |
| Item 5 | 0 (0) | 1 (5) | 0 (0) | 5 (29) | 9 (56) |
| **Drooling** | 1 (3) | 0 (0) | 2 (13) | 4 (24) | 9 (56) |
| **Dry Mouth** | 5 (16) | 2 (10) | 2 (13) | 3 (18) | 5 (31) |
| Item 1 | 3 (9) | 0 (0) | 0 (0) | 1 (6) | 2 (13) |
| Item 2 | 4 (13) | 2 (10) | 2 (10) | 3 (18) | 4 (25) |
| **Face at rest** | 4 (13) | 1 (5) | 2 (13) | 6 (35) | 4 (25) |
| Item 1 | 3 (9) | 1 (5) | 1 (6) | 1 (6) | 1 (6) |
| Item 2 | 3 (9) | 0 (0) | 0 (0) | 3 (18) | 3 (19) |
| Item 3 | 1 (3) | 1 (5) | 1 (6) | 1 (6) | 2 (13) |
| Item 4 | 1 (3) | 1 (5) | 0 (0) | 4 (24) | 2 (13) |
| **Nose breathing** | 2 (6) | 1 (5) | 3 (19) | 4 (24) | 3 (19) |
| **Facial expression** | 7 (22) | 6 (29) | 5 (31) | 12 (71) | 7 (44) |
| Item 1 | 2 (6) | 4 (19) | 4 (25) | 8 (47) | 6 (38) |
| Item 2 | 0 (0) | 2 (10) | 1 (6) | 5 (29) | 5 (31) |
| Item 3 | 5 (16) | 5 (24) | 4 (25) | 8 (47) | 4 (25) |
| **Masticatory muscles and jaw function** | 1 (3) | 1 (5) | 0 (0) | 5 (29) | 3 (19) |
| Item 1 | 0 (0) | 1 (5) | 0 (0) | 5 (29) | 3 (19) |
| Item 2 | 1 (3) | 1 (5) | 0 (0) | 3 (18) | 2 (13) |
| **Oral motor function** | 9 (28) | 6 (29) | 7 (44) | 11 (65) | 8 (50) |
| Item 1 | 2 (6) | 1 (5) | 1 (6) | 3 (18) | 3 (19) |
| Item 2 | 7 (22) | 5 (24) | 4 (25) | 9 (53) | 6 (38) |
| Item 3 | 5 (16) | 5 (24) | 5 (31) | 9 (53) | 6 (38) |
| Item 4 | 1 (3) | 0 (0) | 0 (0) | 4 (24) | 3 (19) |
| **Speech** | 6 (19) | 7 (33) | 3 (19) | 10 (59) | 14 (89) |
| Item 1 | 4 (13) | 3 (14) | 3 (19) | 7 (41) | 8 (50) |
| Item 2 | 1 (3) | 4 (19) | 3 (17) | 3 (18) | 7 (44) |
| Item 3 | 1 (3) | 4 (19) | 1 (9) | 1 (6) | 4 (25) |

**Table.12.** Prevalence of OFD in relation to MACS

| | MACS | | | | |
|---|---|---|---|---|---|
| | **I** (n=35) | **II** (n=31) | **III** (n=20) | **IV** (n=8) | **V** (n=8) |
| **Sensory** | 6 (17) | 11 (35) | 7 (35) | 3 (38) | 4 (50) |
| Item 1 | 5 (14) | 6 (19) | 7 (35) | 3 (38) | 2 (25) |
| Item 2 | 3 (9) | 5 (16) | 4 (20) | 1 (13) | 3 (38) |
| **Breathing** | 8 (23) | 3 (10) | 4 (20) | 1 (13) | 2 (25) |
| Item 1 | 0 (0) | 0 (0) | 1 (5) | 0 (0) | 0 (0) |
| Item 2 | 8 (23) | 3 (10) | 3 (15) | 1 (13) | 2 (25) |
| **Habits** | 6 (19) | 12 (38) | 9 (28) | 2 (6) | 3 (9) |
| Item 1 | 1 (3) | 7 (23) | 5 (25) | 0 (0) | 2 (25) |
| Item 2 | 2 (6) | 2 (6) | 2 (10) | 0 (0) | 0 (0) |
| Item 3 | 5 (14) | 6 (19) | 4 (20) | 2 (6) | 2 (25) |
| **Chewing** | 8 (23) | 8 (26) | 6 (30) | 4 (50) | 4 (50) |
| Item 1 | 2 (6) | 0 (0) | 0 (0) | 0 (0) | 1 (13) |
| Item 2 | 4 (11) | 6 (19) | 3 (15) | 3 (38) | 3 (38) |
| Item 3 | 5 (14) | 4 (13) | 4 (20) | 1 (13) | 1 (13) |
| Item 4 | 3 (18) | 6 (35) | 3 (18) | 2 (12) | 3 (38) |
| Item 5 | 0 (0) | 4 (13) | 5 (25) | 3 (38) | 3 (9) |
| **Drooling** | 0 (0) | 4 (13) | 4 (20) | 4 (50) | 4 (50) |
| **Dry Mouth** | 5 (14) | 5 (16) | 4 (20) | 1 (13) | 2 (25) |
| Item 1 | 2 (6) | 1 (3) | 2 (10) | 0 (0) | 1 (13) |
| Item 2 | 4 (11) | 4 (13) | 4 (20) | 1 (13) | 2 (25) |
| **Face at rest** | 3 (18) | 7 (23) | 4 (20) | 2 (25) | 1 (13) |
| Item 1 | 1 (3) | 3 (10) | 2 (10) | 1 (13) | 0 (0) |
| Item 2 | 2 (6) | 4 (13) | 1 (5) | 2 (25) | 0 (0) |
| Item 3 | 2 (6) | 2 (6) | 1 (5) | 1 (13) | 0 (0) |
| Item 4 | 1 (3) | 0 (0) | 4 (20) | 2 (25) | 1 (13) |
| **Nose breathing** | 2 (6) | 4 (13) | 5 (25) | 2 (25) | 0 (0) |
| **Facial expression** | 4 (11) | 13 (42) | 12 (60) | 4 (50) | 4 (50) |
| Item 1 | 3 (18) | 7 (23) | 9 (45) | 4 (50) | 1 (13) |
| Item 2 | 1 (3) | 4 (13) | 5 (25) | 2 (25) | 1 (13) |
| Item 3 | 3 (18) | 8 (26) | 8 (40) | 4 (50) | 3 (38) |
| **Masticatory muscles and jaw function** | 1 (3) | 1 (3) | 5 (25) | 2 (25) | 1 (13) |
| Item 1 | 1 (3) | 1 (3) | 5 (25) | 2 (25) | 1 (13) |
| Item 2 | 0 (0) | 1 (3) | 5 (25) | 2 (25) | 1 (13) |
| **Oral motor function** | 1 (3) | 1 (3) | 4 (20) | 0 (0) | 1 (13) |
| Item 1 | 10 (29) | 10 (32) | 15 (57) | 4 (50) | 2 (25) |
| Item 2 | 2 (6) | 1 (3) | 5 (25) | 2 (25) | 0 (0) |
| Item 3 | 8 (23) | 7 (23) | 11 (55) | 4 (50) | 1 (13) |
| Item 4 | 6 (17) | 6 (35) | 13 (65) | 4 (50) | 1 (13) |
| **Speech** | 1 (3) | 1 (3) | 3 (18) | 3 (38) | 0 (0) |
| Item 1 | 8 (23) | 10 (32) | 12 (60) | 5 (63) | 5 (63) |
| Item 2 | 7 (20) | 6 (35) | 6 (30) | 3 (38) | 3 (38) |
| Item 3 | 2 (6) | 5 (16) | 7 (35) | 2 (25) | 2 (38) |

**Table.13.** Distribution of children according to GMFCS levels and NOT-S score

| GMFCS | NOT-S score Mean±SD | Median | Min-Max |
|---|---|---|---|
| **I** | 1,97±1,87 | 2 | 0-5 |
| **II** | 1,9±1,95 | 1 | 0-7 |
| **III** | 2,56±1,93 | 2 | 0-6 |
| **IV** | 4,82±2,51 | 5 | 0-9 |
| **V** | 5±1,59 | 5 | 2-8 |

A GMFCS levels had OFD, and increased levels of GMFCS showed increased prevalence of OFD (from level 1=62.5% to level 5=100%) also showed increasing in the NOT-S mean value (from level 1=1,97±1,87 to level 5=5±1,59) .

**Table.14.** Oral variables among the children

| | Mean±SD | Median | Min-Max |
|---|---|---|---|
| **dmft** | 2,63±3,35 | 2 | 0-15 |
| **DMFT** | 0,92±1,43 | 0 | 0-4 |
| **dmft+DMFT** | 3,54±3,66 | 3 | 0-16 |
| **Gingival index** | 0,72±0,81 | 1 | 0-3 |
| **Debris index** | 0,4±0,58 | 0 | 0-3 |
| **Calculus index** | 0,05±0,36 | 0 | 0-3 |
| **OHI-S index** | 0,46±0,83 | 0 | 0-5 |

**Table.15.** Oral variables among the children by age groups

| | 3-6 | | 7-11 | | 12-17 | |
|---|---|---|---|---|---|---|
| | Mean±SD | Median | Mean±SD | Median | Mean±SD | Median |
| **dmft** | 4,06±5,65 | 1,50 | 2,66±3,08 | 2,00 | | |
| **DMFT** | | | 0,94±1,44 | 0,00 | 3,69±6,94 | 1,50 |
| **dmft+DMFT** | 4,15±5,68 | 2,00 | 3,54±3,42 | 2,50 | 3,88±6,87 | 2,00 |
| **Gingival index** | 0,32±0,1 | 0,00 | 0,77±0,1 | 1,00 | 1,44±0,25 | 2,00 |
| **Debris index** | 0,11±0,34 | 0,00 | 0,44±0,6 | 0,08 | 1,04±0,88 | 1,33 |
| **Calculus index** | 0,01±0,06 | 0,00 | 0,05±0,36 | 0,00 | 0,28±0,76 | 0,00 |
| **OHI-S index** | 0,12±0,37 | 0,00 | 0,5±0,84 | 0,08 | 1,35±1,52 | 1,33 |

**Table.16.** Oral variables in relation to orofacial dysfunction

| | Presence of OFD | | | | P |
|---|---|---|---|---|---|
| | AFFECTED | | NOT AFFECTED | | |
| **dmft** mean±SD (median) | 3,25±4,5 | 2 | 3,21±3,85 | 3 | 0,97 |
| **DMFT** mean±SD (median) | 1,8±4,1 | 0,5 | 0,9±1,3 | 0 | 0,43 |
| **dmft+DMFT** mean±SD (median) | 3,93±5,2 | 2 | 3,36±3,68 | 2,5 | 0,63 |
| **Gingival index** mean±SD (median) | 0,85±0,82 | 1 | 0,07±0,55 | 0 | **0,04*** |
| **Debris index** mean±SD (median) | 0,51±0,71 | 0 | 0,12±0,26 | 0 | **0,01*** |
| **Calculus index** mean±SD (median) | 0,09±0,46 | 0 | 0,0±0,0 | 0 | 0,32 |
| **OHI-S index** mean±SD (median) | 0,61±1,05 | 0 | 0,12±0,26 | 0 | **0,03*** |

The mean of gingival index score in patients who have at least one affected NOT-S domain is higher than those who is not affected, and it is 0,85 while in the not affected group the value is 0,85. ($p=0,04$; $p<0,05$).

The mean of Debris index score in patients who have at least one affected NOT-S domain is higher than those who is not affected, and it is 0,51 while in the not affected group the value is 0,12. ($p=0,01$; $p<0,05$).

The mean of OHI-S index score in patients who have at least one affected NOT-S domain is higher than those who is not affected, and it is 0,61 while in the not affected group the value is 0,12. ($p=0,03$; $p<0,05$).

In the other means (DMFT, dmft, dmft+DMFT) were no statistical difference between groups.

**Table.17.** Oral variables in relation to presence of caries

| | Presence of Caries | | | | P |
|---|---|---|---|---|---|
| | No caries | | Caries | | |
| **Gingival index** mean±SD (median) | 0,34±0,76 | 1 | 0,88±0,77 | 1 | **0,02*** |
| **Debris index** mean±SD (median) | 0,18±0,61 | 0 | 0,53±0,66 | 0,16 | **0,01*** |
| **Calculus index** mean±SD (median) | 0,13±0,57 | 0 | 0,05±0,31 | 0 | 0,32 |
| **OHI-S index** mean±SD (median) | 0,31±1,16 | 0 | 0,59±0,86 | 0,16 | **0,03*** |
| **NOT-S total score** mean±SD (median) | 2,93±2,34 | 3 | 2,94±2,39 | 3 | 0,97 |
| **POQL total score** mean±SD (median) | 2,83±10,76 | 0 | 13,5±15,37 | 10,55 | **0,01*** |

The mean of (Gingival index, Debris index, OHI-S index, POQL) score in patients were caries free is higher than those who have caries, ($p<0,05$), There is no statistical difference in NOT-S mean between the two groups.

**Table.18.** Oral variables in relation to dependency level

| | | Independent/Partially Dependent | | Dependent | | p |
|---|---|---|---|---|---|---|
| | | Mean±SD | Median | Mean±SD | Median | |
| **3-6** | **dmft** | 4,48±5,79 | 2 | 2,43±5,16 | 0 | 0,24 |
| | **DMFT** | | | | | |
| | **dmft+DMFT** | 4,59±5,81 | 2 | 2,43±5,16 | 0 | 0,19 |
| | **Gingival index** | 0,37±0,63 | 0 | 0,14±0,3 | 0 | 0.81 |
| | **Debris index** | 0,14±0,38 | 0 | 0±0 | 0 | 0,29 |
| | **Calculus index** | 0,01±0,06 | 0 | 0±0 | 0 | 0,61 |
| | **OHI-S index** | 0,15±0,42 | 0 | 0±0 | 0 | 0,29 |
| | **NOT-S total score** | 1,96±1,85 | 2 | 4,38±2,5 | 4,5 | **0,02*** |
| | **POQL total score** | 13,36±16,62 | 0 | 3,13±8,84 | 0 | 0,08 |
| **7-11** | **dmft** | 2,23±2,8 | 1,5 | 3,41±3,48 | 2 | 0,31 |
| | **DMFT** | 0,94±1,39 | 0 | 0,94±1,56 | 0 | 0,89 |
| | **dmft+DMFT** | 3,1±3,24 | 2 | 4,35±3,69 | 4 | 0,25 |
| | **Gingival index** | 0,64±0,71 | 1 | 1,01±0,71 | 1 | 0,67 |
| | **Debris index** | 0,36±0,48 | 0 | 0,6±0,77 | 0,16 | 0,42 |
| | **Calculus index** | 0±0 | 0 | 0,16±0,63 | 0 | 0,16 |
| | **OHI-S index** | 0,36±0,48 | 0 | 0,75±1,25 | 0,16 | 0,42 |
| | **NOT-S total score** | 2,22±2,06 | 2 | 4,89±2,11 | 5 | **0,001*** |
| | **POQL total score** | 8,16±11,99 | 0 | 13,75±17,86 | 11,6 | 0,28 |
| **12-17** | **dmft** | | | | | |
| | **DMFT** | 2,2±3,05 | 1 | 6,17±10,76 | 2,5 | 0,41 |
| | **dmft+DMFT** | 2,2±3,05 | 1 | 6,67±10,48 | 3 | 0,14 |
| | **Gingival index** | 1,61±0,8 | 2 | 1,61±1,61 | 1 | 0,54 |
| | **Debris index** | 0,97±0,76 | 1,17 | 1,17±1,11 | 1,33 | 0,87 |
| | **Calculus index** | 0,13±0,28 | 0 | 0,53±1,21 | 0 | 0,57 |
| | **OHI-S index** | 1,15±0,99 | 1,17 | 1,69±2,22 | 1,33 | 0,91 |
| | **NOT-S total score** | 2±1,63 | 2,5 | 5,67±1,37 | 5,5 | **0,001*** |
| | **POQL total score** | 8,97±17,07 | 2,5 | 10,49±13,33 | 8,33 | 0,65 |

There was no statistical difference between the Independent/Partially Dependent patients and the Dependent patients in terms of oral variables (dmft, DMFT, dmft+DMFT, Gingival index, Debris index, Calculus index, OHI-S index)

**Table.19.** Oral variables in relation to education of mother

| | Education of Mother | | | | | | | | p |
|---|---|---|---|---|---|---|---|---|---|
| | No education | | Primary school | | High school | | university | | |
| | Mean ±sd | M | Mean ±sd | M | Mean ±sd | M | Mean ±sd | M | |
| **dmft** | 5±7,07 | 5 | 3,8±4,46 | 2 | 3,28±4,51 | 2 | 0,63±1,19 | 0 | 0,17 |
| **DMFT** | 0±0 | 0 | 2,03±4,73 | 1 | 1,22±1,68 | 0 | 0,4±0,89 | 0 | 0,39 |
| **dmft+DMFT** | 5±7,07 | 5 | 4,29±5,3 | 3 | 3,95±4,74 | 2 | 0,78±1,2 | 0 | 0,07 |
| **Debris index** | 0,17±0,23 | 0,17 | 0,57±0,71 | 0,33 | 0,29±0,57 | 0 | 0,3±0,68 | 0 | 0,21 |
| **Calculus index** | 0±0 | 0 | 0,08±0,44 | 0 | 0,08±0,41 | 0 | 0,07±0,22 | 0 | 0,90 |
| **OHI-S index** | 0,17±0,23 | 0,17 | 0,65±1,03 | 0,33 | 0,37±0,91 | 0 | 0,37±0,89 | 0 | 0,23 |
| **NOT-S total score** | 2,5±0,71 | 2,50 | 3,06±2,38 | 3 | 3,15±2,44 | 3 | 2,5±2,22 | 2,50 | 0,63 |
| **POQL total score** | 19,4±27,44 | 19,40 | 11,33±16,08 | 4,58 | 10,8±14,17 | 0 | 2,1±4,72 | 0 | 0,37 |

There is no correlation between education of mother and (dmft, DMFT, dmft+DMFT, Gingival index, Debris index, Calculus index, OHI-S index, NOT-S, POQL)

**Table.20.** Oral variables in relation to education of father

| | Education of Father | | | | | | | | p |
|---|---|---|---|---|---|---|---|---|---|
| | No education | | Primary school | | High school | | University | | |
| | Mean ±sd | M | Mean ±sd | M | Mean ±sd | M | Mean ±sd | M | |
| **dmft** | 6±5,2 | 9,00 | 3,47±4,54 | 2,00 | 3,41±4,42 | 2,00 | 0,5±0,93 | 0,00 | 0,10 |
| **DMFT** | 3±1,41 | 3,00 | 1,89±5,28 | 0,00 | 1,45±2,13 | 1,00 | 0,6±1,34 | 0,00 | 0,21 |
| **dmft+DMFT** | 8±7 | 11,00 | 4,17±5,64 | 2,00 | 3,72±4,24 | 2,50 | 0,88±1,81 | 0,00 | 0,07 |
| **Debris index** | 1,07±0,92 | 1,60 | 0,46±0,68 | 0,00 | 0,41±0,65 | 0,00 | 0,08±0,23 | 0,00 | 0,15 |
| **Calculus index** | 0±0 | 0,00 | 0,07±0,47 | 0,00 | 0,09±0,39 | 0,00 | 0±0 | 0,00 | 0,36 |
| **OHI-S index** | 1,07±0,92 | 1,60 | 0,53±1,03 | 0,00 | 0,52±0,97 | 0,00 | 0,08±0,23 | 0,00 | 0,17 |
| **NOT-S total score** | 1±1 | 1,00 | 3,37±2,37 | 3,00 | 2,83±2,37 | 3,00 | 2,75±2,38 | 2,50 | 0,33 |
| **POQL total score** | 30,55±26,46 | 45,83 | 9,18±14,55 | 0,00 | 11,38±14,59 | 3,30 | 2,78±5,35 | 0,00 | 0,17 |

There was no correlation between education of father and (dmft, DMFT, dmft+DMFT, Gingival index, Debris index, Calculus index, OHI-S index, NOT-S, POQL)

**Table.21.** Oral variables in relation to family income

| | Income | | | | | | p |
|---|---|---|---|---|---|---|---|
| | <1000 | | 1000-3000 | | >3000 | | |
| | Mean ±sd | M | Mean ±sd | M | Mean ±sd | M | |
| **dmft** | 3,86±7,24 | 1 | 3,4±4,11 | 2 | 2,5±3,88 | 1,50 | 0,77 |
| **DMFT** | 0,67±0,82 | 0,50 | 1,96±4,22 | 1 | 0,5±0,97 | 0 | 0,45 |
| **dmft+DMFT** | 3,44±6,31 | 1 | 4,17±4,94 | 3 | 2,63±4,02 | 1 | 0,40 |
| **Debris index** | 0,26±0,52 | 0 | 0,52±0,71 | 0,08 | 0,14±0,36 | 0 | 0,17 |
| **Calculus index** | 0±0 | 0 | 0,1±0,48 | 0 | 0,01±0,04 | 0 | 0,41 |
| **OHI-S index** | 0,26±0,52 | 0 | 0,63±1,08 | 0,08 | 0,15±0,38 | 0 | 0,17 |
| **NOT-S total score** | 3,11±2,57 | 3 | 3,15±2,38 | 3 | 2,37±2,19 | 2 | 0,89 |
| **POQL total score** | 3,7±11,1 | 0 | 12,3±15,82 | 5 | 6,1±10,86 | 0 | **0,03*** |

There is no correlation between family income and (dmft, DMFT, dmft+DMFT, Gingival index, Debris index, Calculus index, OHI-S index, NOT-S)

There is a statistical difference between the groups in the POQL mean score.

**Table.22.** Brushing habits

| | | n | % |
|---|---|---|---|
| **Frequency of brushing** | twice or more | 19 | 19,2% |
| | once a day | 28 | 28,3% |
| | less than once a day | 52 | 52,5% |
| **Who is brushing for the child** | Child | 28 | 33,7% |
| | Family | 26 | 31,3% |
| | Both | 29 | 34,9% |

**Table.23.** Dental problems in the last 3 months

| | | n | % |
|---|---|---|---|
| **In the last 3 months did your child have pain because of his or her teeth or mouth?** | all of the time | 5 | 5,3 |
| | some of the times | 16 | 17,0 |
| | once in a while | 8 | 8,5 |
| | did not happen | 64 | 68,1 |
| | do not know | 1 | 1,1 |
| **In the last 3 months did your child have trouble eating any foods because of his or her teeth or -mouth?** | all of the time | 5 | 5,3 |
| | some of the times | 11 | 11,7 |
| | once in a while | 9 | 9,6 |
| | did not happen | 68 | 72,3 |
| | do not know | 1 | 1,1 |
| **In the last 3 months did your child miss school or daycare because of his or her teeth or mouth?** | all of the time | 0 | 0,0 |
| | some of the times | 4 | 4,3 |
| | once in a while | 4 | 4,3 |
| | did not happen | 84 | 89,4 |
| | do not know | 2 | 2,1 |
| **In the last 3 months did your child feel worried because of his or her teeth or mouth?** | all of the time | 0 | 0,0 |
| | some of the times | 9 | 9,7 |
| | once in a while | 7 | 7,5 |
| | did not happen | 76 | 81,7 |
| | do not know | 1 | 1,1 |
| **In the last 3 months did your child cry because of his or her teeth or mouth?** | all of the time | 1 | 1,1 |
| | some of the times | 9 | 9,6 |
| | once in a while | 7 | 7,4 |
| | did not happen | 76 | 80,9 |
| | do not know | 1 | 1,1 |

**Table.24. Correlation between POQL total score and other variables**

| | | POQL total score |
|---|---|---|
| **dmft** | r* | **0,715*** |
| | p | **0,001** |
| **DMFT** | r* | 0,093 |
| | p | 0,464 |
| **dmft+DMFT** | r* | **0,643*** |
| | p | **0,001** |
| **Gingival index** | r* | **0,258*** |
| | p | **0,011** |
| **OHI-S** | r* | **0,256*** |
| | p | **0,012** |
| **NOT-S total score** | r* | -0,032 |
| | p | 0,750 |

There is statistically significant relationship between POQL total score and (dmft, DMFT, dmft+DMFT, Gingival index, OHI-S index).

**Table.25. Correlation between NOT-S total score and other variables**

| | | NOT-S total score |
|---|---|---|
| **dmft** | r* | -0,07 |
| | p | 0,535 |
| **DMFT** | r* | 0,221 |
| | p | 0,074 |
| **dmft+DMFT** | r* | 0,065 |
| | p | 0,527 |
| **Gingival index** | r* | **0,298*** |
| | p | **0,003** |
| **OHI-S** | r* | **0,336*** |
| | p | **0,001** |
| **POQL total score** | r* | -0,032 |
| | p | 0,750 |

There is statistically significant relationship between NOT-S total score and (Gingival index, OHI-S index).

**Table.26. Correlation between OHI-S and oral variables**

| | | OHI-S |
|---|---|---|
| **dmft** | r* | 0,08 |
| | p | 0,44 |
| **DMFT** | r* | **0,67*** |
| | p | **0,001** |
| **dmft+DMFT** | r* | **0,38*** |
| | p | **0,001** |
| **Gingival index** | r* | **0,663*** |
| | p | **0,001** |

There is statistically significant relationship between OHI-S score and (Gingival index, DMFT, dmft+DMFT).

**Table.27. Correlation between Gingival index and oral variables**

| | | Gingival index |
|---|---|---|
| **dmft** | r* | **0,293*** |
| | p | **0,008** |
| **DMFT** | r* | **0,431*** |
| | p | **0,001** |
| **dmft+DMFT** | r* | **0,262*** |
| | p | **0,001** |
| **OHI-S** | r* | **0,663*** |
| | p | **0,001** |

There is statistically significant relationship between gingival index score and (dmft, DMFT, dmft+DMFT, OHI-S).

# 7. DISCUSSION

## 7.1. Discussion of aim

The aim of this study was to analyze the prevalence and occurrence of orofacial dysfunction and follow its relationship with the oral health status.

In addition to that, an essential part of the study was to determine the influence of the orofacial dysfunction and the status of oral health on the oral health related quality of life in the pediatric population with cerebral palsy in the Republic of Turkey.

A lot of published studies, in which authors focused on many different subjects, were investigated and compared. Some authors focused in their research on certain aspects of CP, like oral motor functions and oral health (Carvalho et al., 2011), and the prevalence of oromotor dysfunction (Santos et al., 2009; Edvinsson et al., 2015). Other authors focused in their research on the prevalence and risk factors of caries. (wyne, 2017), and (De Camargo et al., 2011; Santos et al., 2009), periodontal status and oral findings in children (Hana et al., 2015; Nouf et al., 2011). On the other hand, the focus in some of the studies was on aspects like the quality of life related to oral health of children having cerebral palsy (Leme et al., 2012; Abanto et al., 2012).

It was decided that it would be very beneficial to conduct a study in which we consider the many aspects of CP including; caries, gingival index, orofacial dysfunction, oral hygiene index, and oral health related quality of life.

## 7.2. Discussion of materials and methods

A cross-sectional study was conducted in the pediatric population with CP in Turkey republic (102 children ; 61 males and 41 female, mean age 8,6 ± 1,62, and range 3-16), The number of subjects investigated was quite diverse in many different research papers, with the largest number of subjects being 478 by Al-Allaq et al., 2015, followed by 200 subjects investigated by De Camargo et al., 2008, 124 subjects by Santos et al., 2005, and 53 subjects only by Nallegowda et al., 2005.

Cerebral palsy (CP) is a combination of neurodevelopmental conditions that manifest as motor disorders, where there is a negative influence on orofacial functions that form the bare minimum requirements that enable the individual to socially interact with others in term of emotional communication, speech, appearance and facial expression. Examples of these functions include muscle posture (e.g., tongue and mouth posture), and vital actions (e.g., chewing, swallowing, and breathing,). Several scales can be involved in assessing the orofacial function. Orofacial Motor Function Assessment Scale (OFMFAS) was used by authors in other studies (Leme et al., 2012; Santos et al., 2009).

This study used the Nordic Orofacial Test Screening, known as the NOT-S. This procedure was verified, which allowed the screening to only take 5 to 7 minutes and to be easily applicable, which agrees with Bakke et al., 2007 .The NOT-S was shown to be a valuable tool by these authors, as it was able to comprehensively screen the orofacial dysfunction, and was quick and simple to perform. In addition to the clear instructions and understanding of the steps and tasks that was made possible by the picture manual in this test screening.

The objective of NOT-S is to recognize areas at which orofacial dysfunction takes place and which need special attention. This test screening is simple and quick to administer, and it can be used in different age groups that start from 3 years old. This procedure allows the specialist conducting the examination to deliver a numerical expression of what he perceives of the behaviors and characteristics observed. (Bakke et al., 2007; Bergendal et al., 2009; Lundeborg et al., 2009).

Caries prevalence in this study: The assessment of caries was conducted according to the 2013 criteria set by World Health Organization (WHO) for dental caries in order to recognize and locate decayed, missing and filled teeth in primary teeth (dmft) , as well as in permanent teeth (DMFT) indices were used.

The caries prevalence of DMFT/dmft was recorded as a numerical expression by calculating the number of missing, filled and carious teeth for every patient independently. The final evaluation of the dmft and DMFT values calculated the values separately and then summed them as in d+m+f+D+M+F. After that the results were ready, and then the relations dmft+DMFT = 0 and dmft+DMFT> 0 were used to express caries-free and

presence of caries respectively. Together, these express the severity of caries (WHO guidelines). Expressing group and individual oral hygiene was achieved using simplified Oral Hygiene Index (OHI-S); by which the current status of oral hygiene is measured according to the amount of calculus and debris taking place inside the mouth. Field surveys regarding periodontal disease very often use this procedure. OHI-S is different from OHI in three main ways; the particular method of selecting the teeth, the scored number of tooth surfaces (It is 12 in OHI and 6 in OHI-S), and the final scores. Since the examination was conducted on small children and was not performed on a fully equipped dental chair, it was decided that simplified scores were more suitable to use (J. G. Greene & Vermillion, 1964; J.C. Greene, 1967).

The use of gingival indices can include several options, which are generally divided into two main types; non-invasive indices (visual only(, and invasive (by involving the instrument). Since these children have little motor control, difficulties in communication, sensory-motor deficits and altered cognitive function (Santos & Nogueira, 2005; Kenny et al., 1989), and since the examination was not performed on a fully-equipped dental chair, the Modified Gingival Index (MGI) was decided to be a better approach in this study. Invented by Lobene et al. (1986), the Modified Gingival Index, as its name suggests, introduced some modifications on the way by which the Gingival Index is used (Löe and Silness, 1963), through a non-invasive (no-probing) index and by readjusting the rating for inflammation of mild-to-moderate severity.

This study was a collaboration between the Department of Dentistry and the Department of Physical Medicine and Rehabilitation; the specialists in the Department of Physical Medicine and Rehabilitation handled the diagnosis of cerebral palsy type, the manual ability and the gross motor function classifications.

Classification of individuals having CP was done according to the types of CP they have, and these are spastic diplegia (31,4%), spastic quadriplegia (31,4%), spastic hemiplegia(30,4%), mixed Cerebral Palsy (5,9%), and dyskinetic(1,0%), from the most to the least in prevalence.

Classification was also done according to the GMFCS of the individuals, which categorizes gross motor function by an ordinal scale of five levels using one rating that describes the ambulatory performance of children across different distances and terrains, which led to the therapists and parents tending not to rate children based on their typical performance, but rather, on their best capacity.

Also, classification of CP individuals considered their manual ability, and it was using their Manual Ability Classification System that they were classified into 5 levels. The purpose of the MACS was to analyze and report the performance of the upper extremity of day-to-day tasks for individuals with Cerebral Palsy (Rethlefsen et al., 2010; Palisano et al., 2007; Graham et al., 2004; Eliasson et al., 2006).

Multidimensional oral-health-related concepts have raised some increasing concerns for which theoretical measures and concepts of oral-health-related quality of life (OHRQoL) were developed. The OHRQoL is subjectively evaluated as in it "reflects people's comfort when eating, sleeping and engaging in social interaction; their self-esteem; and their satisfaction with respect to their oral health" (DHHS, 2007). In short, the quality of life is the final result of an interactive relationship among and between oral health conditions, contextual and social factors in general (Locker et al., 2005), And everything else in the body (Atchison et al., 2006).

The measures concerning OHRQoL are being applied with increasing rates in clinical trials in dentistry and surveys of oral health (Slade, 1997). However, the quality of life and the oral health status of children having Cerebral Palsy are measured by a limited number of studies (Ashiry et al., 2016; Abanto et al., 2012).

(Abanto et al., 2012) used, in her study the Children's Oral Health Related Quality of Life instrument which combines the Parental-Caregivers Perception Questionnaire (P-CPQ) and Family Impact Scale (FIS). In the study conducted by Ashiry et al., 2012 OHRQoL was mesaured by the Franciscan Hospital for Children Oral Health-Related Quality of Life (FHC-OHRQOL).

In this study, the English language was the initial language by which (Huntington et al., 2011) has validated and developed the Pediatric Oral Health-Related Quality of Life

(POQL), and (Yazicioğlu et al., 2018) have recently translated and validated it into Turkish language.

The POQL is uniquely suited to capture the influence of oral conditions in both the population at risk of potential syndromes and the general population of children in order to have a better characterization of the general state of oral health in the pediatric population (Huntington et al., 2011).

### 7.3. Discussion of results

Most of the studies included in this thesis show that oral disease in any form acts as a major health problem for those having disabilities in the population (Scott et al., 1998; Aytaç, 2000; Faulks et al., 2000; Jurek & Reid, 1994). The severity and prevalence of oral disease in the group with disabilities are found to be higher than they are in the general population. Children with disabilities have shown a prevalence of poor oral hygiene and periodontal health (Shyama et al., 2001; van Houtem et al., 2007) It was concluded that these negative results can be attributed to the poor physical abilities in this group, which make tooth brushing quite difficult to achieve. In general, oral health can be negatively influenced by any of the following: incomplete awareness of the importance and vitality of the management of oral health (Lindemann et al., 2001), difficulties in expressing the specific needs in oral health, the negative influence on gum health caused by anticonvulsant medications, and the fear and reluctance these individuals usually have of oral health procedures (Marshall et al., 1999; Gordon el at., 1998).

Orofacial dysfunction, in this study, was assessed using the NOT-S. The NOT-S relied in its content on the data provided by a survey to analyze aspects of orofacial function. The aspects of OFD were characterized mainly using data provided by common examination questions used in clinics to identify orofacial problems, as well as clinical and epidemiological studies.

Orofacial dysfunction in one or more NOT-S domains occurred in 78.4% of the participants. 16 children could not participate in the examination part of the NOT-S clinical examination.

In this study The mean value of Nordic total score of the 102 participants was (3±2,36 range 0-9), which was a little lower than the mean in different studies (Bakke et al., 2007; Edvinsson et al., 2015). The mean NOT-S total score that these other studies gave was of range (0-10); M (4.1), in (Bakke et al., 2007), the total score of the healthy children was of range (0-2); M (0.4). This difference may be attributed to the fact that those children who were included in this study were attendees of the clinic of Physical Medicine and Rehabilitation, which allowed them to get continuous care. Another finding was that children who had mixed Cerebral Palsy were the ones with the highest mean total score of Nordic of 7±1,67.

Interview results:

The highest OFD prevalence was found in the domain "Habits" 31,4% followed by "Sensory function" 30,4% and "Chewing and swallowing" 29,4%, The most prevalent items were 'Does brushing your teeth elicit a gag reflex?' 22,5%, 'Do you bite your teeth together hard or grind your teeth during the day?' 18,6%

Examination results:

It was found that the highest OFD prevalence was found in the domain 'Oral motor function' 48,2% followed by 'Facial expression' 44,0%, 'Speech' 39.2%, The most prevalent items were 'Lick your lips 36,9%, 'Blow up your cheeks and hold for at least 3s" 35,3%, in the 'Oral motor function domain and 'Try to whistle" 31,0%, in the 'Facial expression' domain.

Participants of all GMFCS levels had OFD, and increased levels of GMFCS (from level 1=62.5% to level 5=100%) showed increased prevalence of OFD. All levels of MACS also showed occurrence of OFD and increased levels of MACS (from level 1=71.4% to level 5=100%) also showed increased prevalence of OFD. In other words, oral dysfunction prevalence was directly proportional to problems with gross motor function and the

problems with manual ability. A result that is consistent with the conclusions reached by (Edvinsson et al., 2016 )in his study and with other studies by( Benfer KA et al., 2013 and Parkes J et al., 2010).

Participants with all diagnosed types of CP also had OFD, no significant difference in the total score between genders.

Feeding problems, in particular, were demonstrated in approximately one-third of Cerebral-Palsied children in a study by (Akhter, 2018).

Problems in chewing and swallowing are due to abnormalities in oral motor activity; eating takes a noticeably long time compared to children with no neurological problems, . In this study, the "chewing and swallowing" domain reported problems in 29.4% of the participants. As much as 18,6% of those experienced difficulties in eating foods with particular consistencies, 16,7% said they don't chew even when swallowing large bites, and 14,7% said they take as much as 30 mins to finish a basic meal.

18.6% of the entire group said they had the habit of grinding their teeth throughout the day, which is consistent with studies that reported a high bruxism prevalence in individuals with Cerebral Palsy (Dos Santos et al., 2003; Pope JEC et al., 1991). The study has also showed that 15.7% of the participants reported drooling problems, which is also consistent with studies that demonstrated the sialorrhea being a major problem for Cerebral Palsied-patients with a prevalence rate that ranges between 10% - 58% (Bothwell rt al, 2002; Jongirus et al., 2004; Mathur, 2008), and 16.7% of the patients had a problem in the domain 'Dry mouth', which is possibly a side effect of their prescribed medications. 36.9% of the patients could not lick their lip, 35.3% could not Blow up their cheeks and hold for 3 seconds at least, which may be attributed to the Impaired oral motor function. 39.2% had a problem in the 'speech' domain, which is consistent with articles showing delay in speech and language is common and usually more severe in cases of quadriplegic CP (Crary et al., 1995; Yoshida et al., 2010).

Communication problems, low ability of speech production in particular, are thought to be a direct result of the impairment in motor function resulting from a damaged neuromuscular control of the mechanism of speech (Perilla, 2002). In regard to the oral hygiene status and the gingival status, it was found that those who didn't suffer from oral

dysfunction (NOT-S score = 0) had better gingival health and oral hygiene than those who reported a dysfunction in at least one domain of the NOT-S.

Another study suggested that this situation could be attributed to the lack of dental care-information (Guerreiro et al., 2009) as well as the difficulties in conducting daily oral hygiene, resulting from orofacial motor dysfunction and altered intraoral sensitivity (Santos et al., 2009; Carvalho et al.,2011) .These results, however, are inconsistent with the conclusion reached by (Carvalho et al., 2011), that the level of impairment of oral motor function did not have an indicative relationship with the level of oral health in individuals with Cerebral Palsy.

This study did not show any relationship between the final score of NOT-S and the scores of dmft/DMFT in children of ages 3 – 11 years old, but such relationship was clearly demonstrated in children of ages 12-17 years old; children who reported higher oral motor dysfunctions also had higher caries in their permanent teeth, which is consistent with the findings of (Rodrigues Santos et al., 2009).

Periodontal alterations and dental caries are presented more intensively and more clearly in adolescents who have Cerebral Palsy than in those patients who have no neurological deficiency (Du et al., 2010; Santos et al., 2009)

The mean indices of DMFT and dmft were noticeably higher in Cerebral Palsied-patients than in healthy children as shown by articles that evaluated caries prevalence (De Camargo et al.,2008; Nallegowda et al., 2005; Guare and Camponi, 2003). However, few studies showed that no difference that is statistically important was recorded between children who had Cerebral Palsy and children who did not have any disabilities (Subramaniam et al., 2010; Carvalho et al., 2011; Du et al., 2010).

Two other studies show that caries experience was generally lower in individuals with mixed dentition, considering the indices of both the DMFT and the dmft dentitions (Nielsen, 1988; Diniz et al., 2015). A lower DMFT index is reported in children having Cerebral Palsy, compared to those who don't, as suggested by Shun-Te Huang et al., 2010 Among Cerebral Palsy populations, evidences of caries differences are quite controversial.

According to a national survey conducted in Turkey, that mainly collected the mean value of dmft in the examination of children in Istanbul, Turkey (Statistical yearbook of Turkey), the prevalence of children aged 5-6 years old and having dental caries is 76.8%, which was a higher value than that of the dmft-mean of Austria and Australia for children aged 6 years old and Germany for children aged 6-7 years old. It was lower, however, than the values of the dmft of Abu Dhabi and the KSA for children aged 6 years old. A dmft-mean of 4.4 was reported by another study for children aged 6 years old in Turkey (Momen et al.,. 2002; Stadtler,2003).

This study has also evaluated the prevalence of caries in Cerebral-Palsied children aged 3-16 years old; this population was, then, divided to 3 groups, each as a separate classification; group with primary teeth (aged 3-6 years old) had a mean dmft of (4,06±5,65), group with transitional teeth (aged 7-11 years old) had a mean dmft+DMFT of (3,54±3,42), and group with permanent teeth (aged 12-16 years old) had a mean DMFT of (3,69±6,94). The conclusion of this evaluation, in our study, states that the prevalence of children aged 3-16 years old having dental caries is 70,4%, which is close to the dental caries indices of Turkish children according to the last national survey of dental health (Gökalp et al., 2010).The similar, or low, DMFT and dmft indices reported in this study might also be attributed to the fact that participants were given the treatment of the rehabilitation center that offered constant preventive education. (Sehrawat et al., 2014).

In the part concerning the oral hygiene status in this study, the scores of both the calculus and the debris were collected by the use of the simplified oral-hygiene index to evaluate the oral hygiene status in children having CP and included in this study.

This study reported OHI-S mean in three different groups; it was 0,12±0,37 for those participants aged 3-6 years old, 0,5±0,84 for participants aged 7-11 years old, and 1,35±1,52 for participants aged 12-17 years old. It was found statistically significant difference between for age of groups of OHI-S (p=0,03). Moreover, due to the poor oral hygiene it induces the plaque formation on teeth causing inflammation of the surrounding gum tissues. Previous studies reported higher values of gingival hyperplasia and gingival bleeding in children having Cerebral Palsy (Roberto et al.,.2012; Du et al., 2010).

It is possible that this situation could also be attributed to the lack of dental-care information (Guerreiro et al., 2009) as well as the difficulties in conducting daily oral hygiene, resulting from orofacial motor dysfunction and altered intraoral sensitivity (Bratthall et al.,.2000; Kiwanuka et al., 2004). The situation can also be attributed to yet another related factor, which is the involvement of anticonvulsants (phenobarbital, sodium valproate, and DPH), because these particular medications are responsible for gingival hyperplasia and can represent a sign for periodontal diseases (Adawakun et al., 2005).

This study reported Gingival-index-mean of three groups, divided in the same way as was the groups of the OHI-S mean; the Gingival-index-mean was 0,32±0,59 for participants aged 3-6 years old, 0,77±0,72 for the participants aged 7-11 years old, and 1,44±0,96 for participants aged 12-17 years old. It was found statistically significance between age of groups of Gingival (p=0,001).

It is firmly established that, when it comes to children, the level of oral hygiene is directly proportional to the health of gingival tissues. Subsequently, the significance of good oral hygiene to reduce gingivitis and prevent any progressive stages of the disease in the future is simply acknowledged.

In this study It was also found that there is a correlation between gingival index (GI) values and oral hygiene index (OHI-S), and so, the highest mean of GI scores was recorded for those children having the highest mean of OHI-S scores (p=0.001)

This study has found another remarkable correlation between the scores of both the GI and the OHI-S and the scores of DMFT (p=0.001). There is also a possible relationship between dental caries in Cerebral-Palsied-individuals and each of oromotor dysfunction and intellectual disability, as suggested by (Diniz et al.,2015)

Akhter et al., 2016 has analyzed the factors and prevalence associated with the experiencing of dental caries, in children having Cerebral Palsy, in a low-resource setting (Akhter et al.,. 2016). A study by A.Sedky, 2018 has also focused on assessing the status of dental and oral and health of children having Cerebral Palsy in Egypt relative to gross motor skills and different types of CP. Two conclusions are reached by both of these studies; the first was that a less-functional Cerebral Palsy in children (as in cases of GMFCS levels 4-5) is associated with a high caries experience, as opposed to cases of a

more-functional Cerebral Palsy (GMFCS levels 1-3) (Sedky,2018; Akhter et al.,. 2016), the second was that the group with spastic quadriplegia also had a higher caries experience than any group with different spastic subtypes (Sedky,2018; Akhter et al., 2016).

This study was also concerned about evaluating the status of dental and oral health in Cerebral-Palsied children in Turkey, relative to manual ability skills, gross motor skills, and different types of Cerebral Palsy. It was found that the differences between the MACS levels and the GMFCS levels in terms of caries experience and dmft/DMFT scores are statistically insignificant ($p>0.05$). On the other hand, a study conducted in England by Pope et al., 1991 found that the Cerebral-Palsied-children have no significant difference from their healthy group in terms of caries experience. The reason for that was that children with Cerebral Palsy tend to get their carious teeth simply extracted rather than receiving restorative care. Furthermore, restorative care provided to the cp group was relatively inadequate compared to that usually provided to normal children (Pope et al., 1991). Another reason for that may lie in the findings, in this study, that show more than 50% of children either rely on their families' help in brushing their teeth, or, at least, require their supervision, leaving only 33,7% of children to brush their teeth completely by themselves. The definition of oral-health-related quality of life is "The influence of disease or oral health on the well-being and daily functioning of an individual". It is frequently reported that parents of those children who suffer from Cerebral Palsy experience a bigger number, and higher severity, of problems in daily life (Santos et al., 2010; Abanto et al., 2012; Camargo et al.,2008).

There is a relationship of inverse proportionality between caregiving needs in affected children and the status of both physical and psychological health in parents and other members of the family (Lee et al., 2010). This means that many caregivers may find taking care of a disabled child at home a stressful responsibility (Munir et al., 2016).

It was mentioned, by Akhter et al., 2019 that the high experiencing of caries negatively influences the OHRQoL .Since the sample on which that study was conducted belonged to a rural area that consists of a group of a poorer socio-economic level, this conclusion refers more to the cases with the highest severity of OHRQoL among adolescents and children with Cerebral Palsy.

This study also supports the previously-mentioned conclusion; there was found a remarkable correlation between the total score of POQL and each of OHI-S (p=0,012), gingival index (p=0,011), caries presence (p=0.001), and the family income (p=0,03).
In addition to that, the relationship between orofacial dysfunctions and the effect they have on OHRQoL is evaluated by several studies, according to (Leme et al., 2015). These studies have supported the negative influence that orofacial dysfunction has on OHRQoL in schoolchildren of Brazil. That sample showed that there is a remarkable association between a poorer OHRQoL and orofacial dysfunction. In this study, however, there was no significant difference in the scores given between NOT-S and OHRQoL (p=0 ,750).

## 8. CONCLUSION

1- Orofacial dysfunction in one or more NOT-S domains occurred in 78.4% of the participants.
2- The mean NOT-S score of the cerebral palsy patients was 3.08±2.49.
3- Orofacial dysfunction was present in all Gross motor function levels. Prevalence of Orofacial dysfinction increased with increasing levels of Gross motor function from level I=62.5% to level V=100%.
4- Orofacial dysfunction was present in all Manual ability levels. Prevalence of orofacial dysfunction increased with increasing levels of MACS from level I=71.4% to level V=100%,
5- Patient with higher Gross Motor Function levels (full dependent, levels; IV,V) had higher NOT-S mean score which indicates higher orofacial dysfunction ($p<0,05$)
6- Correlation between total NOT-S score and Age, gender, POQL total score was not found.
7- There was a positive correlation between NOT-S score and the gingival and the simplified oral hygiene indices scores. Orofacial dysfunction affected the gingival health and the oral hygiene of the patients.
8- There was no correlation between the NOT-S and dmft/DMFT scores in the ages 3-11, a positive correlation was found between the NOT-S score and DMFT in patients aged 12-17.
9- The prevalence of dental caries in all patients was 70.4%.
10- The gingival index score and the OHI-S score were positively correlated ($p=0.01$).
11- The gingival index score and the DMFT score were positively correlated ($p=0.01$).
12- Patients with higher dmft+DMFT values had significantly higher total POQL score ($p=0,001$).
13- Patients with higher gingival index and OHI-S had significantly higher POQL score ($p=0.01$)
14- More than half of the patients did not brush their teeth on daily basis, therefore, It is important to raise the parents' awareness regarding oral health practices which

promote and establish a sound oral health status of a child which will positively contribute to the child's quality of life

15- Multidisciplinary collaboration between physicians and pediatric dentists can make a major contribution in improving the patients' health and quality of life.

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# 10. ENCLOSURES

**Enclosure 1. Clinical examination form**

Tarih:

## Marmara Üniversitesi Diş Hekimliği Fakültesi Pedodonti Anabilim Dalı Yüksek Lisans Tezi Anket Formu

AD - SOYAD:

TC:

Cinsiyet: KIZ ERKEK

DOĞUM TARİHİ:(gg/aa/yy)

Gestesyonel hafta:

Telefon no:

Adres:

Anne yaşı:

Baba yaşı:

Ebeveyn iş: anne (çalışıyor / çalışmıyor)

baba (çalışıyor / çalışmıyor)

Anne eğitim düzeyi: okur-yazar değil / okur-yazar / ilkokul / ortaokul-lise / üniversite

Baba eğitim düzeyi: okur-yazar değil / okur-yazar / ilkokul / ortaokul-lise / üniversite

Gelir düzeyi (TL): <500 / 500-1000 / 1000-3000 / >3000 İlişki: beraber / boşanmış /ayrı yaşıyor

Kardeş sayısı:

Bakımveren: anne / baba / diğer

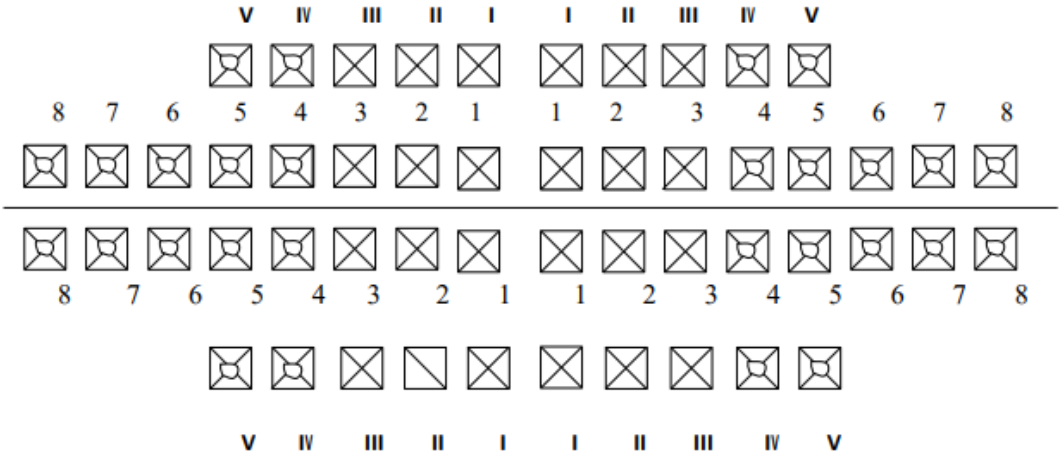
Dominant el:

Serebral palsi tipi: spastik kuadripleji / spastik dipleji / spastik hemipleji / diskinetik / mikst

KMFSS: MACS:

**MUAYENE BULGULARI**

D: M: F:




**Simplified Oral Hygiene Index:**

**Debris index:**

| | | |
|---|---|---|
| **6** | **1** | **6** |
| | | |
| **6** | **1** | **6** |
| | | |

**Calculus index:**

| | | |
|---|---|---|
| **6** | **1** | **6** |
| | | |
| **6** | **1** | **6** |
| | | |

**Simplified Oral Hygein Index (OHI-S)** :

**Gingival Index Score: (0, 1, 2, 3, )**

**Enclosure 2. NOT-S**

| | NOT-S Anamnez | SKOR |
|---|---|---|
| I | **Duyusal Fonksiyon** | |
| | A. Dişlerinizi fırçalarken kusma refleksiniz oluyor mu? Bu hemen hemen her zaman meydana geliyor mu? ☐ | |
| | *Açıklama: Mide bulantısı, kusma veya reflü gibi bariz bir rahatsızlık(artmış hassasiyet).* | |
| | B. Ağzınıza çiğnemede zorlanacağınız kadar fazla miktarda yiyecek aldığınız oluyor mu? Bu hergün oluyor mu? ☐ | |
| | *Açıklama: Ağzın ne zaman dolu olduğunu bilmiyor(azalmış hassasiyet).* | ☐ |
| II | **Solunum** | |
| | A. Herhangi bir solunum desteği kullanıyor musunuz? ☐ | |
| | *Açıklama: CPAP, solunum cihazı, boksijen, diğer.* | |
| | B. Uyurken çok fazla horluyor musunuz? Bu hemen hemen her gece meydana geliyor mu? ☐ | |
| | *Açıklama: Horlama veya apne. Astım veya alerji semptomları olan hastalarda geçerli değildir.* | ☐ |
| III | **Alışkanlıklar** | |
| | A. Tırnak yemek veya parmak ya da başka bir objeyi emmek gibi hergün tekrarlayan bir alışkanlığınız var mı? ☐ | |
| | *Açıklama: 5 yaş altında emzik kullanımı ve parmak emme değerlendirmeye dahil değildir.* | |
| | B. Dudak, dil veya yanak ısırmak ya da emmek gibi hergün tekrarlayan bir alışkanlığınız var mı? ☐ | |
| | C. Gün boyunca dişlerinizi sıkıyor veya gıcırdatıyor musunuz? ☐ | ☐ |
| IV | **Çiğneme ve Yutkunma** | |
| | A. Ağızdan beslenmiyor (nazogastrik tüp, gastrostomi veya diğer) B-E sorularını atlayınız. ☐ | |
| | B. Normal kıvamdaki yiyecekleri çiğnerken zorlanıyor musunuz? ☐ | |
| | *Açıklama: Alerji veya vejeteryan, vegan veya glutensiz diyetler gibi özel diyetler değerlendirmeye alınmamalıdır.* | |
| | C. Bir ana yemeği yemeniz 30 dakika veya daha fazla sürüyor mu? ☐ | |
| | D. Büyük lokmaları çiğnemeden yutuyor musunuz? ☐ | |
| | E. Yemek sırasında sık sık öksürüyor musunuz? ☐ | |
| | *Açıklama: Neredeyse her öğünde oluyor.* | ☐ |
| V | **Salya Akışı** | |
| | A. Hemen hemen hergün ağzınızın köşesinde veya çenenizde tükürük oluyor mu? ☐ | |
| | *Açıklama: Ağzını silme ihtiyacı vardır. Uykuda olan salya akışı dahil edilmez.* | ☐ |
| VI | **Ağız Kuruluğu** | |
| | A. Bir kraker yiyebilmek için içeceğe ihtiyaç duyuyor musunuz? ☐ | |
| | B. Ağız içinizde ya da dil yüzeyinizde ağrıdan şikayetçi misiniz? ☐ | |
| | *Açıklama: En az haftada bir kez tekrar eden ağrı veya yanma hissi Diş ağrısı veya ağzında vezikülleri (baloncuk şeklinde lezyonlar) olan hastalarda geçerli değildir.* | ☐ |
| *Ad:* | ***NOT-S Anamnez TOPLAM*** | ☐ |

## NOT-S Klinik Muayene

| | | | SKOR |
|---|---|---|---|
| **1** | ***İstirahat Pozisyonunda Yüzün Durumu*** | | |
| | | **Şimdi,1 dakika boyunca resme bakınız.** | |
| | *1. Resim* | *1 dakika boyunca hastanın gözlenmesi. A-D değerlendiriniz.* | |
| | *A.* | **Asimetri** ☐ | |
| | *Açıklama:* | *Hem yumuşak dokuları hem de iskeletsel yapıyı ilgilendirir.* | |
| | *B.* | **Deviasyona uğramış dudak** ☐ | |
| | *Açıklama:* | *İzleme süresinin 2/3 ünden fazlasında açık ağız ve diğer deviasyonlar* | |
| | *C.* | **Deviasyona uğramış dil** ☐ | |
| | *Açıklama:* | *İzleme süresinin 2/3 ünden fazlasında dil ucu dişler arasında görülmektedir* | |
| | *D.* | **İstemsiz hareketler** ☐ | |
| | *Açıklama:* | *Tekrarlanan istemsiz yüz hareketleri* | ☐ |
| **2** | ***Burun Solunumu*** | | |
| | *2. Resim* | *A.* **Ağzınızı kapatın ve 5 kere burnunuzdan derin nefes alın (koklayın).** | |
| | *Kriter:* | *Peş peşe 5 kere burundan nefes alamıyor.* | |
| | | *Eğer hasta dudaklarını kapatamıyorsa; kendisi ya da muayene eden kişi el yardımıyla kapatmaya yardımcı olabilir. Soğuk algınlığı olan hastalarda uygulamayın.* | ☐ |
| **3** | ***Yüz Mimikleri*** | | |
| | *3. Resim* | *A.* **Gözlerinizi sıkı bir şekilde kapatın** ☐ | |
| | *Kriter:* | *Yüz kasları simetrik bir şekilde aktive olamıyor* | |
| | *4. Resim* | *B.* **Dişlerinizi gösterin** ☐ | |
| | *Kriter:* | *Dudak ve yüz kasları, dişleri gösterecek kadar simetrik olarak aktive olamamıştır.* | |
| | *5. Resim* | *C.* **Islık çalmayı deneyin** ☐ | |
| | *Kriter:* | *Dudaklarını öne doğru ya da yuvarlak biçimine getiremiyor.* | ☐ |
| **4** | ***Çiğneme Kasları ve Çene Fonksiyonu*** | | |
| | *6. Resim* | *A.* **Arka dişlerinizle sıkıca ısırın.** ☐ | |
| | *Kriter:* | *İki parmak çiğneme kaslarının üzerinde tutulduğunda (her iki taraftaki masseter kasları) hiçbir belirgin simetrik aktivite kaydedilemez.* | |
| | *7. Resim* | *B.* **Ağzınızı açabildiğiniz kadar geniş bir şekilde açın** ☐ | |
| | *Kriter:* | *Sol elinin işaret ve orta parmağını ağzına sokabilecek kadar ağzını açamıyor. Eğer ön dişleri kayıpsa yüzük parmağı da dahil, 3 parmağını ağzına alabilecek kadar açamıyor.* | ☐ |
| **5** | ***Oral Motor Fonksiyon*** | | |
| | *8. Resim* | *A.* **Dilinizi dışarı çıkarabildiğiniz kadar çıkarın** ☐ | |
| | *Kriter:* | *Hasta dilin ucuyla, Vermillion hattının ötesine ulaşamıyor.* | |
| | *9. Resim* | *B.* **Dudaklarınızı yalayın** ☐ | |
| | *Kriter:* | *Dil ucunu dudaklarını ıslatmak için kullanamıyor ve ağız köşesine yetişemiyor.* | |
| | *10. Resim* | *C.* **Yanaklarınızı şişirin ve en az 3 saniye öyle kalın** ☐ | |
| | *Kriter:* | *Hava sızdırmadan veya ses çıkarmadan yanaklarını şişiremiyor.* | |
| | *11. Resim* | *D.* **Ağzınızı geniş bir şekilde açın ve "ah-ah-ah" [a] deyin** ☐ | |
| | *Kriter:* | *Uvula ve yumuşak damakta belirgin bir yükselme gözlemlenmiyor.* | ☐ |
| **6** | ***Konuşma*** | *A.* **Konuşamıyor (B-C'yi atlayın)** ☐ | |
| | *12. Resim* | *B.* **Yüksek sesle 10'a kadar sayın** ☐ | |
| | *Kriter:* | *Bazı sesler belirsizdir ve konuşma anlaşılmaz, ya da burundan konuşma problemi vardır.5 yaş altında R,S ve TH seslerini değerlendirmeyin.* | |
| | *13. Resim* | *C.* **Pataka, Pataka, Pataka söyleyin** ☐ | |
| | *Kriter:* | *5 yaş altındaki çocuklara uygulamayın.* | ☐ |
| ***Ad:*** | | ***NOT-S MUAYENE TOPLAM*** | ☐ |

**Enclosure 3. POQL**

**Lütfen Soruları Cevaplayınız:**

| | | | | | |
|---|---|---|---|---|---|
| Genel olarak çocuğunuzun sağlığı nasıl? | Mükemmel | Çok iyi | İyi | Orta | Kötü |
| | [ ]5 | [ ]4 | [ ]3 | [ ]2 | [ ]1 |
| Genel olarak çocuğunuzun ağız ve diş sağlığı nasıl? | Mükemmel | Çok iyi | İyi | Orta | Kötü |
| | [ ]5 | [ ]4 | [ ]3 | [ ]2 | [ ]1 |
| Bir yıl öncesiyle karşılaştırdığınızda çocuğunuz ağız ve diş sağlığı simdi nasıl? | Çok daha iyi | Biraz daha iyi | Ayni | Biraz daha kötü | Çok daha kötü |
| | [ ]5 | [ ]4 | [ ]3 | [ ]2 | [ ]1 |

| Geçtiğimiz 3 ayda… | Hangi sıklıkla meydana geldi? | | | | | Çocuğunuz ne kadar rahatsız oldu? | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Her Zaman | Bazen | Arada bir | Hiçbir zaman | Bilmiyorum | Çok rahatsız edici | Biraz rahatsız edici | Çok az rahatsız edici | Rahatsız edici değil | Hiçbir zaman | Bilmiyorum |
| 1. Çocuğunuzun ağız veya diş bölgesinden kaynaklanan bir ağrısı oldu mu? | [ ]3 | [ ]2 | [ ]1 | [ ]0 | [ ]9 | [ ]4 | [ ]3 | [ ]2 | [ ]1 | [ ]0 | [ ]9 |
| 2. Çocuğunuz ağız ve diş problemleri yüzünden yemek yeme de güçlük çekti mi? | [ ]3 | [ ]2 | [ ]1 | [ ]0 | [ ]9 | [ ]4 | [ ]3 | [ ]2 | [ ]1 | [ ]0 | [ ]9 |
| 3. Çocuğunuz ağız ve diş problemleri yüzünden okulda dikkat sorunu yasadı mı? | [ ]3 | [ ]2 | [ ]1 | [ ]0 | [ ]9 | [ ]4 | [ ]3 | [ ]2 | [ ]1 | [ ]0 | [ ]9 |
| 4. Çocuğunuz ağız ve diş problemleri yüzünden okula devamsızlık yaptı mı? | [ ]3 | [ ]2 | [ ]1 | [ ]0 | [ ]9 | [ ]4 | [ ]3 | [ ]2 | [ ]1 | [ ]0 | [ ]9 |
| 5. Çocuğunuzun ağız ve diş problemlerinden dolayı başkalarının yanında gülümsemekten kaçındığı oldu mu? | [ ]3 | [ ]2 | [ ]1 | [ ]0 | [ ]9 | [ ]4 | [ ]3 | [ ]2 | [ ]1 | [ ]0 | [ ]9 |

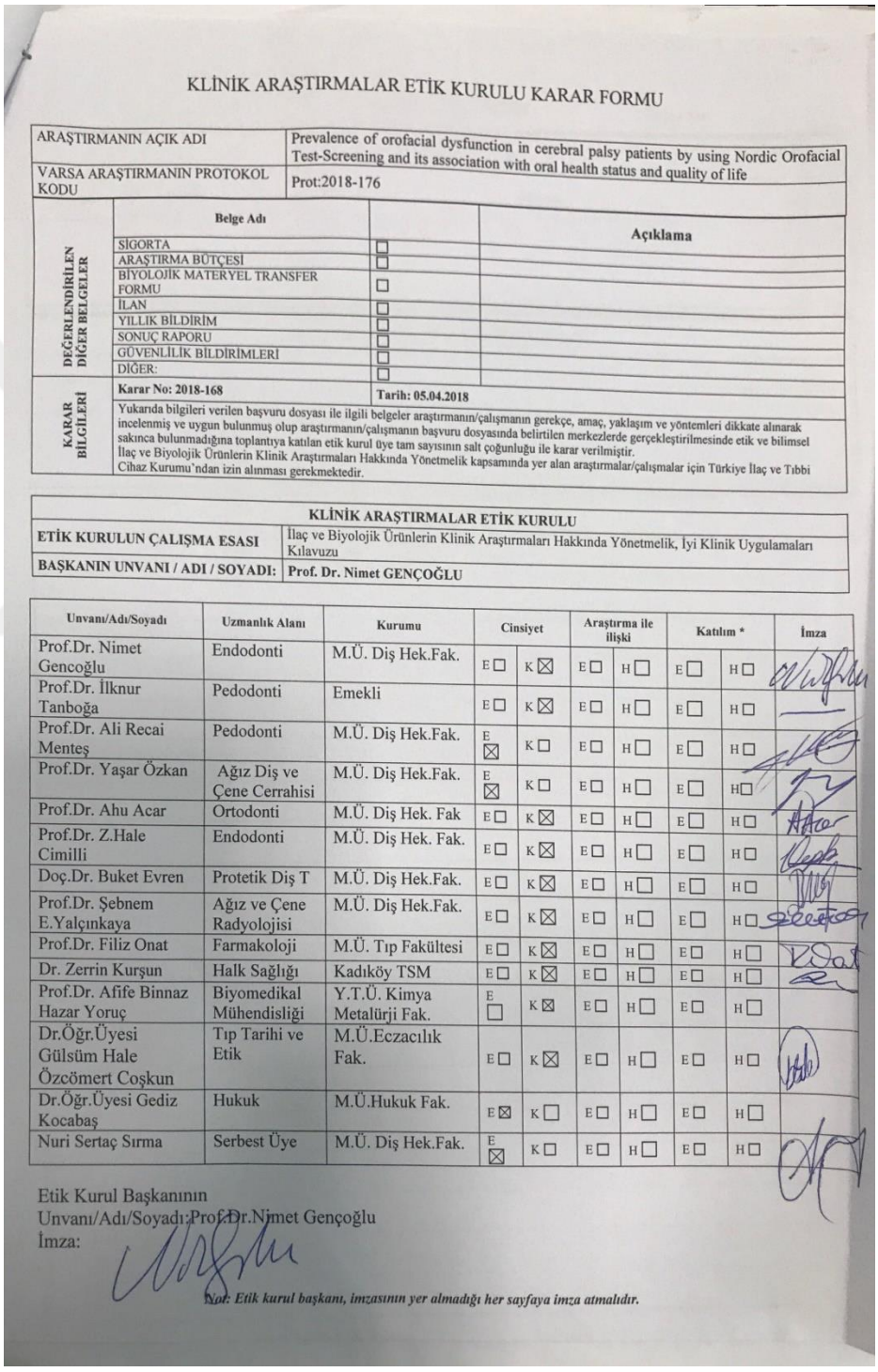


DIGER TARAFA GECIN LUTFEN



| Geçtiğimiz 3 ayda… | Hangi sıklıkla meydana geldi? | | | | | Çocuğunuz ne kadar rahatsız oldu? | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Her zaman | Bazen | Arada bir | Hiçbir zaman | Bilmiyorum | Çok rahatsız edici | Biraz rahatsız edici | Çok az rahatsız edici | Rahatsız edici değil | Hiçbir zaman | Bilmiyorum |
| 6. Çocuğunuz ağız ve diş problemleri yüzünden diğer çocuklardan daha çirkin olduğunu düşünüp endişelendi mi? | [ ]3 | [ ]2 | [ ]1 | [ ]0 | [ ]9 | [ ]4 | [ ]3 | [ ]2 | [ ]1 | [ ]0 | [ ]9 |
| 7. Çocuğunuz ağız ve diş problemleri yüzünden görünüşünden mutsuz oldu mu? | [ ]3 | [ ]2 | [ ]1 | [ ]0 | [ ]9 | [ ]4 | [ ]3 | [ ]2 | [ ]1 | [ ]0 | [ ]9 |
| 8. Çocuğunuz ağız ve diş problemleri yüzünden sinirli ve üzgün oldu mu? | [ ]3 | [ ]2 | [ ]1 | [ ]0 | [ ]9 | [ ]4 | [ ]3 | [ ]2 | [ ]1 | [ ]0 | [ ]9 |
| 9. Çocuğunuz ağız ve diş problemleri yüzünden endişelendi mi? | [ ]3 | [ ]2 | [ ]1 | [ ]0 | [ ]9 | [ ]4 | [ ]3 | [ ]2 | [ ]1 | [ ]0 | [ ]9 |
| 10. Çocuğunuz ağız ve diş problemleri yüzünden ağladı mı? | [ ]3 | [ ]2 | [ ]1 | [ ]0 | [ ]9 | [ ]4 | [ ]3 | [ ]2 | [ ]1 | [ ]0 | [ ]9 |

## Enclosure 4. Ethical Committee Approval



KLİNİK ARAŞTIRMALAR ETİK KURULU KARAR FORMU

| | |
|---|---|
| ARAŞTIRMANIN AÇIK ADI | Prevalence of orofacial dysfunction in cerebral palsy patients by using Nordic Orofacial Test-Screening and its association with oral health status and quality of life |
| VARSA ARAŞTIRMANIN PROTOKOL KODU | Prot:2018-176 |

| | Belge Adı | | Açıklama |
|---|---|---|---|
| DEĞERLENDİRİLEN DİĞER BELGELER | SİGORTA | ☐ | |
| | ARAŞTIRMA BÜTÇESİ | ☐ | |
| | BİYOLOJİK MATERYEL TRANSFER FORMU | ☐ | |
| | İLAN | ☐ | |
| | YILLIK BİLDİRİM | ☐ | |
| | SONUÇ RAPORU | ☐ | |
| | GÜVENLİLİK BİLDİRİMLERİ | ☐ | |
| | DİĞER: | ☐ | |
| KARAR BİLGİLERİ | **Karar No: 2018-168** | **Tarih: 05.04.2018** | |
| | Yukarıda bilgileri verilen başvuru dosyası ile ilgili belgeler araştırmanın/çalışmanın gerekçe, amaç, yaklaşım ve yöntemleri dikkate alınarak incelenmiş ve uygun bulunmuş olup araştırmanın/çalışmanın başvuru dosyasında belirtilen merkezlerde gerçekleştirilmesinde etik ve bilimsel sakınca bulunmadığına toplantıya katılan etik kurul üye tam sayısının salt çoğunluğu ile karar verilmiştir. İlaç ve Biyolojik Ürünlerin Klinik Araştırmaları Hakkında Yönetmelik kapsamında yer alan araştırmalar/çalışmalar için Türkiye İlaç ve Tıbbi Cihaz Kurumu'ndan izin alınması gerekmektedir. | | |

| KLİNİK ARAŞTIRMALAR ETİK KURULU | |
|---|---|
| **ETİK KURULUN ÇALIŞMA ESASI** | İlaç ve Biyolojik Ürünlerin Klinik Araştırmaları Hakkında Yönetmelik, İyi Klinik Uygulamaları Kılavuzu |
| **BAŞKANIN UNVANI / ADI / SOYADI:** | **Prof. Dr. Nimet GENÇOĞLU** |

| Unvanı/Adı/Soyadı | Uzmanlık Alanı | Kurumu | Cinsiyet | | Araştırma ile ilişki | | Katılım * | | İmza |
|---|---|---|---|---|---|---|---|---|---|
| Prof.Dr. Nimet Gencoğlu | Endodonti | M.Ü. Diş Hek.Fak. | E☐ | K☒ | E☐ | H☐ | E☐ | H☐ | |
| Prof.Dr. İlknur Tanboğa | Pedodonti | Emekli | E☐ | K☒ | E☐ | H☐ | E☐ | H☐ | |
| Prof.Dr. Ali Recai Menteş | Pedodonti | M.Ü. Diş Hek.Fak. | E☒ | K☐ | E☐ | H☐ | E☐ | H☐ | |
| Prof.Dr. Yaşar Özkan | Ağız Diş ve Çene Cerrahisi | M.Ü. Diş Hek.Fak. | E☒ | K☐ | E☐ | H☐ | E☐ | H☐ | |
| Prof.Dr. Ahu Acar | Ortodonti | M.Ü. Diş Hek. Fak | E☐ | K☒ | E☐ | H☐ | E☐ | H☐ | |
| Prof.Dr. Z.Hale Cimilli | Endodonti | M.Ü. Diş Hek. Fak. | E☐ | K☒ | E☐ | H☐ | E☐ | H☐ | |
| Doç.Dr. Buket Evren | Protetik Diş T | M.Ü. Diş Hek.Fak. | E☐ | K☒ | E☐ | H☐ | E☐ | H☐ | |
| Prof.Dr. Şebnem E.Yalçınkaya | Ağız ve Çene Radyolojisi | M.Ü. Diş Hek.Fak. | E☐ | K☒ | E☐ | H☐ | E☐ | H☐ | |
| Prof.Dr. Filiz Onat | Farmakoloji | M.Ü. Tıp Fakültesi | E☐ | K☒ | E☐ | H☐ | E☐ | H☐ | |
| Dr. Zerrin Kurşun | Halk Sağlığı | Kadıköy TSM | E☐ | K☒ | E☐ | H☐ | E☐ | H☐ | |
| Prof.Dr. Afife Binnaz Hazar Yoruç | Biyomedikal Mühendisliği | Y.T.Ü. Kimya Metalürji Fak. | E☐ | K☒ | E☐ | H☐ | E☐ | H☐ | |
| Dr.Öğr.Üyesi Gülsüm Hale Özcömert Coşkun | Tıp Tarihi ve Etik | M.Ü.Eczacılık Fak. | E☐ | K☒ | E☐ | H☐ | E☐ | H☐ | |
| Dr.Öğr.Üyesi Gediz Kocabaş | Hukuk | M.Ü.Hukuk Fak. | E☒ | K☐ | E☐ | H☐ | E☐ | H☐ | |
| Nuri Sertaç Sırma | Serbest Üye | M.Ü. Diş Hek.Fak. | E☒ | K☐ | E☐ | H☐ | E☐ | H☐ | |

Etik Kurul Başkanının
Unvanı/Adı/Soyadı:Prof.Dr.Nimet Gençoğlu
İmza:

*Not: Etik kurul başkanı, imzasının yer almadığı her sayfaya imza atmalıdır.*

# KLİNİK ARAŞTIRMALAR ETİK KURULU KARAR FORMU

| | |
|---|---|
| ARAŞTIRMANIN AÇIK ADI, PROTOKOL NO: | Prevalence of Orofacial Dysfunction in Cerebral Palsy Patients and its Association with Oral Health Status and Quality of Life 2019-347 |

| | | | |
|---|---|---|---|
| | İLAN | ☐ | |
| | YILLIK BİLDİRİM | ☐ | |
| | SONUÇ RAPORU | ☐ | |
| | GÜVENLİLİK BİLDİRİMLERİ | ☐ | |
| | DİĞER: | ☐ | |
| KARAR BİLGİLERİ | **Karar No: 2019-338** | **Tarih: 27.06.2019** | |
| | 2018-176 protokol ve 05.04.2018 2018-168 kara nolu çalışmada isim değişikliği yapılmıştır.<br>Yukarıda bilgileri verilen başvuru dosyası ile ilgili belgeler araştırmanın/çalışmanın gerekçe, amaç, yaklaşım ve yöntemleri dikkate alınarak incelenmiş ve uygun bulunmuş olup araştırmanın/çalışmanın başvuru dosyasında belirtilen merkezlerde gerçekleştirilmesinde etik ve bilimsel sakınca bulunmadığına toplantıya katılan etik kurul üye tam sayısının salt çoğunluğu ile karar verilmiştir.<br>İlaç ve Biyolojik Ürünlerin Klinik Araştırmaları Hakkında Yönetmelik kapsamında yer alan araştırmalar/çalışmalar için Türkiye İlaç ve Tıbbi Cihaz Kurumu'ndan izin alınması gerekmektedir. | |

| **KLİNİK ARAŞTIRMALAR ETİK KURULU** | |
|---|---|
| **ETİK KURULUN ÇALIŞMA ESASI** | İlaç ve Biyolojik Ürünlerin Klinik Araştırmaları Hakkında Yönetmelik, İyi Klinik Uygulamaları Kılavuzu |
| **BAŞKANIN UNVANI / ADI / SOYADI:** | **Prof. Dr. Ali Recai Menteş** |

| Unvanı/Adı/Soyadı | Uzmanlık Alanı | Kurumu | Cinsiyet | | Araştırma ile ilişki | | Katılım * | | İmza |
|---|---|---|---|---|---|---|---|---|---|
| Prof.Dr. Nimet Gencoğlu | Endodonti | M.Ü. Diş Hek.Fak. | E☐ | K☒ | E☐ | H☐ | E☐ | H☐ | |
| Prof.Dr. İlknur Tanboğa | Çocuk Diş hekimi | Emekli | E☐ | K☒ | E☐ | H☐ | E☐ | H☐ | |
| Prof.Dr. Ali Recai Menteş | Çocuk Diş hekimi | M.Ü. Diş Hek.Fak. | E☒ | K☐ | E☐ | H☐ | E☐ | H☐ | |
| Prof.Dr. Yaşar Özkan | Ağız Diş ve Çene Cerrahisi | M.Ü. Diş Hek.Fak. | E☒ | K☐ | E☐ | H☐ | E☐ | H☐ | |
| Prof.Dr. Ahu Acar | Ortodonti | M.Ü. Diş Hek. Fak | E☐ | K☒ | E☐ | H☐ | E☐ | H☐ | |
| Prof.Dr. Z.Hale Cimilli | Endodonti | M.Ü. Diş Hek. Fak. | E☐ | K☒ | E☐ | H☐ | E☐ | H☐ | |
| Doç.Dr. Buket Evren | Protetik Diş T | M.Ü. Diş Hek.Fak. | E☐ | K☒ | E☐ | H☐ | E☐ | H☐ | |
| Prof.Dr. Şebnem E.Yalçınkaya | Ağız ve Çene Radyolojisi | M.Ü. Diş Hek.Fak. | E☐ | K☒ | E☐ | H☐ | E☐ | H☐ | |
| Prof.Dr. Filiz Onat | Farmakoloji | M.Ü. Tıp Fakültesi | E☐ | K☒ | E☐ | H☐ | E☐ | H☐ | |
| Dr. Zerrin Kurşun | Halk Sağlığı | Kadıköy TSM | E☐ | K☒ | E☐ | H☐ | E☐ | H☐ | |
| Prof..Dr. Afife Binnaz Hazar Yoruç | Biyomedikal Mühendisliği | Y.T.Ü. Kimya Metalürji Fak. | E☐ | K☒ | E☐ | H☐ | E☐ | H☐ | |
| Dr.Öğr.Üyesi Gülsüm Hale Özcömert Coşkun | Tıp Tarihi ve Etik | M.Ü.Eczacılık Fak. | E☐ | K☒ | E☐ | H☐ | E☐ | H☐ | |
| Dr.Öğr.Üyesi Gediz Kocabaş | Hukuk | M.Ü.Hukuk Fak. | E☒ | K☐ | E☐ | H☐ | E☐ | H☐ | |
| Nuri Sertaç Sırma | Serbest Üye | M.Ü. Diş Hek.Fak. | E☒ | K☐ | E☐ | H☐ | E☐ | H☐ | |

Etik Kurul Başkanının
Unvanı/Adı/Soyadı: Prof. Dr. Ali Recai Menteş
İmza:

# Enclosure 5. Publication



## O:33 Prevalence of orofacial dysfunction in cerebral palsy patients by using Nordic Orofacial Test screening (NOT-S) and its association with oral health status and quality of life

Mennattallah Hussein Abdelrahman,[1] Isil Ozgul Kalyoncu,[1] Esra Giray,[2] Evrim Karadag,[2] Ilknur Tanboga[1]

1. Marmara University, School of Dentistry, Pediatric Dentistry Department, 2. Marmara University, School of Medicine, Department of Physical Medicine and Rehabilitation, Turkey

**Aim**: The objective of this study is to analyse prevalence of orofacial dysfunction in cerebral palsy (CP) patients by using Nordic Orofacial Test screening (NOT-S) and its association with oral health status and quality of life. **Materials-Methods**: A cross-sectional study on a population with CP in a Turkish country (100 individuals, age between (6-18) were assessed for orofacial function using the Nordic Orofacial test- screening (NOT-S), Gross Motor Function Classification System (GMFCS) and Manual Ability Classification System (MACS). Oral health related quality of life was assessed using the Parental- Caregiver Perceptions Questionnaire. Caries experience was measured by identifying decayed, missing, and filled teeth for deciduous and permanent teeth (dmft). **Results**: The study is on-going and results are in progress. **Conclusion**: The study shows the importance of considering the full range of orofacial function for individuals with CP. The potential impact of compromised orofacial function on individual's communication, social relationships, eating, drinking, and health. Moreover, the presence of orofacial dysfunction was associated with worse oral health related quality of life.

**Key words**: *Cerebral palsy, orofacial dysfunction, oral health, quality of life*

## O:34 Self-reported general health and wellbeing of people living with HIV (PLHIV) – implications for oral health: results from Positive Voices 2017

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**Background**: As a result of effective antiretroviral therapy (ART) almost all PLHIV accessing HIV care have undetectable viral loads and near normal life expectancy. Therefore, the dental challenge is no longer to detect/treat oral conditions associated with low CD4 count but rather to provide care for PLHIV on long-term ART. **Aim**: Explore self-reported general health and wellbeing of respondents who have attended a dental service in the last year. **Methods**: Positive Voices is a cross-sectional survey of a representative pre-selected sample of people attending 73 HIV clinics in England & Wales. Participants recruited between January and September 2017 completed an online/paper survey returned to Public Health England. The analyses included: (1) dental attendance in the last year (2) self-reported ever-diagnosed co-morbidities (3) ability to perform daily activities. **Results**: Of 4,416 respondents (51% response rate), 2,289 (52%) attended the dentist in the last year. In the dental subgroup analysis, the majority (76%) were male (including transmen), white British (60%), aged 36-65 years (81%) and 70% reported at least one co-morbidity. Commonly reported co-morbidities included: depression (39%), anxiety (30%), hypertension (23%), osteoporosis (8%), and diabetes (7%). Positive Voices dental attendees had poorer quality-of-life outcomes compared to the Health Survey for England general population:10% experienced severe or extreme pain/discomfort, 6% had severe problems walking or were wheelchair users and 2% had severe problems with or were unable to wash/dress themselves (general population:5%, <1% and <1%, respectively). **Conclusions**: Medical co-morbidities experienced by PLHIV may impact on oral health. Severe pain and limited mobility can pose barriers to accessing services and impaired self-care may have implications for maintaining good oral health.

**Key words**: *Dental public health, HIV, oral health*

## O:35 Silver diamine fluoride and glass ionomer sealant use in preventing occlusal surface caries for special needs children

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**Objectives**: The first objective is to compare the effectiveness of silver diamine fluoride (SDF) with glass ionomer sealant (GIS) in the prevention of dental caries on occlusal surfaces of the permanent teeth for special needs children; the second objective is to measure the efficacy of both materials to the oral hygiene index (OHI-S). **Material-Methods**: A randomised clinical trial conducted on 23 children (aged 6-14 years) with special needs at Istanbul, Marmara University, Department of Pediatric Dentistry. The participants were examined using a dental mirror, blunt dental probe and DIAGNOdent pen. At least each child had two permanent posterior teeth with DIAGNOdent results 0-20 were included. Application of (SDF) (38%) on one side of the mouth and GIS (GC Fuji TRIAGE) on the other side of the mouth. The retention of GIs and occurrence of caries were evaluated at 3-months. For statistical analysis paired T-Test was used. **Results**: A total of twenty children with 104 teeth were evaluated after 3-months. There was statistically significant difference between the mean of baseline and 3-months follow up of OHI-S results. The retention rates for GIs were 80.4% A (complete retention), 14.3% B (partial loss), and 5.3% C (total loss). There was no caries in both groups after 3 months. And for 6 months follow up the study

# 11. CURRICULUM VITAE

| **Name** | MENNATTALLAH | **Surname** | ABDELRAHMAN |
|---|---|---|---|
| **Place of Birth** | Cairo | **Date of Birth** | 05.11.1991 |
| **Nationality** | EGYPTIAN | **Tel** | 00905318561029 |
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**Educational Level**

| | **Name of the Institution where he/she was graduated** | **Graduation year** |
|---|---|---|
| **Masters** | Marmara University Faculty of Dentistry<br>Department of Pedodontics | |
| **Undergraduate** | Misr International University | 2013 |
| **High school** | Saint Fatima School | 2008 |

**Job Experience**

| | **Duty** | **Institution** | **Duration (Year - Year)** |
|---|---|---|---|
| | Dentist | Ein shams hospital | 2014-2015 |

| **Foreign Languages** | **Reading comprehension** | **Speaking*** | **Writing*** |
|---|---|---|---|
| English | Very good | Very good | Very good |
| Turkish | Beginner | Beginner | Beginner |
| Arabic | Mother language | Mother language | Mother language |

| **Foreign Language Examination Grade#** | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| YDS | ÜDS | IELTS | TOEFL IBT | TOEFL PBT | TOEFL CBT | FCE | CAE | CPE |
| | | | 89 | | | | | |

| | **Math** | **Equally weighted** | **Non-math** |
|---|---|---|---|
| **ALES Grade** | | | |
| **(Other) Grade** | | | |

**Computer Knowledge**

| **Program** | **Use proficiency** |
|---|---|
| Microsoft office | Good |