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**Long-term outcome of oral health in uncooperative  
young patients with caries treated under general  
anaesthesia**

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ΕΙΔΙΚΕΥΣΗ ΠΑΙΔΟΔΟΝΤΙΑΤΡΙΚΗΣ

**Μακροχρόνια αποτελέσματα πάνω στην στοματική  
υγεία μη συνεργάσιμων παιδιών με τερηδόνες που  
θεραπεύτηκαν υπό γενική αναισθησία**

ΛΙΑΤΣΗ ΑΙΚΑΤΕΡΙΝΗ

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Επιβλέπουσα Καθηγήτρια για την εκπόνηση της Μεταπτυχιακής Διπλωματικής Εργασίας  
Αναπλ. Καθηγήτρια κα Γκιζάνη Σωτηρία

Τριμελής Επιτροπή για την αξιολόγηση της Μεταπτυχιακής Διπλωματικής Εργασίας:

1. Γκιζάνη Σωτηρία
2. Αγουρόπουλος Ανδρέας
3. Βαδιάκας Γιώργος

## ΠΡΟΛΟΓΟΣ

Η παρούσα μεταπτυχιακή διπλωματική εργασία εκπονήθηκε κατά τη διάρκεια της τριτοετούς φοίτησής μου στο μεταπτυχιακό πρόγραμμα της Παιδοδοντιατρικής του τμήματος Οδοντιατρικής του ΕΚΠΑ, υπό την επίβλεψη της Αναπληρώτριας Καθηγήτριας και Διευθύντριας του Εργαστηρίου Παιδοδοντιατρικής, κ. Γκιζάνη Σωτηρίας. Μέσα από αυτές τις λίγες γραμμές, θα ήθελα να ευχαριστήσω όλους όσους με βοήθησαν και με στήριξαν για την ολοκλήρωση αυτής της πορείας μου η οποία είχε σίγουρα πολλές όμορφες και αξιωματικές στιγμές αλλά και πολλές δυσκολίες και άγχος.

Φτάνοντας λοιπόν στο τέλος, θα ήθελα να ευχαριστήσω την επιβλέπουσα καθηγήτριά μου, κ. Γκιζάνη Σωτηρία για την για την εμπιστοσύνη που μου έδειξε εξ' αρχής, αναθέτοντάς μου το συγκεκριμένο θέμα. Οι πολύτιμες γνώσεις που απέκτησα δίπλα της καθ' όλη τη διάρκεια του κύκλου των σπουδών μου και της διεκπεραίωσης της παρούσας διπλωματικής εργασίας πάντα θα με ακολουθούν στη ζωή μου. Το στέρεο ακαδημαϊκό της υπόβαθρο και η αναλυτική της προσέγγιση μου προσέφεραν ασφάλεια και σιγουριά και αποτέλεσαν θεμελιώδεις λίθους για την επιτυχή εκπόνηση της εργασίας μου. Η υποστήριξη της σε στιγμές αδυναμίας μου και οι ανεκτίμητες παρατηρήσεις και τις συμβουλές της διαμόρφωσε έναν επιστήμονα έτοιμο να ασκήσει το λειτούργημα του παιδοδοντιάτρου.

Ένα ακόμη μεγάλο ευχαριστώ στον Επίκουρο Καθηγητή Εργαστηρίου Παιδοδοντιατρικής κ. Βαδιάκα Γιώργο, για τη διαρκή του ενθάρρυνση και υποστήριξη κατά τη διάρκεια του μεταπτυχιακού προγράμματος και για την ηρεμία που είχε και μετέδιδε σε στιγμές κρίσης κατά την διάρκεια όλων αυτών των χρόνων.

Ευχαριστώ, επίσης, τον Επίκουρο Καθηγητή Εργαστηρίου Παιδοδοντιατρικής κ. Αγουρόπουλο Ανδρέα, για την υποστήριξή του κάθε στιγμή, για την υπομονή του και για τη διάθεσή του πάντα να με βοηθάει και να με ενθαρρύνει. Εμφανιζόταν πάντα την κατάλληλη στιγμή και έλυne οποιοδήποτε πρόβλημα. Η επιστημονική του καθοδήγηση, οι υποδείξεις του, το αμείωτο ενδιαφέρον του, η καθοδήγηση του συνέβαλλαν ουσιαστικά στην εκπόνηση αυτής της εργασίας.

Επιπλέον, θέλω να ευχαριστήσω την περιοδοντολόγο και υποψήφια διδάκτορα του Πανεπιστημίου του Όλσο την κα Μπαλτά Μαρία, για τη στατιστική ανάλυση των αποτελεσμάτων της παρούσας εργασίας, αλλά και για την τόσο σημαντική βοήθειά της, την ενθάρρυνση, τη συμπαράσταση και την υποστήριξή της. Η καθοδήγησης της στον τρόπο γραφής και η εμπειρία της έθεσαν τα θεμέλια πάνω στα οποία γράφτηκε η διπλωματική αυτή εργασία.

Ολοκληρώνοντας, θα ήθελα να πω ένα μεγάλο ευχαριστώ στην παιδοδοντίατρο Ρουμάνη Θεώνη που από τα πρώτα μου βήματα πίστεψε σε εμένα και με την ενθάρρυνση της έπαιρνα καθημερινά δύναμη για να μην ξεχνάω τον τελικό μου στόχο έτσι ώστε στο τέλος να τον πετύχω. Όπως και έγινε. Ακόμα ένα μεγάλο ευχαριστώ στην γραμματέα της μεταπτυχιακής κλινικής Ευαγγέλου Σοφία για την συνεχόμενη και ακούραστη προσπάθεια της για την επικοινωνία με το δείγμα μας. Επιπλέον την οδοντίατρο Τσιλιγιάννη Αθανασία για την ουσιαστική συμβολή της στην μελέτη των αρχείων των ασθενών. Η θετική της διάθεση απλούστευσε χρονοβόρες διαδικασίες.

Θα ήθελα επίσης να ευχαριστήσω τους γονείς μου, Χρυσαιγή και Μιχάλη, τον αδελφό μου Διονύση και τον σύντροφό μου Σπύρο για την υπομονή και την υποστήριξή τους από την αρχή της πορείας αυτής μέχρι και το τέλος της. Καθημερινώς με στήριζαν και με στηρίζουν συναισθηματικά με την αγάπη τους, και προσφέρουν απλόχερα συμπαράσταση και προ πάντων κατανόηση και ανοχή όλα αυτά τα χρόνια. Με την δύναμη από τα λόγια τους και τις πράξεις τους, μου έδιναν και μου δίνουν κουράγιο να προχωρώ και τελικά να πετυχαίνω τους στόχους μου. Χωρίς τη δική τους ενθάρρυνση και αφοσίωση δε θα ήμουν σε θέση να ολοκληρώσω αυτή την εργασία.

Μέσα σε όλη αυτή την πορεία μου σίγουρα όλα φάνηκαν πιο εύκολα χάρη στους φίλους μου που ήταν και είναι δίπλα μου κάθε στιγμή με υπομονή και κατανόηση. Ευχαριστώ λοιπόν μέσα από την καρδιά μου τις συμφοιτήτριες μου γιατί μαζί περνούσαμε τη δύσκολη καθημερινότητα, μοιραζόμασταν όλες μας τις ανησυχίες. Επίσης ευχαριστώ τους φίλους εκτός πανεπιστημίου, για την στήριξη τους και την φωλιά που πάντα μου προσέφεραν αποσπώντας το μυαλό μου από την οδοντιατρική.

ΑΘΗΝΑ, 2021

• • •  
Αυτή την εργασία την  
αφιερώνω στην γιαγιά μου

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## INTRODUCTION

Young children and patients with special needs with extensive dental needs often have limited ability to cooperate to receive quality dental care. Behavior guidance techniques may be sufficient for some of these children to receive treatment, however, general anesthesia (GA) may be the only option in many cases. The decision to choose GA for dental treatment is based on various factors such as patient's ability to cooperate, medical status with any risks involved, and dental treatment severity and urgency (Glassman et al, 2009). The indications for GA according to the American Academy of Pediatric Dentistry (AAPD) in children and adolescents are: (a) patients who cannot cooperate due to a lack of psychological or emotional maturity and/or mental, physical, or medical disability, (b) patients for whom local anesthesia is ineffective because of acute infection, anatomical variations, or allergy, (c) patients who are extremely uncooperative, fearful, anxious, or uncommunicative, (d) patients who require significant surgical procedures or immediate, comprehensive oral/ dental care and (e) patients for whom the use of dental GA may protect the developing psyche and/or reduce the medical risk (AAPD, 2020).

Although, children which undergo such treatment often improve oral health related and total quality of life (de Souza et al, 2017), GA is not without risk (Harrison and Nutting, 2000; Jabarifar et al, 2009). The complications resulting from GA range from nonlife-threatening complications to life-threatening ones. In the first group the most frequent are nausea and vomiting followed by fever, pharyngitis, swollen lips and bleeding while in the second are bronchospasm, anaphylaxis, cardiac arrest and respiratory failure, which are also considered complications of any kind of surgery (Enger and Mourino, 1985; Turet et al, 1988; Johnson et al, 2001). While these morbidities, occur in 40–90% of children receiving a dental GA, the risk of mortality is reported to be rare - 1 in 250,000 (Rodd et al, 2014). Also, there is always considerable likelihood of postsurgical dental relapse in the form of recurrent caries, failure of restorations and the formation of new carious lesions (El Batawi, 2014; Amin et al, 2010; Eshghi et al, 2012).

Among the patients who receive dental treatment under GA, patients with special needs (SNP) and healthy young children with early childhood caries (ECC) are the majority of the population (79.5% and 20.5% respectively) (Ciftci, 2020). Acs et al (2001) reported that 39% of patients requiring dental treatment under GA had a compromised medical or developmental condition while this was the case for approximately 57% of the patients in the study of Delfiner et al (2017) and 49% in the study of Tahmassebi et al (2014). Specifically Bücher 2016 claimed that over 40% of all patients presented congenital and chromosomal malformations followed by mental or behavioural disorders (13.8%) and diseases of the blood and blood-forming organs (10.3%). Literature findings about the reasons



for dental treatment under GA showed that the majority of patients had behavior problems or were unable to cooperate (66.6%) Al- Eheidib, 2004).

### **Children with Early Childhood Caries**

Early childhood caries (ECC) is a particularly aggressive form of dental caries, causing extensive destruction of the primary teeth (Davies, 1998; Vadiakas, 2008). ECC is the most common chronic childhood disease (Bagramian et al, 2009) which affects approximately 12% to 27% of 2- to 3-year-old children (Zhou Y et al, 2011; Dye BA et al, 2015; Plonka KA et al, 2013; Nobile CG et al, 2014; Public Health England, 2013) and 27% to 48% of 4- to 6-year-old children (Public Health England, 2013; Do and Spencer, 2016; Duangthip et al, 2017; Poon et al, 2015). In the past, there were other terms used to describe ECC such as rampant caries, nursing caries and baby bottle tooth decay. Using the clinical picture or the continuous and on demand use of the bottle or inappropriate nursing habits to name this childhood disease (Wyne, 1999; De Grauwe et al, 2004; Vadiakas, 2008). The Bangong declaration, the most recent statement on ECC, where experts from across the world convened under the auspices of the International Association for Paediatric Dentistry (IAPD) defined ECC as “the presence of one or more decayed (non-cavitated or cavitated lesions), missing or filled (due to caries) surfaces, in any primary tooth of a child under six years of age” (Tinanoff et al, 2019).

ECC is characterized by an acute onset of the disease and rapid progression. Pulp involvement is very common, affecting many or all of the emerged teeth with a localization pattern (Winter et al, 1966; Tinanoff et al, 1983; Wendt et al, 1991; O’Sullivan and Curzon, 1991; Grindejord et al, 1993; Douglass et al, 2001; De Grauwe et al, 2004, Machiulskiene et al, 2019). The aetiology of ECC consists of high sugar intake usually via a nursing bottle and on demand breast-feeding, and insufficient oral hygiene, without regular parental supervision, leading to an atypical pattern of caries attack, particularly on labial surfaces of upper anterior teeth in young children (Drury et al, 1999; Tinanoff et al, 2019; Wyne, 1999; Machiulskiene et al, 2019). Consequences of ECC are well documented in the literature and include a higher risk of future decay (in both primary and permanent dentition), risk for delayed growth and development, school absences and as a result diminished learning ability, lower quality of life, and increased hospitalizations and emergency room visits (Acs, 2000; Okunseri, 2005). In addition children with ECC may suffer from malnutrition and speech problems (Poureslami and Van Amerongen, 2009).

Most children receive dental care in a conventional dental clinic setting. However, there are cases that cannot be treated under routine conditions and need an alternative method of treatment (Almeida et al, 2000). Total dental rehabilitation under GA is the preferred treatment modality when the young age of children with ECC, behavioral problems and the complexity and extent of treatment needed make conventional treatment impossible (Vinckier et al, 2001; Vadiakas, 2008; Nies et al, 2009). An increasing number of patients require oral rehabilitation under GA in Germany due to their complex treatment needs (Nies et al, 2009). In USA, Roberts et al (2009) reported a 25% increase in the numbers of GA cases from 63 cases in 1993 to 220 in 2003 (Roberts et al, 2009). The 70–80.8% of all GA patients in pediatric dentistry is about preschool children (5 years old or younger) due to their lack of cooperation and/or their anxiety (Roberts et al, 2009; Abdulkarim et al, 2008; Alcaino et al, 2000; Tahmassebi et al, 2014; Grant et al, 1998). Based on recent national data from

Canada, Schroth and colleagues (Schroth et al, 2016) estimated that the rate of dental GAs due to ECC was 12.1 per 1000 children during a 4-year period. This number equates with 31% of all kind of day surgeries performed among children under the age of 6 in Canada. Researchers have estimated that 1-3% of children younger than 5 years old in USA may undergo dental GA (Eaton et al, 2005; Cravero, 2015).

Treatment of ECC under GA consists of preventive and restorative procedures like pulp therapy and stainless steel crowns (Rayner et al, 2003), extractions of non-restorable teeth, followed by oral health counseling to the parents. The aim of this approach is to treat the decayed teeth in a single visit in order to prevent the possible psychological trauma associated with multiple dental visits at a young age and to provide children with immediate oral-health related quality of life for the rest of their childhood (Mittal and Sharma, 2012). It is a fact that children benefit almost immediately after GA treatment, with significant improvements in their oral health-related quality of life (OHRQoL) (Almaz et al, 2014; Cantekin et al, 2014; Thomson and Malden, 2011). However, the main problem of this treatment approach is that it only focuses on the signs and symptoms of disease. Through this treatment path the real causes of ECC are underestimated, leading to recurrence of the disease (Schroth and Smith, 2007). As a result the main objective of a long-term caries-free childhood easily deteriorates. Studies have resulted to the fact that soon after dental GA, patients are highly susceptible to developing new and recurrent caries lesions (El Batawi, 2014; Amni MS et al, 2014; Eshghi et al, 2012).

Among the parameters involved in the outcome of the treatment under GA, its success depends on the expertise of the medical and dental team as well as the compliance of parents/caretakers/children with preventive dental care after GA (Sheehy et al, 1994). A cross-sectional study of paediatric patients with ECC treated under GA that evaluated the self-reported preventive dental care compliance of parents/families of these children showed that 37% of the parents had not visited the dentist after GA. Parents' knowledge on the causes of carious lesions revealed that 85% of them had a good idea of the causes of caries and believed that good oral habits help to maintain the integrity of the teeth, whereas few parents had no idea as to what causes caries (Peerbhay, 2009). Regarding toothbrushing, 44% of parents brushed their child's teeth, while 34% of children brushed by themselves. The majority of parents (82%) reported that their children's teeth were brushed on average two times a day (Peerbhay, 2009). In another study, there was an important reduction in children's dental plaque index after the GA treatment, but at the six-month follow-up the majority of the patients had again insufficient oral hygiene. This is common among young dental GA patients (Declerck et al, 2008). In regards to dietary habits, 41% of parents reported that their children had reduced the frequency of sugar consumption. However, 51% of them claimed that there was no change in their child's frequency of sugar consumption, and 3 of them reported an increase in their child's sugar intake (Peerbhay, 2009).

Unfortunately, caries recurrence is a frequent finding in children with ECC who were treated under GA regardless of regular recall visits and the preventive protocol followed after treatment (Almeida et al, 2000; Gizani et al, 2001; Vadiakas 2008, Bücher et al 2016). Caries relapse has been found in 37–54% of the children returning to 4–6-month recalls (Berkowitz et al, 1997; Chase et al, 2004; Graves, 2004), and in 53–79% of those returning to recalls within two years (Almeida et al, 2000;

Amin et al, 2010; El Batawi, 2014). A proportion of them may need a second dental treatment under GA (Almeida et al, 2000; El Batawi, 2014). Worthen and Mueller (2000) reported that 20% of children treated under GA before the eruption of the primary second molars required an additional dental GA (Worthen and Mueller 2000). The results displayed in the study of Almeida et al (2000) describe caries recurrence in 79% in the ECC group after 2 years, while 17% of these children repeated the whole procedure under GA. Kakaounaki et al (2011) revealed that 8.9% of children required repeated GA during a 6-year follow-up period, due to new post-operative caries lesions. Foster et al (2006) found that more than the half of the patients developed new caries lesions within 2 years after GA. The high relapse rate of the dental caries is a fact evident in almost all studies for children treated under dental GA, suggesting that the cariogenic challenge in children with ECC remains extremely high. Following this result there are differences in the literature as far as the treatment concepts regarding the use of a more conservative or more invasive approach (Lee et al, 2009; Peerbhay, 2009; Albadri et al, 2006; Sheehy et al, 1994; Worthen and Mueller, 2000). Some authors suggested that a more aggressive treatment approach, including full crown coverage and extractions, might be the solution for the problem (Almeida et al, 2000). However, in other studies where more aggressive restorative treatments were applied, children showed high recurrence rates too (O'Sullivan and Curzon, 1991; Chase et al, 2004; Graves et al, 2004). Children experiencing ECC are highly susceptible to caries recurrence in both primary (O'Sullivan and Curzon, 1991; Almeida et al, 2000; Gizani et al, 2001; Chase et al, 2004; Graves et al, 2004) and permanent dentition after total dental rehabilitation (Vanobbergen et al, 2001; Li and Wang, 2002; Vadiakas, 2008). This high level of recurrence in both dentitions highlights the persistence of unfavorable oral conditions despite the total rehabilitation under GA (Ezeldeen et al, 2014).

The American Academy of Pediatric Dentistry (AAPD) recommends the use of a risk-based recall interval for all patients after completion of the caries risk assessment (CRA). Children who exhibit higher risk of developing caries would benefit from recall appointments at greater frequency than every six months (e.g., every three months). This allows increased professional fluoride therapy application and improvement of oral health by demonstrating proper oral hygiene techniques, in addition to microbial monitoring, antimicrobial therapy reapplication, and reevaluating behavioral changes for effectiveness (AAPD, 2020). These risk assessment instruments assist dental providers in the identification of oral health indicators, which then allow the identification of children at high, moderate, or low risk for developing caries (AAPD, 2014). As suggested, patients who have undergone GA for dental rehabilitation are considered of high caries-risk and they need frequent follow-ups (AAPD, 2014).

The AAPD encourages practitioners to consider future caries risk when determining the types and frequency of diagnostic, preventive, and restorative care for patient specific management of dental caries (AAPD, 2020). Active follow-up programs and parent education might decrease the re-treatment problem (Sheller et al, 2003). The implementation of postoperative follow-ups allows an improvement in the behaviour of the child that eventually minimizes the need of a second GA for dental care (Kwok-Tung and King, 2006). It is an international acceptance that the goal of the paediatric dentist is to facilitate the child's ability to accept care leading to a positive attitude toward care. In a study of Vinson et al (2016), they recalled the patients at 6, 12 and 18 months after

treatment under GA and found an increase in mean Frankl score at follow-up appointments. Similar are the findings of another study where 80% of the children requiring additional dental treatment after GA, accepted dental care using local anesthesia in the dental setting (O'Sullivan et al, 1991). Findings from an Israeli study reported that 92% of non-cooperative children had behavioral improvements two years after dental rehabilitation under GA (Kupietzky and Blumenstyk, 1998). Behavior in the group was positive or definitely positive as rated with the Frankl scale, while only 17% of these children reported being afraid of the dentist. The percentage was similar (11%) in another study five years post-operatively (Vaprio and Wellfelt, 1991).

The compliance of generally healthy children in attending the postoperative review visit scheduled one or two weeks after comprehensive treatment under GA has been reported to vary between 48–100% (Almeida et al, 2000; Worthen and Mueller, 2000; Foster et al, 2006; Jamieson and Vargas, 2007, Amin et al, 2010). Slightly over half of the patients (54%) returned for their 2-week postoperative visit, which is in agreement with Primosch et al, who found that 60% of their subjects came back. However, the compliance in attending the subsequent recalls tends to decline over time (Almeida et al, 2000; Worthen and Mueller, 2000; Jamieson and Vargas, 2007; Amin et al, 2010). One of the studies, reported a surprisingly low routine 6-month recall rate of 13% after GA (Jamieson and Vargas, 2007), whereas Berkowitz et al (1997) and Primosch et al (2001), found recall rates of 29% and 31%, respectively. Sheehy et al found that 77% of the patients treated under GA had regular 6-month follow-up appointments while Ezeldeen et al (2014) recorded a similar percentage (76 %) for at least one visit to the dentist per year. Foster et al (2006) reported that nearly 90% had attended at least one of the scheduled 6-monthly recall appointments within 2 years for examination, cleaning and counseling. Previous studies found that only 26 to 29% of children who were treated for ECC under GA actually returned to follow-up appointments (Roberts, 1990; Berkowitz et al, 1997) and even an additional pre-operative consultation failed to increase their attendance at the 6-month recall (Primosch et al, 2001).

The majority of the studies reports an evaluation of dental treatment after 1 to 3 years after the GA and includes relatively small groups of children with ECC (Almeida et al, 2000; Gizani et al, 2001; Amin, 2015). There are only few reports about the long-term outcome for this group of patients. In the study by EzEldeen et al (2014) who followed the patients after 10 years being treated under GA, an important difficulty was the inability to follow-up the subjects. Only 21% of the subjects initially included in the study presented for recall (EzEldeen et al, 2014). The researchers found a high relapse rate of the dental caries which suggests that the cariogenic challenge in children with ECC remains extremely high.

## **Patients with Special Needs**

In dentistry, patients with special health care needs (SNP) are those whose physical, mental, or social disability complicates dental care (Scully et al, 2000). A lot of terms have been used in the literature through the years to describe people who have difficulty receiving dental treatment in a traditional routine dental environment. Between these terms are “people with developmental disabilities”, “children with special healthcare needs”, “people with complex needs”, and “people with special needs” (Glassman et al, 2005; Glassman and Miller, 2003). The terms which are the most used and

accepted nationally, are “people with developmental disabilities” or “patients with special health-care needs” (Glassman and Miller, 2003). The AAPD defines special health care needs as “any physical, developmental, mental, sensory, behavioral, cognitive, or emotional impairment or limiting condition that requires medical management, health care intervention, and/or use of specialized services or programs”. The condition may be congenital, developmental, or acquired through disease, trauma, or environmental cause and may impose limitations in performing daily self-maintenance activities or substantial limitations in a major life activity. When treating individuals with special needs “specialized knowledge, as well as increased awareness, attention, adaptation, and accommodative measures beyond what are considered routine” is required (AAPD, 2020). It is a fact that most children with disabilities do not have the ability and the cognizance to care for themselves and therefore must rely on parents or caregivers for general care. And that’s because of their limited motor and sensory coordination. Due to many general health problems, oral health care is often overlooked in these children. It is not unusual for caregivers not to possess the needed knowledge to detect potential dental problems, leading to unmet dental needs for SNP (Lewis, 2009; Lewis et al, 2005; Kenney et al, 2008; Van Cleave and Davis, 2008; Mayer et al, 2004).

Studies conclude that SNP patients have a high prevalence and severity of oral diseases (Anders and Davis, 2010; Lewis, 2009; Chen et al, 2014). According to the AAPD guideline, diet, abnormal oral dryness, gastro- esophageal reflux disease, vomiting, intake of medication and difficulty in oral hygiene are implicated in the compromised oral health. In the study by Gizani et al (1997), an evaluation of oral cleanliness of 12 year old handicapped children in Belgium showed poor oral hygiene in 31.8% of them. Many studies confirm these results, proving that the prevalence of a poor oral hygiene index, gingival and periodontal disease (Purohit et al, 2010; Nahar et al, 2010; Oredugba, 2006) as well as malocclusion (Adenubi and Martirez, 1997) were high in SNP. Gace et al (2014) also reported poor oral hygiene and a high prevalence of dental caries in SNP children. The mean dmft/DMFT index for 3-14 year old SNP in a study of Chen et al (2014) was 12.47, which is higher than the previous studies and higher than the national survey of Taiwan for disabled school children (Chen et al, 2014). Lower was the mean DMFT score of 12 year old handicapped children in Belgium [2.9 (SD 2.6)] (Gizani et al, 1997) and those of children with disabilities from a school in a city of Taiwan (dmft/DMFT 4.0) (Hsiao et al, 2007). In a National Health Insurance survey some years later (2006), similar were the results as far as the mean dmft/DMFT index for 3-12 year old SNP (mean dmft/DMFT: 3.25) (HuangST 2006).

In traditional dental settings, it is often a great challenge to provide dental treatment for patients with intellectual and physical disabilities. Lack of cooperation, high anxiety levels, mood swings, combative behavior and physical limitations can set barriers to dental treatment and make conventional treatment under local anesthesia sometimes impossible (Pine et al, 1998; Tae Jun Oh, 2018). Methods of physical restraint are an alternative for this group of patients. But they cause great stress and reluctance to both patients and their guardians. To avoid the risks of injury or excessive stress as well as the inability to provide high quality dental care, dentists often choose to treat special needs patients under GA (Trapp, 1987; Blayney et al, 1999).

Dental treatment under GA is an effective alternative for SNP patients. This method eradicates poor cooperation and lack of compliance providing the patient with a high-quality dental care (O’Sullivan

and Curzon, 1991; Vermeulen et al, 1991; Jamjoom et al, 2001). Also, oral rehabilitation under GA improves quality of life for SNP and their families (Baens-Ferrer et al, 2005). Full mouth rehabilitation should be the main goal for dental treatment under GA for SNP despite the fact that many times these patients are scheduled only for extractions. This should always be accompanied by a preventive program and follow-up appointments in a try to remodel behaviour and avoid another GA in the future (Barberia et al, 2007). Dental GA for patients with special needs can be combined with other medical procedures if required and that is a huge advantage for these patients. If doctors act together it is for the benefit of the SNP. Procedures like grommets operation, percutaneous endoscopic gastrostomy (PEG) tube placement/replacement, incision of operculum, Botox injection for muscle spasms (cerebral palsy), and cleft palate operations can be easily combined with dental treatment (Public Health England, 2016).

Follow-up appointments after dental treatment under GA are crucial. It has been recommended that regular dental appointments with caregivers and/or parents of SNP are necessary to motivate them for better oral hygiene and educate them on proper dietary habits (Oredugba and Akindayomi, 2008). In their study, Berkowitz et al (1997) scheduled follow-up appointments 4–6 months post-operatively. In contrast, Mitchell and Murray (1985) scheduled follow-up appointments every 2 months postoperatively. Since most SNP have poor dental compliance, frequent follow-up appointments would be beneficial both for preventive and behavioral improvement (Messieha et al, 2007). Two studies reported follow-up rates of 2% and 4.6% (Mitchell et al, 1985; Berkowitz et al, 1997). A more recent study showed that the patients' attendance to follow-up appointments declined significantly from 96% at the first follow-up appointment to 36% at the 2 years follow-up appointment (Mallineni, 2014). In addition a retrospective study in 2018 revealed that 25% of special need patients had no visit after the GA and 29.4% stopped follow-up visits two years after the GA (Sung Chul Choi et al, 2018).

In contrast with the previous studies, El Batawi et al (2014) concluded that parents of children with special needs demonstrated comparatively high compliance with the recall visits after GA. However, 15.7% of SNPs required an additional GA during the 2-year follow-up period (Elbatawi et al, 2014). The rates for additional GA treatment for SNP vary. Two studies (Mitchell et al, 1985; Roeters et al, 1985) reported that SNP who received treatment under GA for the second time were 7.2% and 10.2%. The main findings of the study of Bücher et al (2016) observed that only 10.8% of SNP had a repeated GA, despite the high caries experience of the group at the initial treatment. At the same study, less than 2% was admitted for a third GA. Berkowitz et al (1997) reported that 3% of their handicapped patients received dental treatment under GA for the third time, and that possible reasons for repeated GA in SNP are their failure to attend to follow up appointments and the disability itself. For a group of children with and without chronic illnesses or disabilities, Thamassebi et al (2014) reported a rate of repeated treatment of 12.5%.

There have been several studies about the outcomes of dental treatment under GA for SNP but very few had a long term follow up after GA.

In Greece there has been no report on the outcome on the dental condition, dental behavior and anxiety profile of the children treated under GA, over time. Oral healthcare, in Greece, besides

preventive services offered free by the public health care clinics to all children, is mostly provided by private practitioners, with patients paying the total or partial cost of care (96% of dentists are in private practice). Public health centers emphasize more on preventive and other simple treatments to children under the age of 18, without excluding the rest of the population. There are three public hospitals for paediatric patients in Athens. Within these hospitals dentists provide preventive care and emergency or full treatment as needed to all hospitalised patients, free of charge. If it is needed these procedures are carried out under GA. It is very difficult and time-consuming for a non-hospitalized child to undergo total dental rehabilitation under GA in a Greek public hospital. Sometimes waiting lists may go for more than a year. It is a fact that in one of these hospitals, exodontia is the treatment of choice. One should mention that the number of paediatric patients in these hospitals is extremely small. On the other hand, a child can have dental rehabilitation under GA in a private hospital. All paediatric dentists in Greece are trained to provide their services under GA.

As mentioned above, dental rehabilitation under GA is not enough for a child to obtain a high quality of oral health. Change of oral hygiene and dietary habits as well as regular follow-up visits are crucial for maintaining the result of dental rehabilitation over time. Therefore, it is important to investigate the profile of these patients, years after total rehabilitation under GA and record the present oral health status of these patients treated under GA for dental rehabilitation as this can help in establishing better long term preventive program for these patients.

## **AIM**

The aim of this study was to assess the long-term outcome of the oral health and the dental behavior of uncooperative healthy children (HC) and persons with special needs (SNP) that received dental rehabilitation under GA in the Postgraduate Clinic of Paediatric Dentistry of the National and Kapodistrian University of Athens (NKUA), at least 2 years before the present study.

More specifically the objectives were to:

- a) register the demographic characteristics and the dental attendance pattern of the children after GA
- b) evaluate the present oral health status (oral hygiene index, DMFS and restorative index) and behaviour of these children and compare between the two groups
- c) investigate factors affecting the parameters mentioned previously such as demographic characteristics, oral health and dietary habits, visits to the dentists, times lapsed since treatment under GA
- d) register the treatment provided under GA and compare between the two groups

## **MATERIALS AND METHODS**

The present study is a cross-sectional study. The protocol was approved by the Ethics Committee of the School of Dentistry, NKUA (404/18.04.2019).

### **Study sample**

Patients from the Postgraduate Clinic of Paediatric Dentistry of NKUA who received dental treatment under general anesthesia between January 2005 and April 2017 were contacted to participate in this study.

The inclusion criteria were: a) children currently younger than 18 years of age, b) history of dental treatment under GA at the Children's Hospital "Agia Sophia" at least 2 years before the study and c) healthy children (HC) with lack of cooperation for treatment at the dental clinic and special need patients (SNP).

The only exclusion criterion was children where communication was not possible.

### **Procedure**

Patient records of the Postgraduate Clinic of Paediatric Dentistry NKUA from 2005 to 2017, were searched to identify all the patients that received dental treatment under GA. Information was gathered about medical history, oral health condition of the patients at their initial dental visit, the age of the patients at the time of the GA and the treatment provided under GA.

The parents of all patients that fulfilled the inclusion criteria were contacted by telephone from the secretary of the Postgraduate Clinic of Paediatric Dentistry, between January 2019 and October 2020. Three attempts were made within working hours (9am–3pm) in order to reach the families (Crutchfield et al, 2017). When the telephone number was found unavailable or inactive, their current number was searched in the telephone book or online. When communication was not possible the patients were excluded from the study.

Subjects reached via the phone were invited to visit the Postgraduate Clinic of Paediatric Dentistry NKUA for an examination, professional tooth cleaning and fluoride application. At the day of their dental visit, informed consent was obtained from the guardians and children older than 7 years old. Their guardians were interviewed through a questionnaire and subjects who were not willing to attend the dental clinic, were interviewed over the phone and the reason for not attending was registered (after obtaining a verbal consent over the phone). Next, the patient was asked to report his/her dental anxiety level and clinical exam was performed to record oral hygiene, dental caries and cooperation.



### **Questionnaire**

The guardian was interviewed using a 44-item questionnaire consisted of open and closed type questions (modified version by Agouropoulos A. 2012). Demographic and socio-economic characteristics of the family, patient's medical history, current oral hygiene, dietary habits (tooth brushing pattern, fluoride exposure, and frequency of sugar consumption) and dental follow ups were recorded. [Appendix 1]. A designated dental assistant was available to help the responders if they didn't understand the language fluently. This questionnaire was answered over the phone by parents who were not able to present for dental examination, (Roberts et al, 2007; Kourany et al, 1990; Madelyn et al, 1985). [Appendix 2]

### **Clinical examination**

Before the clinical examination, each patient was asked to indicate, with parental help if necessary which of the five level facial image scale represented his/her dental anxiety at that moment (Buchanan et al, 2002) [Appendix 3].

Clinical examination was carried out by one single examiner using dental unit's light, a mirror and a blunt dental probe. The examiner was trained and calibrated for caries registration against a gold-standard examiner, and intra-examiner reliability was assessed before starting the study. For this training, 20 children which attended the Postgraduate Clinic of Paediatric Dentistry for dental treatment were used. The ICDAS score was calculated during their first visit and then two weeks later before any treatment was provided

Oral hygiene: The presence or absence of dental plaque was recorded on four tooth surfaces (buccal/labial, lingual/palatal, mesial and distal) of all teeth with the help of a periodontal dental probe without using a disclosing agent (Hygiene Index, Lindhe 1982). A probe was passed along the surfaces of the tooth both supra- and sub-gingivally. At the end of the examination, clean surfaces (absence of dental plaque) were added together and then they were divided by the total number of surfaces of each patient.

Caries: After dental plaque's removal, caries was recorded using the criteria of the International Caries Detection and Assessment System (ICDAS) (Pitts, 2004; Ismail et al, 2007) and then converted to dmft/DMFT. When a surface was evaluated with code 3 or higher from ICDAS first digit, it was considered that the tooth was restored and was calculated in the f/F component from dmf/DMF index. Codes 3-6 of the second digit of ICDAS were used to calculate the d/D component dmf/DMF – (Braga, et al 2009; Clara et al, 2012; Iranzo-Cortes, et al 2013). DMFS and dmfs scores were used to indicate the caries experience for each person

Finally, evaluation of each child's behavior during the dental examination was carried out by the examiner, based on the Frankel scale scoring from definitely positive (Score 1) to definitely negative (Score 4) (Frankl et al, 1962). [Appendix 4]

## **Statistical analysis**

Data were presented as percentage (%) and mean  $\pm$  SD. To evaluate normal distribution of the data Shapiro-Wilk test was performed. When p values were less than 0.05 the data were considered to be non-normally distributed. HI, RI, DMFS, D, M, F values in the permanent and primary dentition were stored and analyzed as numerical data. Presence of special needs, time elapsed since last GA, educational level of the mother, working status of the mother, dental attendance, toothbrushing frequency and dietary habits of the child were stored and analyzed as categorical variables. Differences in numerical variables, e.g. age, HI, RI, DMFS etc. between the different categories were evaluated by independent t test when the data were normally distributed and by Mann-Whitney test when the data were non-normally distributed. To assess the association between independent/predictive categorical variables (presence of special needs, time elapsed since last GA, educational level of the mother, dietary habits of the child etc.) and dependent/predicted numerical variables (HI, RI, DMFS, D, M, F) linear regression analysis was performed and adjusted R-squared values were presented. Differences associated with P values less than 0.05 were considered to be statistically significant. Statistical analyses and graphs were carried out using GraphPad Prism V8.0.1 (GraphPad Software, San Diego, California).

## RESULTS

A total number of 176 medical records of children treated under GA were retrieved from the archives of the department of Paediatric Dentistry in Athens. From these, 120 medical records met the inclusion criteria in the present study and were reviewed. Seventy-nine patients were contacted (65.83%) and ten refused to participate in the study. From the 69 patients who completed the questionnaire 39 presented for clinical examination but two were completely uncooperative resulting in 37 children with clinical data. An overview of the patient flow is presented in Figure 1.

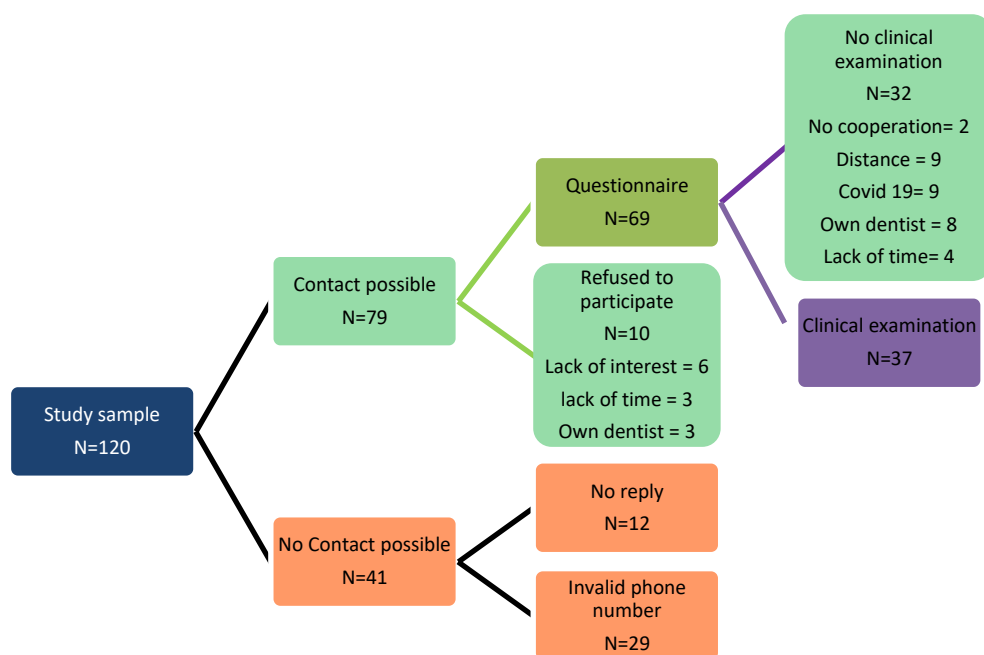


Figure 1: Flow chart of study sample

## **Questionnaire**

All children were born in Greece but 45% of the parents, although were born and lived abroad at least until the age of fifteen years. In the total group the mean age of HC was 9.49 (SD: 3.21) and of SNP 12.73 (SD: 3.35). Of the HC, 96% received dental treatment under GA at an age younger than 5 years old (ECC), while for SNP, this was the case for the 43.18%. Most of the SNP children had more than one health disorders. The most frequent health disorders were mental retardation, syndrome/chromosomal disorders and autism.

The demographic data of the children, oral hygiene and dietary habits and dental attendance after GA are presented in Tables 1, 2 & 3 respectively. The majority of the subjects (71.01%) reported tooth brushing at least once per day (SNP 72.73% and HC 96%). Approximately 34% of SNP and 36% of HC parents described their children's oral hygiene as good. Regarding diet, more than half of the participants (50.72%) reported daily consumption of sweet snacks (SNP 50% and HC 48%) while most eat sweet snacks or drink beverages between main meals (SNP 72.73% and HC 72%).

Four children who completed the questionnaire had a second GA the time elapsed between first GA and their interview for the present study and one had a third GA at the same time. The rest of the children were treated in dental chair when needed. Most of the children attended the one-week follow-up after GA but 9 did not because they visited another dentist or said they were not informed about this visit. Since GA, 86.96% returned to the dentist at least one time. The reasons for their dental visit are presented in Table 4. After dental rehabilitation under GA 24.64% of the subjects had cancelled a booked appointment to the dentist, and among those only 64.70% had rescheduled the lost appointment. From the total sample 13.04% had never been to the dentist after GA and among these patients, 66.67% belonged to the SNP group.

## **Dental Rehabilitation under GA**

From the 37 patients examined clinically SNP had a mean age of 6.03 (SD 2.26) and HC had a mean age of 3.43 (SD 2.30) at the time of the GA. In the SNP 68.2% had received treatment under GA more than five years before clinical examination and the corresponding percentage was 40% for the HC.

### **Primary dentition**

During dental rehabilitation under GA children received 137 extractions, 89 pulpotomies, 104 stainless steel crowns (SSCs) and 174 composite resin restorations and/or a built up on primary teeth.

Extractions most often referred to primary upper incisors (51.09%), followed by the first upper primary molars (15.33%). Pulpotomy was more frequently performed on lower first primary molars (34.52%) followed by upper first primary molars (26.19%). Approximately, 34% of the pulpotomies

were performed on second primary molars (upper and lower) and 3.57% on upper incisors 3.57% of the cases. Endodontic treatment was not performed in primary teeth treated under GA. SSC were more frequently applied in primary first molars (61.54%) followed by second primary molars (38.46%). Finally, resin composite restorations and/or built-up was the treatment choice for all incisors (18.86% of resin restorations) and canines (32.57% of resin restorations) requiring treatment. As far as posterior teeth, 14.86% of resin composite restorations were performed on first primary molars restorations and 40.69% on second primary molars. Sealants were only applied on 13 second primary molars.

### Permanent dentition

Regarding permanent teeth, rehabilitation included extractions of 4 permanent teeth, 3 SSCs, 34 composite resin restorations, 1 pulpotomy and 2 endodontic treatments. First permanent molars (FPMs) were the only permanent teeth extracted (two #26 and two #36 were extracted). These were also the only permanent teeth treated with SSCs (one SSC on #16 and two SSCs on #46). Treatment on the rest of the permanent teeth included only composite resin restorations. 12 composite resin restorations were performed on FPMs, 3 on second permanent molars (SPMs), 8 on premolars (#14, #15, #24, #25, #34, #35, #44, #45) and 11 on incisors.

The dental rehabilitation of SNP and HC is presented in Table 5 separately for permanent and primary teeth. In primary dentition, HC had statistically more sealant applications during total dental rehabilitation under GA when compared with SNP. The significance was at the borderline regarding pulpotomies and SSCs, showing a clear trend for more pulpotomies and SSCs performed in HC than in SNP.

### Clinical examination

The intra examiner reliability for ICDAS II was  $k=0.85$ . Among 37 subjects having received clinical examination, 2 (5.4%) were in primary 20 (54.05%) in mixed and 15 (40.54%) children in permanent dentition. SNP had a mean age of 12.73 (SD 3.35) at the time of the examination and HC had a mean age of 9.49 (SD 3.21). The difference was statistically significant ( $p=0.001$ ) with SNP being older at the time of the examination. The clinical examination revealed that visible plaque accumulation was present in all subjects and only 3 patients (8.57%) were caries free. Regarding oral hygiene, proximal surfaces displayed the highest amounts of plaque followed by buccal and lingual/palatal surfaces. Analysis of the clinical parameters for SNP and HC are presented in Table 6. In primary dentition HC had statically more new caries lesions in comparison with SNP. In permanent dentition special need patients had significantly more filled surfaces than healthy children and a higher restorative index on surface level.

Regarding dental anxiety, four out of 37 children (10.81%) did not manage to indicate a face of the facial image scale due to severe mental disability. The majority of the children who answered seemed very happy or happy for their visit to the dentist. That was the fact for 83% of SNP and 87%

of HC. Only 6.06% of the children said that it was very sad for its presence to the waiting room of the dental clinic (6.67% HC, 5.55% SNP).

Linear regression analysis was performed to evaluate the association between independent variables DMFS, D, M, F, HI, RI at surface and tooth level. In the permanent dentition the analysis revealed that special needs and time elapsed since the last GA were significantly associated and can be therefore used as predictors for filled surfaces. In fact, presence of special needs and <5 years since last GA explain 13% and 12% respectively in the variation in the F compartment. Similarly, special needs were found to be a significant predictor for the RI at surface level. Accordingly, frequent toothbrushing was found to be significantly associated with HI (Table 7). Additionally, linear regression analysis in the primary dentition yielded an association between regular dental visits of the parents and RI at surface level, suggesting that 30% of the variation in this index can be attributed to regular dental visits of the parents (Table 8).

**Table 1:** Demographic data of the total sample and the participants who only answered the questionnaire and those who also had a clinical examination.

	Questionnaire only (N=32)	Questionnaire and clinical examination (N=37)	Total sample (N=69)
	(%) or (mean±SD)	(%) or (mean±SD)	(%) or (mean±SD)
<b>Sex (boys)</b>	75	51.35	62.32
<b>Age</b>	13.03 (±3.34)	10.47 (±3.43)	11.63 (±3.57)
<b>Time from GA (&lt;5 years)</b>	40.62	43.24	42.03
<b>Special need patients</b>	68.75	59.46	63.77
<b>Parental education (low)</b>			
<b>Mother's education</b>	25	32.43	28.98
<b>Father's education</b>	21.87	32.43	27.54
<b>Parents origin (Greece)</b>			
<b>Mother's origin</b>	81.25	37.84	43.48
<b>Father's origin</b>	84.37	37.84	44.93
<b>Children's origin (Greece)</b>	100	91.89	95.65
<b>City they live (Athens metropolitan area)</b>	53.12	64.86	59.42
<b>Working habits</b>			
<b>Both parents working</b>	59.38	27.03	42.03
<b>Both parents unemployed</b>	0	8.11	4.35
<b>One parent working</b>	40.62	56.76	49.27

**Table 2:** Oral hygiene and dietary habits of the total sample and the participants who only answered the questionnaire and those who also had a clinical examination.

	Questionnaire only (N=32)	Questionnaire and clinical examination (N=37)	Total sample (N=69)
	(%)	(%)	(%)
Brushing frequency (at least once per day)	75	67.57	71.01
Fluoride toothpaste	100	100	100
Fluoride supplements	25	13.51	18.84
Floss	6.25	10.81	8.7
Consumption of sugary snacks (Daily)	50	51.35	50.72
Consumption of juices or beverages (Daily)	12.5	13.51	13.04
Timing of snacks and beverages consumption (With or right after main meals)	21.87	27.03	24.64

**Table 3:** Dental attendance after GA of the total sample and the participants who only answered the questionnaire and those who also had a clinical examination.

	Questionnaire only (N=32)	Questionnaire and clinical examination (N=37)	Total sample (N=69)
	(%)	(%)	(%)
Attendance to 1-week follow up after GA	78.12	94.59	86.96
Attendance since GA	81.25	91.89	86.96
Attendance			
The last year	81.25	83.78	82.61
2 years ago	6.25	8.11	7.25
>3 years ago	12.5	8.11	10.14
Parents' dental attendance (at least once per year)	56.25	56.76	56.52
Cancelled appointments	18.75	29.73	24.64
Missed appointments	28.12	8.11	17.39

**Table 4:** Reasons given by parents for visiting the dentist after GA

<b>Reasons</b>	<b>Percentage (N=60)</b>
Check-up	23.33%
Professional cleaning and fluoride application every 3- months	23.33%
Professional cleaning and fluoride application every 6-months	36.67%
Pain	8.33%
Dental trauma	1.67%
Swelling	1.67%
Ortho consult	3.33%
Other reasons	1.67%

**Table 5:** Dental rehabilitation under GA on primary and permanent teeth

<b>Treatment</b>	<b>SNP mean (SD)</b>	<b>HC Mean (SD)</b>	<b>P</b>
<b>Primary teeth</b>			
<b>Sealant</b>	0.14 (0.47)	0.93 (1.44)	0.03 *
<b>Resin composite</b>	5.33 (2.75)	5.27 (3.08)	0.95
<b>Extraction</b>	3.77 (3.16)	4.00 (2.65)	0.62
<b>Pulpotomy</b>	1.96 (2.13)	3.07 (1.34)	0.047
<b>SSC</b>	2.32 (2.26)	3.80 (1.94)	0.049
<b>Permanent teeth</b>			
<b>Resin composite</b>	4.56 (5.64)	-	NA
<b>Extraction</b>	0.44 (0.88)	-	NA
<b>SSC</b>	0.22 (0.44)	-	NA



**Table 6:** Analysis of OHI, dmfs/DMFS and ri/RI indices and differences between the groups (mean  $\pm$ SD)

	<b>HC</b>	<b>SNP</b>	<b>P value</b>
	% or mean (SD)	% or mean (SD)	
OHI (%)	34.29 $\pm$ 20.78	32.01 $\pm$ 19.78	0.7
dmfs	34.75 $\pm$ 14.91	22.10 $\pm$ 17.18	0.08
D	5.58 $\pm$ 4.54	2.30 $\pm$ 2.31	0.05
M	13 $\pm$ 11.82	7.7 $\pm$ 11.86	0.1
F	16.17 $\pm$ 9.46	12.1 $\pm$ 12.92	0.4
ri (%)	76.89 $\pm$ 29.43	67.11 $\pm$ 29.43	0.87
New caries lesions in primary teeth	1.27 $\pm$ 2.15	0 $\pm$ 0.00	0.04*
DMFS	6.39 $\pm$ 4.99	12.95 $\pm$ 13.29	0.12
D	4.92 $\pm$ 5.08	5.41 $\pm$ 6.26	0.8
M	0 $\pm$ 0.00	1.36 $\pm$ 3.51	0.28
F	1.54 $\pm$ 3.27	6.18 $\pm$ 6.17	0.004*
RI (%)	26.23 $\pm$ 40.46	62 $\pm$ 40.46	0.02*
New caries lesions in permanent teeth	2.46 $\pm$ 2.84	2.88 $\pm$ 2.37	0.7

**Table 7:** Linear regression analysis results for permanent teeth

	<b>DMFS dmfs</b>	<b>D</b>	<b>M</b>	<b>F</b>	<b>OHI</b>	<b>RI (surf)</b>
<b>Special needs</b>	0.05 0.1	-0.03	0.03	0.13*	-0.03	0.16*
<b>Last GA&gt;5 years ago</b>	0.03	-0.03	-0.03	0.12*	0.003	0.00
<b>Low educational level (mother)</b>	0.00	-0.03	-0.03	0.07	0.01	0.03
<b>Working mother</b>	-0.03	-0.03	-0.03	-0.03	-0.03	-0.03
<b>Regular dental visits of parents</b>	-0.01	-0.02	-0.03	0.002	-0.03	-0.003
<b>Frequent toothbrushing</b>	-0.02	-0.07	0.002	0.03	0.11*	0.02
<b>Frequent consumption of sweet snacks</b>	-0.03	-0.03	-0.02	-0.02	-0.02	-0.02
<b>Sweet snacks between meals</b>	0.04	-0.02	0.01	0.07	-0.02	-0.01

**Table 8:** Linear regression analysis results for primary teeth

	<b>dmfs</b>	<b>d</b>	<b>m</b>	<b>F</b>	<b>ri (surf)</b>
<b>Special needs</b>	0.1	0.14	0.004	-0.01	-0.02
<b>Last GA&gt;5 years ago</b>	0.12	-0.01	0.05	-0.01	-0.05
<b>Low educational level (mother)</b>	0.05	0.02	-0.05	0.1	-0.03
<b>Working mother</b>	-0.1	0.1	-0.04	-0.04	-0.01
<b>Regular dental visits of parents</b>	-0.03	0.03	0.1	0.01	0.3*
<b>Frequent toothbrushing</b>	0.02	0.05	-0.04	-0.03	0.05
<b>Frequent consumption of sweet snacks</b>	0.06	0.1	-0.04	0.004	-0.04
<b>Sweet snacks between meals</b>	-0.01	-0.05	-0.05	0.07	-0.03

## DISCUSSION

This study reports on the long-term outcome of oral health and oral habits in young healthy children (HC) and patients with special needs (SNP) having received total dental rehabilitation under GA. All children attended for clinical examination had visible plaque accumulation and only 3 children were caries free. SNP had statistically more filled surfaces on permanent teeth and a higher restorative index on surface level in comparison with HC. As far as dental procedures under GA between these two groups, HC had statistically more sealant applications than SNP. Children treated more than 5 years before the present study had statistically more filled surfaces on permanent teeth.

The findings of the present study, as far as the questionnaire and the information from the patients' records, are in general agreement with previous reports in the literature. The unique characteristic of this study is that the researchers examined the patients after a long time period following the GA intervention. Most of the studies on the topic are retrospective based on dental records data and only a few contacted the patients to complete a questionnaire (Sheehy et al, 1994; Al-Eheideb et al, 2004; Peerbhay et al, 2009; Jamieson and Vargas, 2009). Up to our knowledge there are only two studies that attempted to clinically examine the children after GA (Al-Eheideb et al, 2004; Ezeldeen et al, 2014). Only one of these is about long term outcome after GA but it is only about healthy children (Ezeldeen et al, 2014). Difficulties in reaching out this population are certainly involved in this. Overcoming this obstacle the present study is the first to our knowledge managed to recall a satisfactory amount of patients (both healthy and special needs patients) and examine children undergone GA even 14 years ago.

It is evident that in longitudinal studies, a major problem is the inability to follow-up the subjects, especially in long term follow ups (Ezeldeen et al, 2014; Jamieson and Vargas, 2007). This was the case in the present study where 30.22% of the subjects which were initially included in the study were finally examined. The main reasons for the low attendance were the inability to reach the subjects over the telephone, their refusal to attend the dental clinic due to time restrictions, distance, lack of interest for the study and Covid-19 pandemic. Almost half of the families lived outside of Athens (where the study took place) and this may have played the most important role in low recall attendance. In the study of EzEldeen et al (2014), they managed to recall 21% of the subjects of the initial sample. In another study of Al-Eheideb et al (2004), 58.70% of children responded to telephone and/or recall cards and presented for a clinical examination. The amount was higher than in our study, but the time elapsed between GA and the attempt for recall was 6-27 months while in our study was 2-14 years.

The questionnaire was completed by interviewing the parents by a trained dental auxiliary to overcome difficulties in understanding the questions. The same dental auxiliary was used throughout the study (clinical examination). Due to the fact that almost half of the parents \ didn't have Greek as their native language this interview was considered necessary for the proper completion of the questionnaire. From our initial sample, 57.5% completed the questionnaire.

Peerbhay et al (2009) in their study managed to interview telephonically a similar amount of the parents of patients (60%) in order to evaluate parental dental health knowledge and preventive practices after dental rehabilitation under GA. In the study of Sheehy et al (1994) the results were similar. Parents of 57% of patients treated under GA were interviewed over phone. The remaining parents could not be contacted for reasons such as disconnected phones or changed addresses. Jamieson and Vargas (2009) tried to send questionnaires to the parents by mail but this method had not the results expected so the questionnaire data was not included in that study.

As far as their medical condition, 63.77% were patients with at least one health issue. It would appear that there was a high number of children with a medical condition in the current study in comparison to others that have reported special needs patients ranging between 49-57% (Tahmassebi et al, 2014; O'Sullivan and Curzon's, 1991; Acs et al, 2001; Delfiner et al, 2017). In the most recent study of Ciftci et al (2020), 79.5% of the patients in the study population were SNP and 20.5% were healthy. These differences exist because of the different definition of "special need patients" in each study. In the present study the group of SNP included every child who met the inclusion criteria and had at least one health problem, even mild ones (for example receive T4 due to hypothyroidism). Furthermore, the difference is also due to the approach followed for treatment of very young healthy children. The small number of HC treated under GA in Greece reflects the fact that children are treated using behaviour management techniques and GA for dental rehabilitation is the last choice, because parental acceptance is very low for this type of procedure.

The majority of the subjects (71.01%) reported tooth brushing at least once per day (with 43.47% reporting tooth brushing twice per day or more). That was the case for 72.73% of SNP and 96% of HC, showing that healthy children are more compliant to oral hygiene instructions and confirming the difficulties in health care of SNP. Similar findings were shown by Ezeldeen et al (2014) where 95% of the subjects (healthy children) mentioned brushing their teeth every day (52% twice per day). The percentage was almost half of the one reported in the study of Peerbhay et al (2009). At the last study, the majority of parents (82%) reported that their children's teeth were brushed on average two times per day. However, this study had a very short mean time elapsed after GA (15 months) and although the sample consisted of both medically compromised and healthy patients, they could not be quantified due to a lack of information in this regard from patient records. In addition, the researchers mentioned that one of the limitations of their study was the tendency for parents to want to please the researcher during the phone interview process and therefore parents are less likely to admit negative responses. Furthermore, all patients reported the use of a toothpaste containing fluoride but few used fluoride supplements and very few used dental floss, findings similar to Ezeldeen et al (2014). Regarding the dietary habits, half of the participants reported daily consumption of sweet snacks in both groups. A similar noncompliance with recommendations for sugar reduction is a common finding in other studies (Peerbhay et al 2009, Peretz et al, 2000; Roberts, 1990).

One should mention that 14% of the patients never came even for the post-operative one week follow up after GA a finding that has also been reported in similar studies (Mathu-Muju et al 2010, Peerbhay et al 2009, Jamieson and Vargas 2007)The main reason given by parents for not attending the one week follow-up visit was that they were not given an appointment or informed

that they had to bring their children back for a follow-up visit. The no compliance to the immediate follow-up visit can point out a general profile of patients who will have a poor compliance to recommendations for oral hygiene habits and dietary habits in the future. This session seems to motivate parents and appears to reduce the likelihood of a recurrence of caries, particularly in the primary dentition (Foster et al, 2006) and if this cannot be achieved, the regular follow up of the patient is difficult resulting in an unfavorable oral condition.

Since GA 86.96% remembered returning to the dentist after the one week follow-up visit and 72.97% visited at least one time our clinic (68.18% SNP and 80% HC). This comes to contrast with the results of the study of Elbatawi et al (2013) where the parents of children with special needs demonstrated comparatively high compliance with the post-operative care plan. The same study reported that only 18% did not attend at any point during the 2-year post-operative follow-up period. The rest 82% appeared at least once during the 2 years follow up. Tahmassebi et al (2014) reported a return rate of 67 % in their review (review period 6 years) which is comparable to the 68.18% of the present study. In the study by O'Sullivan and Curzon (1991) (review period 2 years)  $\frac{3}{4}$  of the patients returned to the dentist. Higher return rates were documented in two other studies (Mitchell et al. 1985; Drummond et al. 2004). More than a half (60%) mentioned prevention as the reason of their visit (professional cleaning and fluoride application at 3 months or at 6 months). Sheehy et al (1994) found that 77% of the patients treated under GA had regular 6-month follow-up appointments while Ezeldeen et al (2014) recorded the same percentage (76 %) for at least one visit to the dentist per year. At the present study 11.67% visited the dentist only for emergencies. The percentage was double in the case of Ezeldeen et al (2014) were 24% reported that they visited the dentist only in case of dental problems. 13.04% had never been to the dentist since the end of GA. The study of Elbatawi et al (2013) reported that 18% did not attend at any point during the 2-year post-operative follow-up period.

Regarding parents' dental attendance, the present study shows that more than the half visits the dentist regularly (at least once per year). But 37.68% of them attend the dentist only when in pain. These results are in agreement to those of Peerbhay et al (2009) where a great amount of parents (37%) had not visited the dentist at all in the past two years. Children's dental health practices are influenced most by parental direction and guidance as well as parental dental health practices (Bullen et al, 1988). Parental involvement seems to be the key element in the area of preventive dentistry for children. It would be therefore be safe to assume that by effecting a change in parental behaviour, a change in attitude is likely to occur and perhaps this would motivate parents to improve compliance as far as preventive oral health practices of their children.

This no-attendance to follow up visits sometimes leads to repeat of dental treatment under GA. Some 5.79% of the children completed the questionnaire had a second GA the time elapsed between first GA and their interview for the present study and a 1.45% had a third GA at the same time. All the patients who repeated GA were SNP (4/44 SNP, 9.1%). The amount of repeat of dental treatment under GA varies between the studies counting from 4.2% to 24% for a second GA and from 1.5% to 2% for a third GA (Tahmassebi et al, 2014; Thompson, 1994; Drummond et al, 2004; Kakaounaki et al, 2006; Elbatawi et al, 2013; Kakaounaki et al, 2011; Mallineni et al, Bucher et al,

2016; Rudie et al, 2018; Ezeldeen et al, 2014). It seems that the follow up period of each study, the sample size and the medical history of the sample can justify this range.

As only 5.79% of the children of the present study had a second GA for rehabilitation of new caries lesions, the rest of the subjects who developed caries or had any dental problem at the subsequent follow-up visits, were treated under local anaesthesia in dental chair. Lower tolerance (<65%) to treatment in dental chair was found in the study of Tahmassebi et al (2014) and Jamieson and Vargas (2007). From these, there were children who required oral sedation or inhalation sedation with nitrous oxide. In the present study only one child needed treatment with nitrous oxide as an adjunct to local anaesthesia. Change in children's behavior and anxiety of the present study is confirmed by the chosen images of the facial image scale. Almost every child answered positively while being in the waiting room. That makes sense if anyone considers that the majority of the children were at the age of 3 at their first visit to the dental clinic and they definitely have matured (emotionally) and their cognitive state and psyche had developed enough by age 4 to 5 to deal with a traditional dental treatment.

In the present study SNP were older than HC at the time of GA as well as at the time of the clinical examination. The age difference was statistically significant showing that children without health problems are having dental rehabilitation under GA at a younger age than SNP. The same results were profound in the study of Ciftci et al (2020) and Delfiner et al (2017). This is reasonable if we consider that HC learn to deal and coop with dental stress as they grow older.

From the children clinically examined, the total sample had visible plaque accumulation. That was also the fact for the study of Ezeldeen et al (2014). It is evident from the results of the present study that as the time elapsed between GA and our clinical examination, children had no differences at the OHI. Both SNP and HC had a similar oral hygiene index, indicating that there is no difference in dental plaque accumulation on tooth surfaces of the two groups. Anterior and posterior teeth had a similar amount of dental plaque.

When the surfaces of each tooth were examined separately, palatal/lingual surfaces were the most clean (half of the surfaces were out of plaque), while ¼ of interproximal surfaces had visible plaque accumulation. That could be explained from the fact that only four children out of 37 used dental floss.

When frequency of tooth brushing was introduced as a factor possibly relevant with oral hygiene index, it was found that children brushing their teeth at least once per day had a higher oral hygiene index when compared with children brushing few times per week. It was the only factor seemed to affect oral hygiene index.

From 37 children examined only 3 were caries free (8.08%). The amount is similar to the study of Ezeldeen et al (2014) where 9 % of the subjects presented with no caries. It is important to mention than in the present study ICDAS II was chosen as a more detailed index for caries experience.

As far as primary dentition concerns, was a clear trend for higher dmfs score for the children who had been treated under GA less than 5 years before the clinical examination. That is normal if

somebody considers that children in this group have more primary teeth in their mouth in comparison with children who had dental rehabilitation under GA more than five years before. That was the fact for more primary teeth with new caries lesions in the first group in comparison with the second.

It is interesting to mention that the present study can confirm the fact that children's dental health practices are influenced mostly by parental direction and guidance as well as parental dental health practices (Bullen et al, 1988). Restorative index in primary teeth on surface level was found to have a statistically significant difference between children whose parents attend the dentist often (at least once per year) and those whose parents attend infrequently or only when in pain. The difference was statistically significant ( $p=0.02$ ), indicating that children of the first group had a higher restorative index of primary teeth on surface level in comparison with children of the second one. After linear regression analysis of these factors, it seems that 30% of the variation of ri can be attributed to regular dental visits of the parents to the dentist. This results to the fact that frequent attendance of parents to the dentist can be a predictor of a high restorative index at surface level of primary teeth. Taking these into account, we could assume that by affecting parental behaviour, a change in their dental attitude is likely to occur and perhaps this would motivate parents to improve compliance as far as preventive oral health practices for their children.

In the present study an average of 10 surfaces of permanent teeth were decayed or filled or missing in each child. In the present study D component in surface level had the highest rate indicating that patients having total dental rehabilitation under GA at a young age remain at high risk for developing dental caries in their permanent dentition. The greatest indicator of future caries is past caries experience. Therefore, all patients who have undergone GA for dental rehabilitation should be assigned initially at a high-caries risk level and then attend recall appointments, follow prevention protocols and have caries risk reassessment (American Academy of Pediatric Dentistry, 2013; Schwendicke, 2013).

When the factor of health condition was used to divide participants in SNP and HC group significant differences were found as far as caries experience. Special need patients had significantly more filled surfaces on permanent teeth than healthy children. Our results show that special need patients can be used as a predictor for more filled surfaces on permanent teeth. In fact the presence of a health disorder in a child can explain 13% in the variation in the F compartment. This result could be explained from the fact that HC are younger in age, have fewer permanent teeth and the time period they exist in their mouth is shorter. This concludes to a statistically significant difference to the RI (restorative index) on both surface and tooth level in the two groups. But special needs were found to be a significant predictor for the RI only at surface level.

In addition, there was a statistically higher DMFS score in children treated under GA more than five years before as well as a statistically higher F component meaning that children treated under GA more than 5 years before had more filled surfaces on permanent teeth than those treated less than 5 years before. Our results show that oral rehabilitation more than 5 years before the clinical examination can be used as a predictor for filled surfaces on permanent teeth. In fact treatment

under GA more than five years before can explain 12% in the variation in the F compartment. It is a fact that as time passed from GA becomes longer, permanent teeth exist longer time in oral cavity.

The American Academy of Pediatric Dentistry states that frequent consumption of between-meal snacks and beverages containing sugars, whether added or naturally occurring, increases the risk for dental caries due to prolonged contact between sugars in the consumed food or liquid and cariogenic bacteria on the teeth (AAPD, 2020). As far as beverages containing natural sugar for example juice consumption - if consumed – they should be part of a meal or snack, not sipped throughout the day. In the present study a statistically significant difference was found neither in OHI nor in DMFS/dmfs between children treated under GA claimed to eat sweets every day and those who consume sweets few times per week. But children consuming sweets between main meals had more filled surfaces on permanent teeth than children consuming sweets with or right after main meals.

Li and Wang (2002) concluded to the fact that if infants or toddlers experience caries in their primary dentition it is three times more likely to develop caries in his permanent dentition than children previously disease free. At the same results conclude the research of Ezeldeen et al (2014), where patients with a history of ECC remain at high risk for developing dental caries in their permanent dentition. As a result, very young patients are at a higher risk of developing new carious lesions after dental surgery, especially on the newly erupted teeth, if their dietary and oral hygiene habits do not improve (Amin et al, 2010).

In the present study, first permanent molars are the teeth with the most caries lesions in the majority of the children. Carvalho et al and Mejàre et al claimed that the period with the highest risk for caries lesion development in permanent teeth is the first few years after tooth eruption (Carvalho et al, 2014; Mejàre et al, 2014). Most of the detected increase in dental caries is limited to pit and fissure of the occlusal surface of first molars (Batchelor et al, 2004; Brown et al, 1995; McDonald et al, 1992). And that is the fact for schoolchildren, where the occlusal surfaces of the first permanent molars are the most susceptible to dental caries (Mejàre et al, 2014; Lussi, 1991). It is not rare that carious lesions start before teeth fully erupt (Alves et al, 2014; Zenkner et al, 2013), because of their anatomy which favors biofilm formation and retention. This anatomy is about the depth and the incomplete coalescence of the fissures of the first permanent molars. In addition, the first permanent molars have a long eruption time, during which the tooth remains in a lower occlusal level. Dentists must carefully examine these teeth during this period and make the patient aware of the caries risk to their newly erupted molars (Batchelor et al, 2004; Quaglio et al, 2006; Carvalho et al, 2014). While the rate of caries on smooth surfaces has fallen enough the last years, this isn't the fact for the rate of occlusal caries among young people which has not fallen to the same extent (Brown et al, 1995). The newly developed caries lesions in the permanent dentition were associated with fissure depth in the lower first permanent molars (Sánchez-Pérez et al, 2019).

In primary teeth the most frequent dental rehabilitation was resin composite restoration with each child having almost five resin composite restorations under GA, followed by extractions (almost four extractions/per child). Similar results had the study of Bucher et al (2016) and Savanheimo et al (2012). Teeth most frequent extracted in the present study were upper incisors followed by upper



first primary molars. These results are in coordination with these of Schroth et al (2016). The treatments in the present sample showed an invasive character (few applications of fissure sealants and frequent use of stainless steel crowns). There is a group of scientists supporting for more aggressive treatment plans with full coverage restorations to prevent future operative visits (Worthen and Mueller, 2000; Sheehy et al, 1994). On the another hand there are studies which support that very young patients are at a higher risk of developing new carious lesions after dental surgery, especially on the newly erupted teeth, if their dietary and oral hygiene habits do not improve (Amin et al. 2010).

Dentists generally prefer less complex procedures for SNP than healthy patients to avoid complications or necessity for retreatment (Harrison and Roberts, 1998; Lee et al, 2009; Chia-Ling et al, 2006). The types of dental treatment performed under GA in the present study were found different between HC and SNP. In primary dentition HC had statistically more sealants while there was a trend for more pulpotomies and SSCs performed in HC in comparison with SNP. In permanent dentition only the group of SNP had any kind of dental treatment. These results are in contrast with the majority of studies where disabled patients had more extractions under the GA in comparison with healthy ones ASA I patients (Harrison and Roberts, 1998; Tsai et al, 2006; Stanková et al,2011, Ciftci et al, 2020).

It is appropriate to mention that the nature and design of the present study had some limitations. Sample size and subsequent group allocations were relatively small. That is mainly due to the fact of difficulties in the system of public paediatric hospitals in Athens which allow only a small number of no-hospitalized children to undergo dental rehabilitation under GA. Furthermore, restrictions due to Covid-19 pandemic and fear of movement especially for special need patients, had definitely decreased the number of patients who attended dental clinic for examination. In addition, from the protocol of the present study no radiographs were planned to be taken. There were radiographs available of the patients who continued attending the dental clinic after GA but information from these were not included in the data collection. This introduced an underestimation of the caries experience observation. Also, response bias to the questions of the interview may have resulted from 'social desirability,' meaning that parents in-accurately reported their own or their children's nutritional or oral hygiene habits, tending to over-report behaviors considered socially desirable, and under-report habits viewed as undesirable.

Taking into account the results of the present study, someone could think that parents should be more motivated as far as follow-up appointments concerns, but they aren't. Our study in agreement with the literature has shown that the conventional approach of delivering the message about oral health behaviors to the parents of children treated under GA does not effectively change in their oral hygiene behavior or their dental attendance. New concepts could be beneficial such as motivational interviewing and/or health coaching on line. Future studies should address whether or not new preventive strategies would result in a significantly reduced incidence of new caries following dental rehabilitation under GA.

The dentist should know that every child treated under general anaesthesia for dental rehabilitation should be classified as a high risk patient. Thus, they should return every 3 months for recall visits,

which should include clinical examination, oral hygiene instructions, caries risk reassessment and a fluoride varnish application. The follow up of these children should be adapted to their caries risk and lifestyle.

## **CONCLUSION**

Within the limitations of this study, it can be concluded that:

1. Only three children were caries free in both primary and permanent dentition while the total sample had visible plaque accumulation. In the present study, first permanent molars are the teeth with the most caries lesions and/or fillings.
2. SNP had statistically more filled surfaces on permanent teeth and a higher restorative index on surface level in comparison with HC, at least 2 years after GA.
3. The dental anxiety of the children treated under GA seems to improve as they grow up. A 94.2% of children were able to receive treatment in a dental setting after GA.
4. Consumption of sweet snacks between main meals seems to be a predictor for more filled surfaces on permanent teeth.
5. Children treated under GA more than 5 years before the present study had statistically more filled permanent teeth than children treated under GA less than 5 years before.
6. Almost 40% of participants claimed that they attend the dentist only when in pain while a 13% had never been to the dentist since treatment under GA.
7. Difficulties in getting contact with this group of children treated under GA are a great challenge for this study.

## **SUMMARY**

### **Introduction**

Young children and patients with special needs (SNP) with extensive caries often have limited abilities to cooperate and receive quality dental care. For this reason, general anaesthesia (GA) is often required for the dental treatment in these groups (Vermeulen et al 1991). Unfortunately caries

recurrence is a common finding especially in children with early childhood caries (ECC) who receive dental rehabilitation under GA (Almeida et al 2000, Gizani et al 2001) despite the frequent recalls and preventive programs (new caries lesions: 37-52% of children, 6 months after the initial GA treatment, Graves et al. 2004, Berkowitz et al. 2011). Few long term studies reported an evaluation after GA in ECC children while even fewer, long term studies reported the clinical findings in. Therefore the aim of the present study is to report data on the long term oral health and dental behavior of uncooperative children after dental rehabilitation under GA and to highlight the difficulties involved in the set-up of such a study.

## **Material and method**

The study sample originally consisted of 120 patients of the Postgraduate clinic of Paediatric Dentistry (NKUA) who received dental treatment under general anesthesia, between 2005 and 2017, at the Children's Hospital "Paidon Agia Sophia". The main reasons for their admission were extensive caries/no cooperation and special needs. The children should be not older than 18 years of age at present. The protocol was approved by the Ethics Committee of the Dental School and informed consent was obtained from the children and their legal guardians. From the university's dental archives, information was gathered about the dental situation of the patients at their initial dental visit and the treatment provided under GA. The parents were contacted from the secretary of the postgraduate clinic of paediatric dentistry by telephone, between January 2019 and October 2020. When no telephone number was available, or the number was no longer active, their current number was searched for in the telephone book or online. When communication was not possible the patients were excluded. Subjects reached via the phone were invited to attend the dental clinic for an examination, professional tooth cleaning and fluoride application. They also completed a questionnaire about the oral health and dietary habits and dental attendance during the period between GA and present. Any changes in the medical history were registered while demographic and socio-economic data of the family were obtained from the records of the dental clinic. Subjects, who were not willing to attend the dental clinic, were interviewed over the phone. During their appointment and before the clinical examination, each patient was asked to indicate, with parental help, if necessary, one of the images of the facial image scale which was considered to be the most representative of his/her dental anxiety at that moment (Buchanan *et al.* 2002). Oral hygiene was registered using the Hygiene index (Lindhe 1982), on four surfaces of all teeth using a periodontal dental probe and without a discoloration agent. After tooth cleaning, caries experience was recorded using the criteria of the International Caries Detection and Assessment System (ICDAS) (Ismail *et al.*, 2007). DMFS and dmfs scores were used to indicate the caries experience for each person (DS=ICDAS 1, 2, 3).

## **Results**

Study sample - The group of patients that could be contacted was 79 out of 120. From these, only 10 individuals refused to complete the questionnaire mainly due to lack of interest for the study.

Therefore the final study sample was 69 [26 females and 43 males with mean age 11.63 (SD 3.57)]. From these, 63.77% were SNP while 36.23% were Healthy children (HC). The most frequent health disorders were: mental disorders (50%), Syndrome/chromosomal disorders (41.91%) and autism (29.54%). The mean age of HC at the time of GA was 3.2 yrs (SD 0.8) and SNP was 5.82 yrs (SD 2.43) at that time. Most of the patients were younger than 5 yrs old at the time of GA. Some 37 patients (19 males and 18 females) out of 69, with mean age of 10.47 years (SD 3.43) agreed to attend the dental clinic. The reasons for the patient who did not want to have a clinical examination were mainly the distance (28.12%) or concerns due to Covid-19 pandemic (28.12%). Questionnaire - From the 69 individuals, 37 completed the questionnaire on site while the rest of them, at the phone by interview. Since GA, most of the subjects (71.01%) reported tooth brushing at least once per day (SNP: 72.73% and HC: 96%). Use of fluoride toothpaste was reported by all patients. Regarding their diet, half of the participants (50.72%) reported daily consumption of sweet snacks. The majority of the subjects (82.61%) reported at least one visit to the dentist in the previous year of the present study. Interestingly, 13.04% had never been to the dentist since the treatment under dental GA. Approximately half of them (50.72%) consulted the dentist for professional tooth cleaning and fluoride application, while 18.84% visited him/her due to pain. Among the rest of them which received dental treatment, extractions and/or restorations were most often provided. Clinical examination - The overall mean oral hygiene index was 32.93% (SD 0.2) (SNP: mean 32%, SD 19.78 and HC: mean 34.29, SD 20.78). Considering their caries experience at the present, the mean DMFS was 9.66 (SD 9.27) and dmfs 29 (SD: 15.91). Only 3 patients were caries free. More specifically HC patients had mean DMFS 6.39 (SD 4.99) [FS: 1.54 (SD 3.27)] while the mean DMFS of SNP was almost double 12.95 (SD 13.29). The largest component was DS for HC 4.92 (SD 5.08) and FS followed by DS, for the SNP 5.41 (SD: 6.26), FS 6.18 (SD 6.17). Patients were treated in daily dental routine setting. When the elapsed time between GA and the examination was considered, patients that were treated 2-5 years ago had mean DMFS 6.64 (SD 9.33). For them for which the elapsed time was longer (5-10), the mean DMFS score was 11.67 (SD9.27). Only two children reported that very sad about their visit to the dentist (face image scale).

## **Conclusion**

Uncooperative children with caries in the primary dentition at the time of GA are susceptible to developing caries in their permanent dentition as well as new caries in the primary teeth, especially in 5 years afterwards. Oral hygiene is a problem for all children. Absence of regular follow ups of the patients with dental rehabilitation after GA is an important parameter while difficulties in getting contact with them is a great challenge for this study.

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## Appendix 1

### A. Κοινωνικο-οικονομικά Χαρακτηριστικά

1. <u>Για την μητέρα</u> : Που ζήσατε το μεγαλύτερο μέρος της ζωής σας μέχρι την ηλικία των 15 ετών; Νομός:..... Δήμος:..... Ξένη Χώρα :.....	
2. <u>Για τον πατέρα</u> : Που ζήσατε το μεγαλύτερο μέρος της ζωής σας μέχρι την ηλικία των 15 ετών; Νομός:..... Δήμος:..... Ξένη Χώρα :.....	
3. Πού γεννήθηκε το παιδί; Νομός:..... Χώρα:.....	
4. Πού κατοικείτε τώρα; Νομός:..... Πόλη:..... Χώρα:.....	
5. Επίπεδο εκπαίδευσης μητέρας: Δεν πήγα σχολείο Μερικές τάξεις Δημοτικού Απολυτήριο Δημοτικού Απολυτήριο Γυμνασίου Απολυτήριο Μέσης Επαγγελματικής Σχολής Απολυτήριο Λυκείου Φοίτησα σε ανώτερη-ανώτατη σχολή Πτυχιούχος ανώτερης σχολής Πτυχιούχος ανώτατης σχολής Κάτοχος διδακτορικού-μεταπτυχιακού διπλώματος	<input type="checkbox"/>



<p>6. Επίπεδο εκπαίδευσης πατέρα:</p> <ol style="list-style-type: none"> <li>1. Δεν πήγα σχολείο</li> <li>2. Μερικές τάξεις Δημοτικού</li> <li>3. Απολυτήριο Δημοτικού</li> <li>4. Απολυτήριο Γυμνασίου</li> <li>5. Απολυτήριο Μέσης Επαγγελματικής Σχολής</li> <li>6. Απολυτήριο Λυκείου</li> <li>7. Φοίτησα σε ανώτερη-ανώτατη σχολή</li> <li>8. Πτυχιούχος ανώτερης σχολής</li> <li>9. Πτυχιούχος ανώτατης σχολής</li> <li>10. Κάτοχος διδακτορικού-μεταπτυχιακού διπλώματος</li> </ol>	<input type="checkbox"/>
<p>7. Για την μητέρα: Εργάζεστε αυτή τη περίοδο;</p> <ol style="list-style-type: none"> <li>1. Ναι</li> <li>2. Όχι</li> </ol>	<input type="checkbox"/>
<p>8. Για τον πατέρα: Εργάζεστε αυτή τη περίοδο;</p> <ol style="list-style-type: none"> <li>1. Ναι</li> <li>2. Όχι</li> </ol>	<input type="checkbox"/>

## B. Δημογραφικά χαρακτηριστικά

<p>1. Γεννήθηκε το παιδί σας στον 9<sup>ο</sup> μήνα της κύησης;</p> <ol style="list-style-type: none"> <li>1. Ναι</li> <li>2. Όχι</li> </ol> <p>Αν Όχι, σε ποιόν μήνα γεννήθηκε;.....</p>	<input type="checkbox"/>
<p>2. Πόσα κιλά ζύγιζε όταν γεννήθηκε;</p> <ol style="list-style-type: none"> <li>1. &lt;2.000gr</li> <li>2. 2.000-3.000gr</li> <li>3. &gt;3000gr</li> </ol>	<input type="checkbox"/>
<p>3. Μέχρι ποια ηλικία θήλαζε το παιδί σας;</p> <ol style="list-style-type: none"> <li>1. Έως 6 μηνών</li> <li>2. Έως 1 έτους</li> <li>3. Έως 2 ετών</li> <li>4. Μεγαλύτερο από 3 ετών</li> </ol>	<input type="checkbox"/>

4. Μέχρι ποια ηλικία χρησιμοποιούσε το παιδί σας το μπιμπερό; 1. Έως 1 έτους 2. Έως 2 ετών 3. Έως 3 ετών 4. Μεγαλύτερο από 3 ετών	<input type="checkbox"/>
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### Γ. Ιατρική Κατάσταση

1. Έχει διαγνωστεί το παιδί σας με κάποιο σύνδρομο;	1. Ναι 2. Όχι	<input type="checkbox"/>
2. Αν ναι, αναφέρατε το σύνδρομο:		
3. Παρουσιάζει το παιδί σας κάποιο πρόβλημα με:	1. Την καρδιά 2. Το αναπνευστικό 3. Τα νεφρά 4. Το αίμα 5. Το νευρικό σύστημα 6. Ήπαρ	<input type="checkbox"/>
4. Έχει νοσηλευθεί ποτέ το παιδί σας στο νοσοκομείο;	1. Ναι 2. Όχι	<input type="checkbox"/>
5. Αν Ναι, αναφέρατε τον λόγο νοσηλείας:		
6. Παίρνει το παιδί αυτή τη στιγμή κάποιο φάρμακο;	1. Ναι 2. Όχι	<input type="checkbox"/>
7. Αν ναι, αναφέρατε το φάρμακο:		
8. Έχει διαγνωστεί το παιδί με κάποια νευροαναπτυξιακή διαταραχή;	1. Φάσμα Αυτισμού 2. ΔΕΠΥ 3. Υπερκινητικότητα 4. Διαταραχή Asperger 5. Καμία	<input type="checkbox"/>
9. Παρουσιάζει το παιδί σας κάποιου είδους νοητική υστέρηση;	1. Ναι 2. Όχι	<input type="checkbox"/>

#### Δ. Στοματική υγιεινή και διατροφικές συνήθειες

Τελευταία οδοντιατρική επίσκεψη	1-3 μήνες πριν 6 μήνες πριν 1 χρόνο πριν 2 χρόνια πριν >3 χρόνια πριν	<input type="checkbox"/>
Αιτία επίσκεψης	Τακτικός έλεγχος Απλός έλεγχος Πόνος Τραυματισμός	<input type="checkbox"/>
Συχνότητα βουρτσίσματος	1 φορά την εβδομάδα 1 φορά κάθε 2 μέρες 1 φορά τη μέρα 2 φορές τη μέρα >2 φορές τη μέρα	<input type="checkbox"/>
Χρήση νήματος	Ναι Όχι	<input type="checkbox"/>
Χρήση στοματικού διαλύματος	Ναι Όχι	<input type="checkbox"/>
Χρήση φθοριούχου οδοντόκρεμας	Ναι Όχι	<input type="checkbox"/>
Συχνότητα κατανάλωσης γλυκών	1. Καθημερινά 2. 3-4 φορές την εβδομάδα 3. 1-2 φορές την εβδομάδα	<input type="checkbox"/>
Συχνότητα κατανάλωσης αναψυκτικών	1. Καθημερινά 2. 3-4 φορές την εβδομάδα 3. 1-2 φορές την εβδομάδα 4. Σπάνια	<input type="checkbox"/>
Χρονική περίοδος ημέρας που γίνεται η κατανάλωση γλυκών / αναψυκτικών	1. Ανάμεσα στα γεύματα 2. Με το κύριο γεύμα	<input type="checkbox"/>

Πώς θα αξιολογούσατε την στοματική κατάσταση του παιδιού σας	1.Καλή 2.Μέτρια 3.Κακή	<input type="checkbox"/>
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## Ε. Οδοντιατρική θεραπεία μετά την γενική αναισθησία

1.Το παιδί σας έχει λάβει οδοντιατρική θεραπεία υπό γενική αναισθησία	1. Μία φορά 2. Δύο φορές 3. Περισσότερες από τρεις φορές	<input type="checkbox"/>
2.Πόσα χρόνια έχουν περάσει από την διεξαγωγή της τελευταίας οδοντιατρικής θεραπείας κάτω από γενική αναισθησία;	1.Μέχρι 5 χρόνια 2. 5-10 χρόνια 3. >10χρόνια	<input type="checkbox"/>
3.Μετά τη διεξαγωγή της γενικής αναισθησίας προσήλθατε κανονικά στην πρώτη προγραμματισμένη επανεξέταση στο Πανεπιστήμιο;	1.Ναι 2.Όχι	<input type="checkbox"/>
4.Αν Όχι, αναφέρατε τον λόγο:		
5.Στο χρονικό διάστημα μέχρι σήμερα επισκεφθήκατε ξανά τον οδοντίατρο;	1.Ναι 2.Όχι	<input type="checkbox"/>
6.Αν Ναι, επιλέξτε τον λόγο επίσκεψης;	1.Απλός έλεγχος 2. Τακτικός 3μηνιαίος καθαρισμός 3.Τακτικός 6μηνιαίος καθαρισμός 4.Πόνος 5.Τραυματισμός 6.Οίδημα 7.Ορθοδοντική εκτίμηση 8.Άλλο.....	<input type="checkbox"/>
7.Έχουν γίνει εξαγωγές δοντιών μετά την γενική αναισθησία;	1.Ναι 2.Όχι	<input type="checkbox"/>
8.Έχουν γίνει σφραγίσματα μετά την γενική αναισθησία;	1.Ναι 2.Όχι	<input type="checkbox"/>
9.Ακυρώσατε ποτέ ραντεβού στον οδοντίατρο;	1.Ναι 2.Όχι	<input type="checkbox"/>
10.Αντικαταστήσατε άμεσα το ακυρωμένο ραντεβού;	1.Ναι 2.Όχι	<input type="checkbox"/>

11.Αμελήσατε να προσέλθετε ποτέ σε προγραμματισμένο ραντεβού στον οδοντίατρο;	1.Ναι 2.Όχι	<input type="checkbox"/>
12.Εσείς πόσο συχνά επισκέπτεστε τον οδοντίατρο σας για το δικό σας οδοντιατρικό επανέλεγχο ή θεραπεία;	1.Μία φορά το 6μηνο 2.Μία φορά τον χρόνο 3.Μία φορά τα δύο χρόνια 4.Μόνο σε περίπτωση πόνου	<input type="checkbox"/>

## Appendix 2

### ΕΠΙΚΟΙΝΩΝΙΑ ΜΕ ΤΟΥΣ ΣΥΜΜΕΤΕΧΟΝΤΕΣ

ΟΝΟΜΑ:

ΑΡΙΘΜΟΣ ΦΑΚΕΛΟΥ:

ΕΠΩΝΥΜΟ:

ΗΜΕΡΟΜΗΝΙΑ ΤΕΛΕΥΤΑΙΑΣ ΕΠΙΣΚΕΨΗ ΣΤΗΝ ΟΔΟΝΤΙΑΤΡΙΚΗ ΣΧΟΛΗ:

1.Μετά από πόσες προσπάθειες απάντησαν στις κλήσεις μας	1.Με την πρώτη προσπάθεια 2.Μετά από 2 προσπάθειες 3.Μετά από 3 προσπάθειες 4.Κάλεσαν εκείνοι όταν είδαν την κλήση μας 5.Κάλεσαν πριν τους καλέσουμε 6.Ήρθαν στην σχολή για να κανονίσουν ραντεβού 5.Δεν απάντησαν	
2.Λόγος που δεν απάντησαν τις κλήσεις	1.Συνδρομητής απενεργοποιημένος 2.Νούμερο δεν αντιστοιχεί σε συνδρομητή 3.Λάθος νούμερο 4.Χτυπούσε αλλά δεν πήραμε απάντηση 5.Άλλο.....	
3.Πως αντέδρασαν αρχικά στην πρόταση για επανεξέταση στην σχολή	1.Έδειξαν ενδιαφέρον αλλά δεν έκλεισαν Ραντεβού 2.Έκλεισαν ραντεβού 2.Αδιάφοροι/ αρνητικοί	
4.Αρνήθηκαν να έρθουν	1.Ναι 2.Όχι	
5.Αν αρνήθηκαν, για ποιον λόγο:		
6.Ακύρωσαν ή αμέλησαν να προσέλθουν σε προγραμματισμένο ραντεβού	Ναι (Μία φορά) Ναι ( Επανειλημμένα) Όχι	

1<sup>Η</sup> ΠΡΟΣΠΑΘΕΙΑ ΕΠΙΚΟΙΝΩΝΙΑΣ

3<sup>Η</sup> ΠΡΟΣΠΑΘΕΙΑ ΕΠΙΚΟΙΝΩΝΙΑΣ

ΗΜΕΡΟΜΗΝΙΑ:

ΗΜΕΡΟΜΗΝΙΑ:

2<sup>Η</sup> ΠΡΟΣΠΑΘΕΙΑ ΕΠΙΚΟΙΝΩΝΙΑΣ

## Appendix 3

ΗΜΕΡΟΜΗΝΙΑ:

ΟΝΟΜ/ΜΟ:

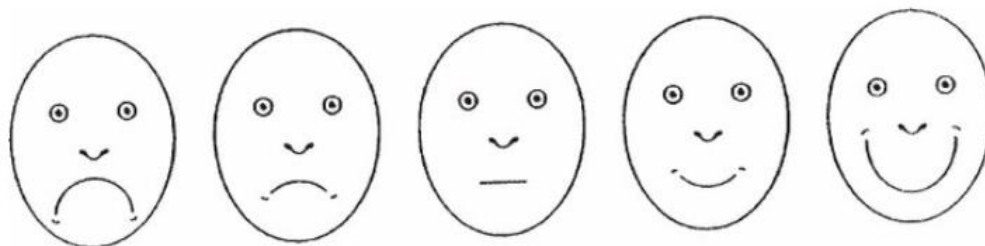
Αγόρι  Κορίτσι

Ηλικία:

ΗΜΕΡΟΜΗΝΙΑ:

### ΕΡΩΤΗΜΑΤΟΛΟΓΙΟ ΑΥΤΟΑΞΙΟΛΟΓΗΣΗΣ

ΟΔΗΓΙΕΣ: Πιο κάτω θα βρεις πέντε σκίτσα με τα οποίες τα αγόρια και τα κορίτσια περιγράφουν τον εαυτό τους. Κοίταξέ τα προσεκτικά και αποφάσισε πώς νοιώθεις εσύ αυτή τη στιγμή. Μετά βάλε ένα x στο τετράγωνο, το οποίο είναι κάτω από το σκίτσο που περιγράφει καλύτερα το πώς νοιώθεις τώρα. Δεν υπάρχουν σωστές ή λανθασμένες απαντήσεις. Θυμήσου, βρες το σκίτσο, που περιγράφει καλύτερα το πώς εσύ νοιώθεις αυτή τη στιγμή.



## Appendix 4

### Καταγραφή συμπεριφοράς

Καταγραφή σύμφωνα με την κλίμακα του Frankel (The Frankel scale, 1962)

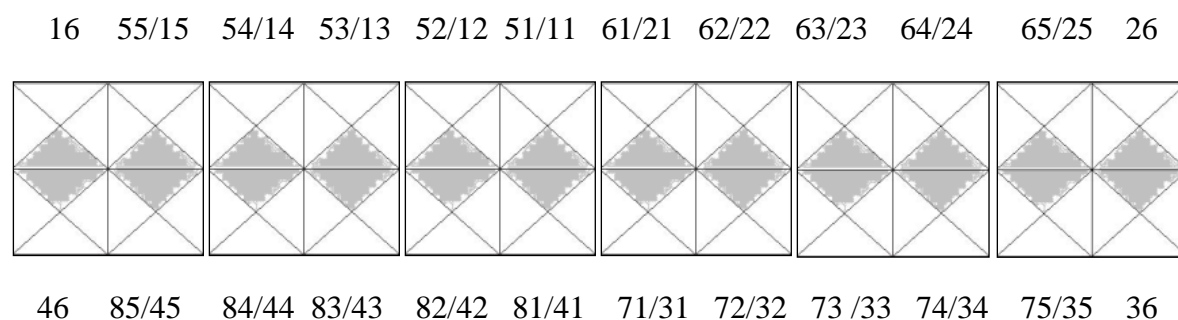
Απόλυτα αρνητική 2. Αρνητική 3. Θετική 4. Απόλυτα θετική

### Καταγραφή οδοντικής πλάκας

Καταγραφή εγγύς, άπω, παρειακά (Απλουστευμένος ουλικός δείκτης, Linde, 1981)

0 = απουσία πλάκας

1 = παρουσία πλάκας



$$N = \frac{\text{ο αριθμός των επιφανειών χωρίς οδοντική μικροβιακή πλάκα}}{\text{ο αριθμός των εξεταζόμενων επιφανειών}} \times 100\%$$



# Καταγραφή κατάστασης σκληρών οδοντικών ιστών

Καταγραφή με βάση το σύστημα ICDAS ( International Caries Detection and Assessment System)

Restoration and Sealant Codes		Caries Codes	
No restored or sealed	0	0	Sound tooth surface
Sealant, partial	1	1	First visual change in enamel
Sealant, full	2	2	Distinct visual change in enamel
Tooth coloured restoration	3	3	Enamel breakdown, no dentine visible
Amalgam restoration	4	4	Underlying dentinal shadow (not cavitated into dentine)
Stainless steel crown	5	5	Distinct cavity with visual dentine
Porcelain or gold or PFM crown or veneer	6	6	Extensive distinct cavity with visible dentine
Lost or broken restoration	7		
Temporary restoration	8		

97 = Tooth extracted because of caries (all tooth surfaces will be coded 97)

98 = Tooth extracted for reasons other than caries (all tooth surfaces coded 98)

99 = Unerupted (all tooth surfaces coded 99)

## Καταγραφή κατάστασης σκληρών οδοντικών ιστών (συνέχεια)

16	55/15	54/14	53/13	52/12	51/11	61/21	62/22	63/23	64/24	65/25	26	
												DISTAL
												OCCLUSAL
												MESSIAL
												BUCCAL
												LATERAL

46	85/45	84/44	83/43	82/42	81/41	71/31	72/32	73/33	74/34	75/35	36	
												DISTAL
												OCCLUSAL
												MESSIAL
												BUCCAL
												LATERAL

$$RI = \frac{\text{ΑΘΡΟΙΣΜΑ ΕΜΦΡΑΧΘΕΝΤΩΝ ΔΟΝΤΙΩΝ}}{\text{ΑΘΡΟΙΣΜΑ ΕΜΦΡΑΧΘΕΝΤΩΝ ΚΑΙ ΤΕΡΗΔΟΝΙΣΜΕΝΩΝ ΔΟΝΤΙΩΝ}} \times 100\%$$

Νεογιλή οδοντοφυΐα	d.....	m.....	f.....	dft.....	dmft.....
	ds.....	ms.....	fs.....	dfs.....	dmfs.....
Μόνιμη οδοντοφυΐα	D.....	M.....	F.....	DFT.....	DMFT.....
	DS.....	MS.....	FS.....	DFS.....	DMFS.....

