T.C. ISTANBUL YENİ YÜZYIL UNIVERSITY

HEALTH SCIENCE INSTITUTE

DEPARTMENT OF ORTHODONTICS

MASTER THESIS

Cross section study: Oral Hygiene State (OHI-S) in the School Children at Late Mixed Dentition in Libya

NURAL HUDA AB BAKER ELKAHILY

Supervisor

Prof. Dr. Gökmen Kurt

Istanbul-Turkey

AUGUST 2017

ACCEPTANCE AND APPROVAL

T.C. ISTANBUL YENİ YUZYIL UNIVERSITY

This study was conducted within the framework of the Department of Orthodontics was accepted by president of jury as a Master Thesis.

Thesis presentation date: 09.08.2017

Professor Dr. Haluk İŞERİ
Orthodontics Department
İstanbul Yeni Yüzyıl University

Professor Dr. Gökmen KURT
Orthodontics Department
İstanbul Yeni Yüzyıl University

Assist. Prof.Dr. Delal Dara KILINÇ
Orthodontics Department
Medipol University

ABSTRACT

Aims: The overall aim of this thesis was to collect knowledge and to provide the base line data of oral hygiene state by use of simplified oral hygiene index (OHIS) among school going children (10-12 years) of rural and urban area in Tripoli of Libya.

Materials and methods: Total of 504 school children, aged 10 - 12 years, from two public school children in Tripoli of Libya were included to this study. One elementary school selected from rural area and one elementary school selected from urban area, and stratified random sampling was used in each school to distribute the sample to three Groups according to the age, the Group 1 (10 years), Group 2 (11 years) and Group 3 (12 years). The stratified random sampling was also used in each school to distribute the sample according to sex to equal number, with a random selection of boys and girls from each selected elementary school. The final sample was 504, 10-12-year-old school children (252 urban and 252 rural), (252 boys and 252 girls) resident in Tripoli, studying from Grades 4 to 6 in two elementary public schools, each Group contain 84 child, 42 boy and 42 girl. One calibrated dentist scored all subjects for Simplified Oral Hygiene Index (OHI-S). Upon completion, statistical comparison of the study variables by region, sex and age was achieved.

Results: In Group 1, the mean values of OHIS scores in the rural Group were higher than the urban Group while in Group 3 the mean values of OHIS scores in the urban Group were higher than the rural Group (p=0,005 and p=0,022). The mean OHI-S score comparison between boys and girls showed that, in the rural Group 3, there was significant difference between the means of OHIS scores in the boys and the girls, in which the mean value of OHIS scores of the boys were higher than the girls (p=0,002). According to the age, the mean value of OHIS scores in the Group 1 was higher than the Group 3 (p=0,006).

Conclusion: Overall, Libyan school children had OHI-S scores from fair to good oral hygiene and generally the girls have better OHI-S scores than their male counterparts. The variation in the OHI-S scores of urban and rural children may also be related to socio-economic status or the availability and affordability of toothbrushes.

DEDICATES

I dedicate this thesis to my father Abdulhafid, my mother Naima, my husband Mohanid, my daughter Rofan, my whole family and my country Libya. I wish to thank you for your support in the difficult and easier times. It is impossible to find the right words to thank you. With all my heart and love, I say, thank you very much.

ACKNOWLEDGEMENTS

I would like to express my deep gratitude and respect to professor doctor Gökmen Kurt, my supervisor, for his generous help, valuable advice during my research period. I wish to thank him for his patience, precious time and moral support. His interest in my work, constant encouragement and confidence were essential to accomplish this work. These few words stated above could not express my deep respect to Doctor Gökmen Kurt, his suggestion and creative ideas will never be forgotten. Thank you very much.

Special thanks to Assistant Professor Doctor Evren Delilbaşı for everything do for me to complete my study. Also, I want to thank Prof. Dr. Haluk İşeri, Prof. Dr. Faik Çokpekin and Prof. Dr. Handan Ayhan for their efforts and guidance during my education.

LIST of TABLES

Page

LIST of FIGURES

Page

TABLE OF CONTENTS

Page

1. INTRODUCTION

Oral health has strong biological, psychological, and social projections, because it affects esthetics and communication, and the quality of life is affiliated with oral health status. The World Health Organization (WHO) defined Health as "a state of complete physical, mental and social well-being and not merely absence of disease or infirmity". Oral health is linked to happiness and good general health, and there is evidence that esthetically acceptable and functionally adequate dentitions affect self-esteem, confidence, and socialization. (1)

Oral health is now recognized as equally important in relation to general health. Healthy teeth and oral tissues and the need for oral health care are important for any section of society. Oral disorders can have a profound impact on the quality of life Good oral health has real health gains, in that it can improve general health and quality of life and contribute to self-image and social interaction. Epidemiologic studies may be of value in assessing the prevalence of diseases, in disclosing trends in disease development, and in analyzing possible factors influencing the disease pattern. (2)

Oral hygiene is the most effective measure to prevent caries and periodontal disease. Ideally brushing should be performed twice a day in order to maintain oral health. However, many children globally brush less than once a day. (3)

The study done by Mohammed Al Nuaimi et al. in 2014 obtained that the Middle East subject's averaged significantly higher debris and OHI-S scores when compared to South Asia children's overall. The highest debris score average was found in Middle East male (Egypt) and female (Palestine) children's. The highest calculus score average was found in South Asia male and female (both Bangladesh) children's. The highest OHI-S score average was found in South Asia male (Bangladesh) and female (Pakistan) children's. Debris and OHI-S scores were lowest for Middle East female Iran children's. (4)

1.1. Libyan Population:

As of 1 January 2016, the population of Libya was estimated to be 6 678 697 people. This is an increase of 2.06 % (135 061 people) compare to population of 6 543 636 the year before.

The sex ratio of the total population was (1015 males to 1000 females) similar with global sex ratio, which were approximately 1016 males to 1000 females in 2015. Below are the data related to Libya population in 2015.

- 157 309 live births.
- 22 248 deaths.
- Natural increase: 135 061 people.
- Net migration: 0 people.
- 3 363 779 males as of 31 December 2015.
- 3 314 918 females as of 31 December 2015.

As of the beginning of 2016 according to our estimates Libya had the:

- Percentage of population under 15 which was 32.8%
- Percentage of population between 15 and 64 years old which was 62.7%
- Percentage of population 65+ which was 4.6%.
- 2 188 409 young people under 15 years old (1 118 081 males / 1 070 328 females)
- 4 185 873 persons between 15 and 64 years old (2 150 073 males / 2 035 867 females)
- 304 415 persons above 64 years old (148 735 males / 155 680 females). (5)

1.2. Libyan Health System, Oral Health Care and Human Resources:

Libya has 25 specialized hospitals, 18 central hospitals, 21 general hospitals, 32 rural hospitals, with a total of 96 public hospitals and 1,424 primary health care facilities. Many of the general, rural hospitals and primary health care facilities have dental clinics attached to them. (6)

Hospitals in Libya are autonomous bodies by law. The designing and development of oral health services in Libya has been carried out with little evidence of the dental

needs of the population, as data are sparse. The Health Ministry provides dental health services to people of all ages through the public dental clinics with dental health services generally spread throughout the cities. The main treatments are minor oral surgery, tooth scaling, and restorations with very little development of preventive services. For a long time, populations decided to seek treatment only when they noticed symptoms, contrary to preventing disease before its occurrence. Unfortunately, government expenditure in respect to oral health follows this outdated model and it targets on diagnosis of and treatment for oral and dental diseases rather than on oral health prevention programs. Every procedure involving basic oral treatment such as dental extractions, dental restorations of both amalgam and anterior tooth coloring are offered free in the public oral health sector. (7)

Public schools employ dentists for providing primary dental treatments and dental education. Impressively, population access to local health services for both rural as well as urban populations during 1999-2012 has remained 100%. Furthermore, six dentists per 10,000 persons by 2012 were present in Libya. (8)

In Sweden oral healthcare is the responsibility of county government, although counties are not required to provide the services themselves. 8% of total governmental spending on health care is spent on dentistry. Almost all oral health care is provided in one of two ways. Firstly, there is a Public Dental Service (NDS) which provides free dental care to children up to the age of 19. These dental services are mainly delivered in local clinics which are managed by the counties. Children and their parents can choose to attend either the NDS or private practitioners. Secondly, adults and elderly people who are not entitled to free care from the Public Dental Service can get subsides dental care from the NDS or dentists in private practice. (9)

Health care in Canada falls under provincial jurisdiction, and each province has its own dental legislation that affects dental services. Dental services are not included as Medicare services under the national Canada Health Act, however dental services provided in hospitals are covered under Medicare. These and other public dental services represent a very small proportion of the overall dental services in Canada approximately 5% of dental expenditures in 2009 were public sector dental

expenditure. There have also been changes to health care legislation in some provinces affecting the scope of practice of dental hygienists and denturists, but nothing significantly altering the funding of dental care services in the Canadian health care system. The term “dental services” as defined by the Canadian Institute of Health Information “expenditures for professional fees of dentists (includes dental hygienists and assistants) and denturists, as well as the cost of dental prostheses, including false teeth and laboratory charges for crowns and other dental appliances.” (This encompasses all dental services, but does not include products like tooth pastes). Federal spending on public dental programs in 2009 was between $250 to $275 million dollars whereas provincial and municipal public sector expenditures accounted for the remainder. In summary, oral health care occupies a relatively separate position in the Canadian health system. The federal government covers a portion or all of oral health care costs to veterans, refugees and eligible Indigenous individuals and every province recognizes some dental care as medically necessary and “targets oral health care resources to marginalized groups, using different ways and varied health and social services provisions.” (10)

Dental caries and periodontal diseases are the most common oral ailments and the major causes of tooth loss. Libya is one of the most arid countries in the world, yet potable water is available across the country. Water fluoridation is a primary prevention mechanism employed against dental caries across the globe. There is a steady rise in the use of bottled water in Libya. A clear agenda or scheme that could oversee water fluoridation is lacking. With urbanization on the rise, increasingly westernized food intake and a lack of primary preventive measures in place, Libya could see a rise in dental caries and related ailments. This could burden its already ailing health care system. (7)

Periodontal diseases are widely prevalent in the human population worldwide. They along with dental caries, encompass the common dental ailments of any given human population. Dental plaque is the primary cause of both dental caries and general periodontal diseases. Oral hygiene is the most advised primary prevention for removal of dental plaque. Insufficient data exists with regard to dental caries and periodontal disease prevalence in the Libyan population. Available data also suggest

that a significant percentage of the population does not practice basic oral hygiene. (11)

1.3. Gingivitis in Children:

Gingivitis or inflammation of the gingiva is the most common oral disease in children and adolescents. It is characterized by the presence of gingival inflammation without detectable bone loss or clinical attachment loss. The causes and risks are as varied in children as in adults and range from local to systemic causes. The most important local predisposing factor in children however is poor oral hygiene. Gingivitis is also regarded as the most common periodontal disease in children, with the primary etiology as plaque. In poor oral hygiene, food debris, plaque and microorganisms also accumulate and the process of inflammation starts. (12)

The most common oral diseases among children are gingivitis and dental caries the latter affecting 60-90% of children globally. Pain from teeth or mouth can compromise their concentration and their participation in school, thereby hampering not only their play and development but also denying them the full benefit of schooling. (13)

1.4. Oral Hygiene Measures:

Personal oral hygiene is the maintenance of oral cleanliness for the preservation of Oral health, whereby microbial plaque is removed and prevented from accumulating on teeth and gingivae. Current mechanical and chemotherapeutic approaches to oral hygiene aim to modify the oral microflora to promote healthy periodontal and dental tissues. (14)

1.4.1 Mechanical Oral Hygiene Measures:

Mechanical disruption and removal of plaque is simple and effective; tooth brushing and flossing are most common oral hygiene measures used today. The objectives are to remove plaque or interfere with its formation to prevent it from becoming Pathogenic. In addition, tongue brushing (from back to front) to reduce the accumulation of plaque and debris on the tongue can reduce halitosis. (15)

Tooth Brushing and Tooth Brushes:

No one manual toothbrush design appears superior for plaque removal**.** For small children, tooth brushing should be performed by an adult until the child is about 6 year old, when increasing dexterity and cognition may permit supervised brushing until the child is capable independent brushing in young children, gingival health is common despite plaque accumulation due to immature host responses and poor oral hygiene Never the less, establishing good hygiene habits is valuable for present and future oral health. (16)

Other Interdental Cleaning Aids:

Adaptable interdental brushes and wooden sticks, which are easier to use than floss, can be used to clean proximal tooth surfaces These aids can remove plaque and accumulated food debris from areas inaccessible to toothbrushes, most children exhibit healthy gingiva and do not require interdental cleaning aids other than floss. Interdental brushes or wooden sticks may cause trauma if they are forced into children's narrow gingival embrasures. Toothpicks impregnated with 3-4 % sodium fluoride are promising vehicles for delivery of fluoride especially to exposed root surfaces. (17, 18, and 19)

Electric Interdental Cleaners:

Are now on the market the cleaning tip has fine rotary filaments that vibrate interproximally and a flexible gum stimulator which moves at 100 strokes per second.

Chewing Gums:

The use of sugar free chewing gum as a mechanical salivary stimulant after eating can accelerate the clearance of dietary substances and microorganisms, promote buffers to neutralize plaque acids and provide antibacterial substances. (20)

1.4.2. Chemotherapeutic Oral hygiene Measures:

Mechanical oral hygiene measures have been supplemented by chemotherapeutic agents that can greatly improve oral hygiene. In contrast to mechanical methods,

these measures do not require manual dexterity, knowledge or motivation The list includes anticalculus agents such as pyrophosphate, antibacterial such as TriclosanTM and chlorhexidine, anticaries agents such as fluoride, whitening agents such as alumina and desensitizing agents such as strontium chloride. (21)

Dentifrices:

As pastes or gels, modern dentifrices are adjuncts to tooth brushing and vehicles for agents to inhibit calculus, reduce plaque, prevent caries, whiten enamel and desensitize exposed root surfaces. Mild abrasives and detergent components promote plaque removal, although the abrasively can damage exposed root surfaces. (22)

Anticalculus Agents:

Pyrophosphate and zinc citrate are now incorporated in many dentifrices. As a 3.3 per cent formulation, pyrophosphate interferes with the transformation of amorphous calcium phosphate to hydroxyapatite, inhibiting crystal formation and reducing supragingival calculus formation by 29-48 per cent.

Antibacterial Agents:

Triclosan, TM active against gram positive and gram negative microorganisms, in dentifrices decreases supragingival plaque formation and gingival inflammation. Combined with either Gantrez TM or zinc citrate, the substantively or oral retention of Triclosan is increased, further reducing plaque formation and gingival bleeding without causing major shifts in oral microflora, development of microbial resistance or colonization of pathogens. (23 and 24)

Anti-microbial Agents:

Chlorhexidine (CHX) into dentifrices is hindered by its inactivation by Calcium ions and anionic surfactants such as sodium lauryl sulphate. However, an experimental dentifrice containing 0.4 per cent CHX, 0.34 % zinc ion and 1,450 ppm fluoride showed statistically significant reductions in plaque, gingivitis and calculus and exhibited less tooth staining than a 0.12 % CHX rinse. Enzymes such as dextranase

and lactoperoxidase have been added to dentifrices (for example, BioteneTM) with the intent of enhancing the antibacterial properties of saliva. (25)

Fluoride Incorporated into Dentifrices

Usually 100-1500 ppm fluoride as sodium fluoride or sodium monofluorophosphate, offers well recognized Cariostatic benefits (approximately 20-40 % reductions) for coronal and root surfaces. Acting topically, fluoride inhibits demineralization and promotes remineralization of early lesions. Children should swish the dentifrice saliva mix vigorously after brushing, forcing it interproximally, for additional caries protection Since young children may ingest dentifrices, small amounts of dentifrices with lower fluoride concentrations (405 -500 ppm) are recommended to minimize the risk of fluorosis. (26)

Studies of new stabilized stannous fluoride formulations have shown some antimicrobial properties, reducing gingival indices by approximately 20 % but tooth staining was apparent and plaque reductions were negligible. (23)

Tooth Whitening Dentifrices:

Common whitening agents include silica, alumina and peroxide. To date, studies have been largely laboratory-based, although one test dentifrice demonstrated whitening clinically in a six month trial. (27)

Desensitizing Dentifrices:

Containing strontium chloride and acetate, potassium nitrate and chloride, sodium citrate and fluoride to relieve tactile and thermal sensitivity have been accredited by the British and American dental associations. These chemicals reduce dentinal or cemental hypersensitivity by directly desensitizing pulpal nerve fibers or forming insoluble precipitates within the tubules to limit fluid displacement (28)

Mouth Rinses and Gels:

Mechanical plaque control shortfalls can be redressed by antibacterial and cariostatic Mouth rinses and gels. The antimicrobial mouth rinses include as active ingredients CHX, Triclosan and cetylpyridinium chloride, cariostatic products contain fluoride.

Chlorhexidine Gluconate:

Chlorhexidine gluconate has been accepted as an effective treatment for gingivitis by the American Dental Association. The cationic bis-biguanide chlorhexidine is the gold standard broad spectrum antiseptic Chlorhexidine displays substantively, adsorbs to tooth surfaces and disrupts cytoplasmic membranes of bacteria. (29)

Plaque formation and gingivitis were reduced by 45-61 % and 27-67 % respectively in clinical trials and twice-daily rinsing with 10 ml of 0.2 % CHX almost completely inhibited plaque development and gingivitis. (30)

Chlorhexidine is inactivated by anionic dentifrice surfactants and therefore tooth brushing should precede its use or be performed 30 minutes after rinsing. Long term use of CHX may promote yellow-brown staining, taste alteration, calculus formation and mucosal desquamation, reducing patient acceptance. Oral flora develops resistance after about six months, use although base line sensitivity is re-established after discontinuation. (31)

The mouth rinse Listerine, TM containing the essential phenolic oils eucalyptol, thymol and menthol, is less effective than CHX, reducing plaque and gingivitis by 20-35 % and 25-35 % respectively, by disrupting cell walls and inhibiting bacterial enzymes. Listerine does not disrupt the normal oral flora. (29)

Adverse effects include burning sensations, a bitter medicinal taste, occasional staining and potential tissue irritation. The high alcohol content means accidental or deliberate ingestion of particular concern in children, can lead to intoxication or poisoning. (29 and 31)

Mouth Rinses Containing TriclosanTM-GantrezTM

Mouth rinses containing TriclosanTM-GantrezTM have demonstrated similar reductions to dentifrice formulations for plaque indices (24-36 %) and gingival indices (about 20 %). Although less thoroughly investigated, TriclosanTM-zinc citrate has shown statistically significant reductions in plaque and gingival indices and recent work suggests that both 0.5 % zinc citrate and 0.5 % GantrezTM enhance the clinical effects of TriclosanTM equally. (32 and 33)

Antimicrobial mouth rinses containing cetylpyridinium chloride have demonstrated lower clinical efficacy than CHX (attributed to lower substantively), with plaque and gingival score reductions of 25-35 %, similar to TriclosanTM-GantrezTM mouth rinses. Side effects are more common at higher concentrations and include tooth staining, calculus formation, burning sensations and mucosal desquamation. (29)

In healthy children, antimicrobial mouth rinses offer few benefits over satisfactory mechanical measures The possible ingestion of rinses by young children may result in toxicity. Though less susceptible than adults to periodontal disease, children have less need of antimicrobial rinses but antimicrobial rinses may be indicated for those wearing orthodontic appliances, in order to reduce plaque accumulation around bands. If a patient cannot use mechanical plaque control (for example, after periodontal surgery), short-term CHX use can maintain plaque control, reduce gingivitis and post-surgical complications and enhance periodontal wound healing. (31)

If fluoride mouth rinses are regularly self-administered, they provide repeated exposure to low concentrations of fluoride and can reduce new caries increments by 20-50 %. Low concentration daily use fluoride mouth rinses to (100 ppm F) containing neutral sodium fluoride or acidulated phosphorfluoride are available over the counter and higher concentration rinses or gels for weekly use are available on prescription. After rinsing, calcium fluoride is formed on tooth surfaces and released later, elevating salivary and plaque fluoride concentrations for several hours, to favour remineralization and inhibit demineralization (34)

Due to the risk of toxicity or fluorosis, fluoride mouth rinses are not advised for preschool children These products are indicated for older children and adolescents at moderate to high risk of dental caries, those undergoing orthodontic treatment or those with low salivary flow, such as post-irradiation or medication-associated xerostomia.

Fluoride can enhance the benefit of CHX by prolonging suppression of mutant's streptococci and the inhibitory effects on acidogenesis by CHX-fluoride are significantly greater than for CHX alone. Likewise, the reductions in depth of carious lesions and demineralization achieved by CHX-fluoride are significantly greater than

for fluoride alone. The combination gave greater reductions in plaque and gingivitis scores than achieved by CHX solely. And an improved cariostasis in high-risk subjects have been shown to reduce radiation caries. Combination CHX-fluoride products in the form of varnishes, rinses, dentifrices and gels have been developed but await further clinical evaluation. (35)

Chewing Gums:

The popularity of sugar-free chewing gums offers convenient delivery for chemotherapeutic agents. Gums promote salivation and require hydration to release the agent, which can then be effective for longer periods of time than rinses or dentifrices. Clinical studies with CHX acetate or CHX-xylitol chewing gums used twice daily showed CHX is released after chewing and can reduce plaque and gingivitis. A popular non-cariogenic sugar substitute, the sugar alcohol xylitol, also has antibacterial action, reducing plaque acidogenicity following a sucrose rinse and reducing mutants streptococci levels. Gum containing sodium fluoride (0.25mg fluoride) can release fluoride and promote salivation, complementing fluoride dentifrices and rinses in patients with xerostomia or rampant caries The fluoride released tends to accumulate on the chewing side rather than distributing around the oral cavity. (36)

To promote healthy periodontal and dental tissues, current mechanical and chemotherapeutic approaches to oral hygiene aim to modify the oral microflora. Current oral hygiene measures, appropriately used in conjunction with regular professional care, are capable of virtually preventing caries and most periodontal disease and maintaining oral health. (37)

1.5. Oral Hygiene Promotion:

Oral hygiene promotion involves any combination of educational, organizational, economic and environmental supports for behavior conducive to oral health. Health promotion involves more than health education. (37)

1.5.1. Promoting Oral Hygiene to Children:

Childhood, particularly the preschool years, is a critical time to learn oral hygiene skills. Mothers play a key role in the development of the oral hygiene habits of their children and it is essential that parents be dentally aware. (38)

1.5.2. Promoting Oral Health through Schools

Fortunately, a number of prevention and health promotion interventions exist. In 1995, the World Health Organization (WHO) launched the "Global School Health Initiative" which is designed to improve the health of students, school personnel, families and other members of the community through schools. (39)

As children spend much time in school, teachers can assist with dental health education programs. These programs have proven successful in improving knowledge and motivating oral hygiene practices via activities such as group participation, coloring, activity books, films, interactive computer programs, parent child information nights, contracting and rewarding of behavioral changes. (40)

1.5.3. Specific Preventive Care Provided through Schools

Preventive care provided through schools varies according to the local situation. Extensive treatment is typically limited to locations with a well-equipped school-based clinic. However, even a basic or mobile clinic can provide useful services such as oral health screening, treatment of high risk children with fluoride varnish, and basic dental care such as ART (A traumatic Restorative Treatment and tooth extractions. The school may also provide a unique platform for fissure sealant programs and some positive outcome from applications of fissure and pit sealants. (39)

As emphasized by the Ottawa Charter for Health Promotion schools can provide a supportive environment for promoting health of children. The ways to improve oral health at individual, community and national levels are known (Kwan and Petersen, 2010). (39)

1.6. Importance of Oral Hygiene Status of Patients Undergoing Orthodontic Treatment:

Good oral hygiene is very important to ensure successful orthodontic treatment. Maintaining good oral hygiene in orthodontics is one of the elements related to compliance. Assessment of oral hygiene practices is essential for adequate understanding of the patients, oral healthcare needs. However, Hadler-Olsen et al. found that it was difficult to implement a comprehensive oral hygiene regimen in orthodontic patients. (41)

Patients undergoing orthodontic treatment with fixed appliances are at risk for developing gingival inflammation because of the increased challenge to oral hygiene. Dental plaque is a primary etiologic factor in gingivitis. The patient's inability to clean his or her teeth adequately around fixed orthodontic devices promotes plaque accumulation that can then lead to gingival inflammation. (41 and 42)

Good oral hygiene is very important to ensure successful orthodontic treatment. Maintaining good oral hygiene in orthodontics is one of the elements related to compliance**.** Atassi et al. found that it was difficult to implement a comprehensive oral hygiene regimen in orthodontic patients. (43)

A number of studies have been done in different parts of the world to evaluate the oral hygiene status of the patients, especially those receiving orthodontic appliances, resulting in poor oral hygiene, and accumulated food debris along the gingival margin leads to gingival and periodontal diseases. (44)

Plaque build-up is greater in patients wearing fixed orthodontic appliances due to difficulty to clean the teeth. Even with good cleaning of the teeth during treatment period, generalized gingivitis commonly developed in most patients. Retention of plaque may result in subsequent oral health problems such as decalcification caries, periodontal disease, halitosis and staining of teeth. White spot lesions were found higher in fixed appliance patients, both patients and dental professionals should play an active role in controlling the plaque build-up by maintaining good oral hygiene. (41)

Maintenance of an Adequate Level of Oral Hygiene and Refrain from Hard and Sticky Foods

Increasing the frequency of tooth brushing does not automatically lead to clean teeth. Consequently, the frequency of tooth brushing alone cannot be used as a measure of the quality of oral hygiene. Levels of education and motivation, as well as continuous reinforcement of oral hygiene, can improve patient's performance of oral home care. (44)

Orthodontic patients, in particular, must be trained in proper oral hygiene maintenance and their brushing procedures must be checked regularly. But no oral hygiene program will be effective unless orthodontists accept the responsibility for motivating their patients and staff. (43)

Saqib et al. in two separate studies found deterioration of periodontal health of children, three months after the start of orthodontic treatment. Similar to that in Zachrisson study, was that after the removal of fixed orthodontic appliances gingival health improved significantly. (44)

Lee et al. found that comprehensive oral hygiene care program helped patients to control plaque, decrease gingival inflammation and improve patients, oral health status. McGlynn et al. and Boyd respectively used a behavioral self-management program and a self-monitoring plaque control program to improve the oral health of patients. (41, 45 and 46)

Plaque control and removal can be done through mechanical or chemotherapeutic measures. Lee et al. found that comprehensive oral hygiene care program helped patients to control plaque, decrease gingival inflammation and improve patients' oral health status. (41)

All patients used toothbrush and most of them brushed at least twice daily. The most preferred toothbrush was the type with soft, tapered tip bristles, block pattern filaments, diamond shaped head, and slip prevention grip handle. Other cleaning tools or materials used daily were interdental brush, mouthwash and dental floss. (41 and 47)

Atassi et al. concluded that patients with poor oral hygiene might benefit from using an electric toothbrush, especially because dental plaque can be removed easily and fast. Consequently, oral hygiene instruction and reinstruction must take place during orthodontic treatment. Also some patients need to be reminded to concentrate on cleaning the cervical area of their teeth below the brackets. (43)

A continuous increase in oral hygiene awareness not only will reduce the prevalence and severity of iatrogenic tissue damage but also will extend the long-term benefits of orthodontic therapy. But no oral hygiene program will be effective unless orthodontists accept the responsibility for motivating their patients and staff. (43)

1.7. Socio-Economic Factors in Relation to Oral Hygiene:

Oral health (health of mouth and teeth) of school children represents a significant social and economic value of the modern world. Retrospective research data show that there is a difference in attitudes of examined children regarding the regular control of oral health, which is in correlation with social and educational structure of their families.

The opinion that by practicing a regular preventive controls diseases of mouth and teeth can be prevented, obviously and unfortunately is not prevalent as life practice in many of primary school children's families. (48)

Even though the children are exposed to the oral health at the fairly young age and although the parents are increasingly aware of the importance of the oral health for the entire well-being of their children, in many instances the role of parents and children in maintaining health of mouth and teeth is not sufficient, so the necessity arises to seek the professional help. It is best to seek help of dental professionals preventively, even then when everything seems to be well with the health of mouth and teeth. (49)

Factors that were predominant in relation to residence and caries were: eating poor quality food during the big break at school, and in urban areas more than in rural areas, one of the essential factors of consuming sweets and snacks was equally represented in all areas. Regular brushing was the factor that had an impact on the

formation of cavities, but it could not be correlated with the geographic distribution. (50)

According to the type of food consumed we could see that in urban and rural areas the responses were fairly balanced, with the city where the larger number of respondents ate foods that posed risk factors for tooth decay and deterioration of an oral hygiene than in rural areas. (50)

1.7.1. Mother Education Level:

Because mother education level is perceived as a relatively reliable SES estimate, 9 out of the 15 papers investigated the association between parental education level and the prevalence of dental caries especially severe early childhood caries (ECC). Except for the study in Seoul, Korea, by Jin et al., which showed no significant association between parental education level and the prevalence of dental caries, 5 studies demonstrated a significant effect when other factors were taken into consideration. (51)

Poster et al. showed that the education level of caregivers had a statistically significant protective effect against caries in their study groups. (52) The Willems, Sayegh and Du groups showed an independent effect of parental education level on the occurrence of dental caries in their studied groups, but the effect became insignificant when the data were fitted into multivariate logistic regression models. (53 and 54)

1.7.2. Income Level:

Income level has also been studied widely. Sgan Cohen et al. were unable to show a statistically significant effect of income on the prevalence of caries when ethnicity and neighborhood deprivation were considered in the logistic regression analysis interestingly, in Abu Dhabi, Al-Hosani and Rugg-Gunn demonstrated that when parental education level was controlled, higher parental income was related to higher caries prevalence. However, the remaining studies found that the lower the income level, the higher the prevalence of dental caries and ECC. The causal approach in dental caries was previously presented. Low socioeconomic status, low monthly

household income and low educational level are associated with less access to dental services and oral hygiene products, poorer knowledge regarding oral health and oral hygiene and, consequently, a greater frequency and severity of dental caries. (55 and 56)

1.8 Tooth Brushing and Fluoride Toothpaste:

Daily tooth brushing with fluoride tooth paste is believed to be the primary reason for the caries decline that has been observed since the 1970s. For small children, tooth brushing should be performed by an adult until the child is about 6, when increasing dexterity and cognition may permit supervised brushing until the child is capable of independent brushing. In young children, gingival health is common despite plaque accumulation due to immature host responses and poor oral hygiene Nevertheless, establishing good hygiene habits is valuable for present and future oral health. (39)

Fluoride has a well-documented effect in caries prevention and this is primarily due to the topical effect of different fluoride vehicles after tooth eruption. All over the word, fluoride tooth paste is by far the most widely used method of applying fluoride. (57)

Studies have shown that the frequency of tooth brushing had a significant association with caries prevalence. Good oral hygiene habits established at an early age and maintained during pre-school age, appear to be essential to achieve good oral health in infants and pre-school children. However, very little information is available about the maintenance of good oral health factors over time, from early childhood to adolescence, and its effect on caries development later in life. (58)

Childhood, particularly the preschool years, is a critical time to learn oral hygiene skills. If oral hygiene skills are acquired and maintained in early childhood, these skills can become established habits and are less liable to change. Mothers play a key role in the development of the oral hygiene habits of their children and it is essential that parents be dentally aware. For example, teaching pregnant or nursing mothers the importance of oral hygiene through prenatal classes, home health visitors, nurses, midwives and auxiliaries at child health centers and hospitals can establish sound

oral hygiene practices later in childhood and adolescence. As children spend much time in school, teachers can assist with dental health education programs. These programs have proven successful in improving knowledge and motivating oral hygiene practices via activities such as group participation, coloring, activity books, films, interactive computer programs. (59 and 60)

1.9. Over Weight and Obesity in Relation to Oral Hygiene State:

According to the American Academy of Pediatrics, Committee on Nutrition (2003), being overweight is now the most common medical condition of childhood, with the prevalence having doubled over the past 20 years. About one in three children is at risk of being overweight, and one out of every six is overweight. (61)

Body adiposity status is determined by calculating body mass index (BMI= weight/height2). The cut off points for overweight and obesity are body mass index of 25 kg/m2 and 30 kg/m2, respectively. In childhood, body mass index changes substantially with age, therefore the international classification system for childhood obesity (isoBMI) is recommended by the International Obesity Task Force. (62)

Dentists must be aware of how nutrition impacts on general and oral health and how dental treatment can impact on the patient's nutritional status. Oral health is strongly influenced by the daily intake of food; on the other hand, oral health can also play a significant role in nutritional intake and general health status. Oral hygiene and Dental caries and obesity are both multifactorial diseases with a complex etiology and both are associated with dietary habits. A sugar-rich diet, including beverages, is associated with various health problems such as obesity, dental caries and poor diet quality. Relatively few studies of the relationship between overweight/obesity and oral health have been published and a systematic review revealed contradictory results. (61)

Recently published studies have also reported conflicting results. A study by Bailleul-Forestier et al. assessed caries experience in an adolescent population being treated for severe obesity and found that there was a significant association between BMI and DMFT in the severely obese group. Further studies are needed to evaluate a

possible relationship between caries (including proximal initial caries lesions) and overweight/obesity. (63)

2. AIMS AND OBJECTIVES

To the best of our knowledge, this is probably the first country survey to assess oral hygiene status among Libyan school children. The overall aim of this thesis was to collect knowledge, to provide the base line data of oral hygiene state by use of simplified oral hygiene index (OHIS) among school going children (10-12 years) of rural and urban area in Tripoli of Libya.

In more detail, the aims of this thesis were:

- To measure oral hygiene state by use of simplified oral hygiene index (OHIS) among school going children (10-12 years) of rural and urban area in Tripoli of Libya.
- To compare the scores of simplified oral hygiene index (OHIS) among school going children (10-12 years) between the rural and the urban area in Tripoli of Libya.
- To compare the scores of simplified oral hygiene index (OHIS) according to the age of children of rural and urban area in Tripoli of Libya.
- To compare the scores of simplified oral hygiene index (OHIS) among school going children (10-12 years) according to the gender of rural and urban area in Tripoli of Libya.

The results found here would probably be helpful in making future plans concerning the best methods to improve oral hygiene in children, preparing ideal health education program for the school aged children, make necessary improvements in the Libyan health system especially in the field of oral and dental health problems

Also, it would be interesting to develop similar studies in other cultures do define the facilitators and barriers in other cultures. Moreover, since barriers have been defined, governments, oral health companies and dental professional should focus on taking measures to overcome these barriers.

3. MATERIAL AND METHODS

The study was designed as cross-sectional observational study conducted in Tripoli, the capital city of Libya. From 26 February to 28 March 2016, the present study was conducted from the Orthodontics Department, Faculty of Dentistry, and Istanbul Yeni Yüzyıl University.

3.1. Ethical approval:

Ethical approval and permissions from the Health Ministry, Education Ministry of Libya as well as local authorities were secured. Written informed consents were received from all participant children and parents.

3.2. Study area:

The study was conducted in Alfornaj area (urban) and Algabailia area (rural), Tripoli, Libya, Alfornaj area situated 3500 meter from Town center of Tripoli where the offices, banks, libraries, hospital, dental clinic and shopping malls are concentrated, Algabailia area is the rural area situated 20 KM from Town center of Tripoli larger than the urban area where houses are widely dispersed, and have just one government dental clinic, one private dental clinic, just one pharmacy, one bank, haven't library and any hospital. These areas selected by Education Ministry of Libya, and they select one school for every area. Alzohor School for Alfornaj area (urban) and Shuhada Libya school for Algabailia area (rural) as in Figure 1 and Figure 2.

3.3. Study participants:

Total of 504 Schoolchildren, aged 10–12 years, from 2 public school children 252 for each public school in Tripoli of Libya, were included in the study. All the students from Grades 4 to 6, also all the study participants include only the children with Libyan nationality the study participants include only the children living with their biological parents or legal guardians and for whom the parents or legal guardians gave written informed consent for their child to participate in the study.

Figure (1). The geographic position of the study schools.

Alzohor School **Shuhada Libya School**

Figure (2) The outside photographs of the study schools.

The inclusion criteria of this study were:

- Children with no chronic medical conditions that required prolonged use of sweetened medication.

- Children don’t use of antihistamines, and anti-asthmatic drugs; those with medical conditions that may lead to bad oral hygiene and increase risk of dental caries.
- Non Syndromic patient like Sicca syndrome or Sjögren’s syndrome.
- Children with no previous orthodontic treatment.
- No mental retardation that can affect the cooperation for maintaining oral hygiene.
- No other conditions associated like xerostomia; and those with dental developmental anomalies, such as mesiodense, that result in increased food stagnation and lead to bad oral hygiene and increase risk for caries.

3.4. Dental Assessment:

Dentists were calibrated before the survey by the principal investigator. Three days training and calibration course was conducted for one dentist. The seminar involved the explanation of the method of data collection, definition of terms and standardization of the diagnostic criteria following the WHO guideline. Prior to dental assessment, a short lecture on healthy snacking, tooth brushing and dental visits using dental models was delivered to the children. The study participants were then examined by dentists, the dentists recorded the data on a WHO form.

3.5. Sample (Procedure – Size):

This cross-sectional observational study was conducted in government schools in Tripoli, Libya. A cluster sampling method with schools as cluster was used, one elementary school in rural area "Shuhada Libya school for Algabailia area (rural). And one elementary school in urban area Alzohor school for Alfornaj area (urban)", also stratified random sampling used in each school to distribute the sample to three Groups according to the age, the Group 1 (10 years), Group 2 (11 years) and Group 3 (12 years). The stratified random sampling also used in each school to distribute the sample according to sex to equal number, with a random selection of boys and girls from each selected elementary school made. The final sample was 504, 10-12-year-old schoolchildren (252 urban and 252 rural), (252 boys and 252 girls) resident in Tripoli, studying from Grades 4 to 6 in 2 elementary public schools, each Group contain 84 child, 42 boy and 42 girl.

3.6. Clinical Examination:

Five hundred and four schoolchildren representing the age group 10-12 years, and belonging to the school going population of Tripoli were subjected to dental examination according to the WHO diagnostic criteria. Oral examination of the participants was conducted from February to March 2016. All participants were examined with disposable mirror, disposable probe, and disposable tweezers along with disposable masks and gloves as in **Figure 3**. The examination procedure and forms used were based on WHO criteria.

Figure (3) Disposable set used for the examination.

Clinical dental examinations of participant subjects were conducted in the schools in the first aid medical room with the child seated in front the examiner and using artificial lighting as in **Figure 4.** No further diagnostic aids were employed. One calibrated examiner (NA) dentally examined six fully erupted permanent teeth for oral hygiene record in the children, using the OHI-S index.

Indices:

OHI-S index used for only permanent teeth for 10-12 years school children, only six fully erupted permanent teeth are examined as in **Figure 5**.

(a) **(b)**

Figure (4 a) The examination procedure (the position of child to the examiner during examination) **(4 b)** describe the room used for examination in the urban school.

The Simplified Oral hygiene index (OHI-S) utilized six tooth surfaces for scoring, four posterior (upper right first molar, upper left first molar, lower right first molar and lower left first molar) and two anterior teeth (upper right central incisor and lower left central incisor). In the absence of first molar, the first fully erupted teeth distal to the second bicuspid, the second or third molar were examined. The buccal surfaces of the selected upper molars (upper right first molar, upper left first molar) and the lingual surfaces of the selected lower molars (lower right first molar and lower left first molar) were inspected. In the anterior portion of the mouth, the labial surfaces of the upper right and the lower left central incisors were scored. In the absence of either of these anterior teeth, the central incisor on the opposite side of the midline was used. **(Figure 5 a)**

The scoring system of the OHI-S consists of two components, the debris index and the calculus index. Plaque is defined as a soft matter adhering to the tooth surface and consisting of bacteria in a matrix of bacterial and salivary polymers and cell remnants.

The scoring for debris (DI-S) was done according to the following criteria:

0= no debris or stain present.

1= soft debris not covering more than one-third of the tooth surface being examined.

2= soft debris covering more than one-third, but not more than two-thirds, of the exposed tooth surface.

3= soft debris covering more than two-thirds of the exposed tooth surface. **(Figure 5 b)**

Calculus is a hard deposit of inorganic salts mixed in an organic matrix. There are two types of calculus differentiated by location: supragingival calculus above the gingival margin; and subgingival calculus below the gingival margin.

The scoring for calculus (CI-S) was done according to the following criteria:

0 = No calculus present.

1 = Supragingival calculus covering not more than one third of the exposed tooth surface.

2 =Supragingival calculus covering more than one-third, but not more than two-thirds of the exposed tooth surface or the presence of the individual flecks of sub gingival calculus around the cervical portion of the tooth or both.

3 = Supragingival calculus covering more than two thirds of the exposed tooth surface or a continuous heavy band of sub gingival calculus around the cervical portion of the tooth, or both. **(Figure 5 b)**

Calculation of Debris, Calculus and Simplified Oral Hygiene Index:

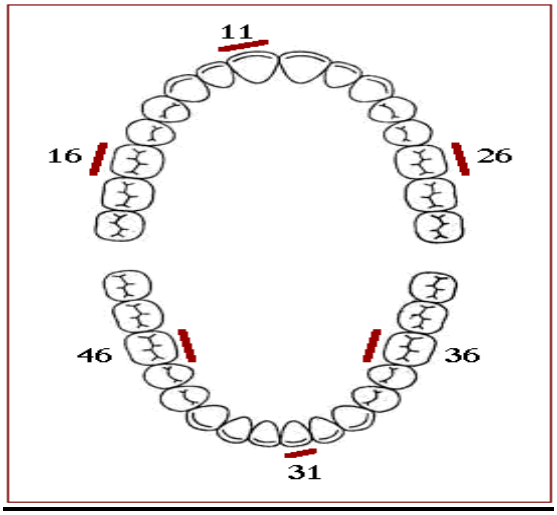
Each surface is assessed on a scale of 0 to 3. Only a mouth mirror and a Shepherd's Crook or sickle-type dental explorer, and no disclosing agent are used for examination. The six tooth surfaces examined are 16, 26, 11, 31 (Facial surface) and 36, 46 (Lingual surfaces). Each tooth surface is divided horizontally into gingival, middle and incisal thirds. For the DI-S, a dental explorer is placed on the incisal third and moved towards the gingival third and scores are awarded according to the

criteria. The DI-S score per person is obtained by totaling the debris score per the tooth surface and dividing it by the number of surfaces examined. The CI-S assessment is performed by gently placing a dental explorer into the distal gingival crevice and drawing it subgingivally from the distal contact area to the mesial contact area. Scoring is done according to the criteria. The CI-S score per person is obtained by totaling the calculus scores per tooth surface and dividing it by the number of surfaces examined. The OHI-S score per person is the total of DI-S and CI-S scores per person.

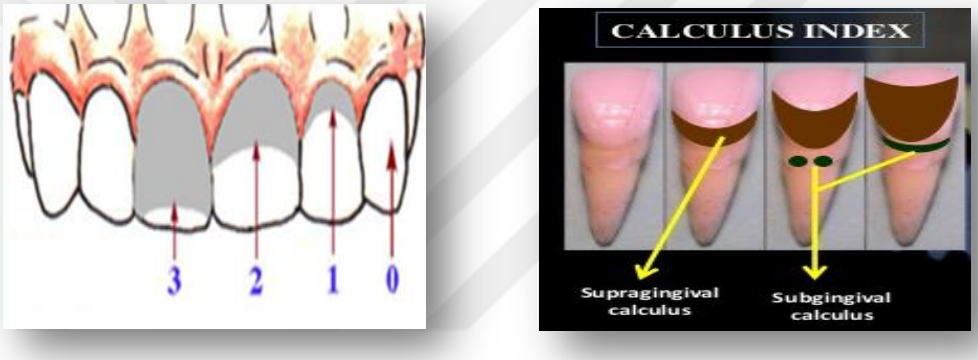
The average individual or group debris scores plus the calculus scores were combined to obtain the Simplified Oral Hygiene Index. The CI-S and DI-S values may range from 0 to 3and the overall OHI-S score ranged from 0 to 6. (12)

3.7. Data Collection and Transformation:

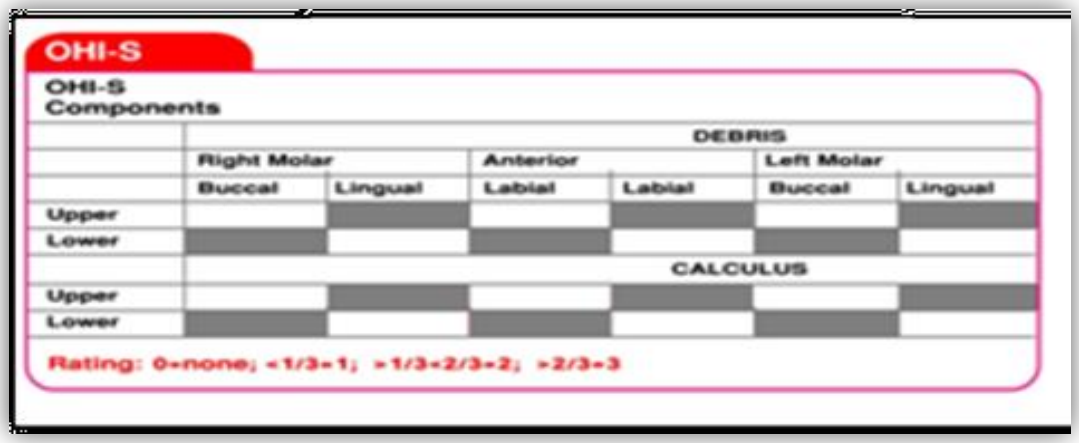
The data collection form for recording (OHI-S) was based on the indices recommended by the World Health Organization and arranged in tables before undergoing to statistical analysis. **(Figure 5c)**



(a)



(b)



(c)

Figure (5) Teeth used in (OHI-S) index (a), diagram illustrating how the plaque and calculus scores (b), screening forum used to collect OHI-S data (c).

4. STATISTICAL METHODS

Statistical calculations were performed with NCSS 2007 program for Windows. Besides standard descriptive statistical calculations (mean, standard deviation), One-Way ANOVA was used in the comparison of groups, post Hoc Tukey multiple comparison test was utilized in the comparison of subgroups, Unpaired test was used in the comparison of two groups. Statistical significance level was established at p<0, 05.

5. RESULTS

The informed written consents were obtained from 550 of the total of 675 subjects aged 10 -12 years attending the 2 schools all of whom were invited to participate in the study. This represented a response rate of 81.48%. From those children providing written consents, lists by school were made and the required sample number (504 pupils; 91.63% of the consenting children) was selected randomly and included in the study.

Comparison of OHI-S Scores between Males and Females

In the urban Group 1, There was no significant difference between the means of OHIS scores in the boys and the girls (p=0,397). In the rural Group 1, There was no significant difference between the means of OHIS scores in the boys and the girls (p=0,857). **(Table 1)**

In the urban Group 2, There was no significant difference between the means of OHIS scores in the boys and the girls (p=0,975).In the rural Group 2, There was no significant difference between the means of OHIS scores in the boys and the girls (p=0,082). **(Table 1)**

In the urban Group 3, There was no significant difference between the means of OHIS scores in the boys and the girls (p=0,864). In the rural Group 3, There was significant difference between the means of OHIS scores in the boys and the girls, in which the mean value of OHIS scores in the boys group higher than in the girls Group (p=0,002). In Table (1) and Figure (6) showed the simplified oral hygiene index (OHIS) scores of the 10-12 years children (Group 1, Group 2, and Group 3) and compare the (OHIS) scores between the male and the female in rural and urban schools.

Comparison of OHI-S Scores between Urban and Rural

In the male Group 1, there was significant difference between the means of OHIS scores in the urban and the rural, in which the mean value of OHIS scores in the rural group higher than in the urban Group (p=0,005). In the female Group 1, there was no

significant difference between the means of OHIS scores in the urban and the rural (p=0,102). **(Table 2)**

In the male Group 2, there was no significant difference between the means of OHIS scores in the urban and the rural (p=0,056). In the female Group 2, there was no significant difference between the means of OHIS scores in the urban and the rural (p=0,979). In the male Group 3, there was significant difference between the means of OHIS scores in the urban and the rural, in which the mean value of OHIS scores in the urban group higher than in the rural Group (p=0,022). In the female Group 3, there was no significant difference between the means of OHIS scores in the urban and the rural (p=0,220). In Table (2) and Figure (7) showed the simplified oral hygiene index (OHIS) scores of the 10-12 years children (Group 1, Group 2, and Group 3) and compare the (OHIS) scores between the rural and urban schools.

Comparison of OHI-S Scores between Group (1), Group (2) and Group (3)

In the male Group of urban school, there was no significant difference in the means of OHIS scores between the Group (1), Group (2) and Group (3) (p=0,163). In the female Group of urban school, there was no significant difference in the means of OHIS scores between the Group (1), Group (2) and Group (3) (p=0,403). **(Table 3)**

In the male Group of rural school, there was no significant difference in the means of OHIS scores between the Group (1), Group (2) and Group (3) (p=0,426). In the female Group of rural school, there was no significant difference in the means of OHIS scores between the Group (1) and Group (2) (p=0,007). **(Table 3)**

But there was significant difference in the means of OHIS scores between the Group (1) and Group (3), in which the mean value of OHIS scores in the Group (1) higher than in the Group (3) (p=0,006). In Table (3) and Figure (8) showed the simplified oral hygiene index (OHIS) scores of the 10-12 years children (Group 1, Group 2, and Group 3) and compare the (OHIS) scores between the rural and urban schools.

In the urban school, there was no significant difference in the means of OHIS scores between the Group (1), Group (2) and Group (3) (p=0,067). **(Table4)**

In the rural school, there was significant difference in the means of OHIS scores between the Group (1), Group (2) and Group (3) (p=0, 02), in which the mean value of OHIS scores in the Group (3) lower than in the Group (1) and Group (2) (p=0,043) (p=0,037). **(Table 4)**

But there was no significant difference in the means of OHIS scores between the Group (1) and Group (2) (p=0, 0998). In Table (4) and Figure (9) showed the simplified oral hygiene index (OHIS) scores of the 10-12 years children (Group 1, Group 2, and Group 3) and compare the (OHIS) scores between the(Group 1, Group 2, and Group 3) in the rural and urban schools.

In the Group 1, there was significant difference between the means of OHIS scores in the urban and the rural, in which the mean value of OHIS scores in the rural Group higher than in the urban Group (p=0,003). In the Group 2, there was no significant difference between the means of OHIS scores in the urban Group and the rural Group (p=0,159). **(Table 5)**

In the Group 3, there was no significant difference between the means of OHIS scores in the urban Group and the rural Group (p=0,503). In Table (5) showed the simplified oral hygiene index (OHIS) scores of the 10-12 years children (Group 1, Group 2, and Group 3) and compare the (OHIS) scores between the rural and urban schools.

Table (1) The simplified oral hygiene index (OHIS) scores of the 10-12 years children (Group 1, Group 2, and Group 3) and compare the (OHIS) scores between the Male and the Female in rural and urban schools.

OHIS		Male	Female	p
Group 1	**Urban**	1,89±0,3	1,97±0,317	0,397
	Rural	2,27±0,5	2,31±0,88	0,857
Group 2	**Urban**	2,14±0,41	2,15±0,38	0,975
	Rural	2,45±0,57	2,14±0,55	0,082
Group 3	**Urban**	2,02±0,53	2,05±0,54	0,864
	Rural	2,24±0,62	1,65±0,53	**0,002**

Figure (6) The simplified oral hygiene index (OHIS) scores of the 10-12 years children (Group 1, Group 2, and Group 3) and compare the (OHIS) scores between the male and the female in the urban and rural schools.

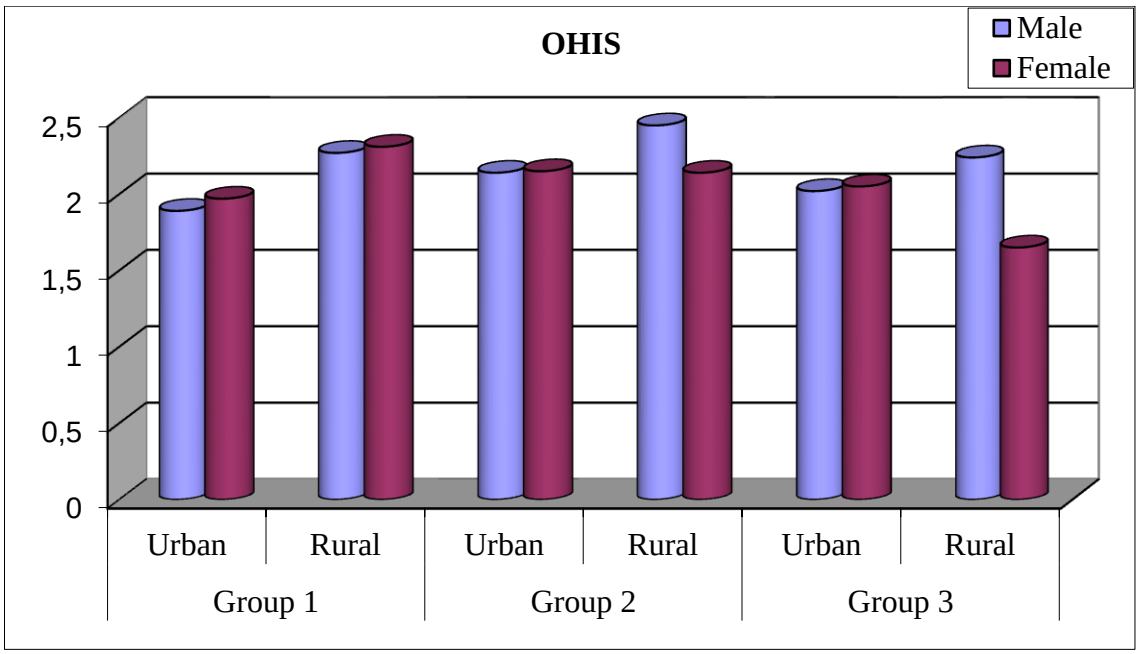


Table (2) The simplified oral hygiene index (OHIS) scores of the 10-12 years children (Group 1, Group 2, and Group 3) and compare the (OHIS) scores between the rural and urban schools.

OHIS		Urban	Rural	p
Group 1	**Male**	1,89±0,3	2,27±0,5	**0,005**
	Female	1,97±0,31	2,31±0,88	0,102
Group 2	**Male**	2,14±0,41	2,45±0,57	0,056
	Female	2,15±0,38	2,14±0,55	0,979
Group 3	**Male**	2,02±0,53	2,24±0,62	0,220
	Female	2,05±0,54	1,65±0,53	**0,022**

Figure (7) The simplified oral hygiene index (OHIS) scores of the 10-12 years children (Group 1, Group 2, and Group 3) and compare the (OHIS) scores between the urban and rural schools.

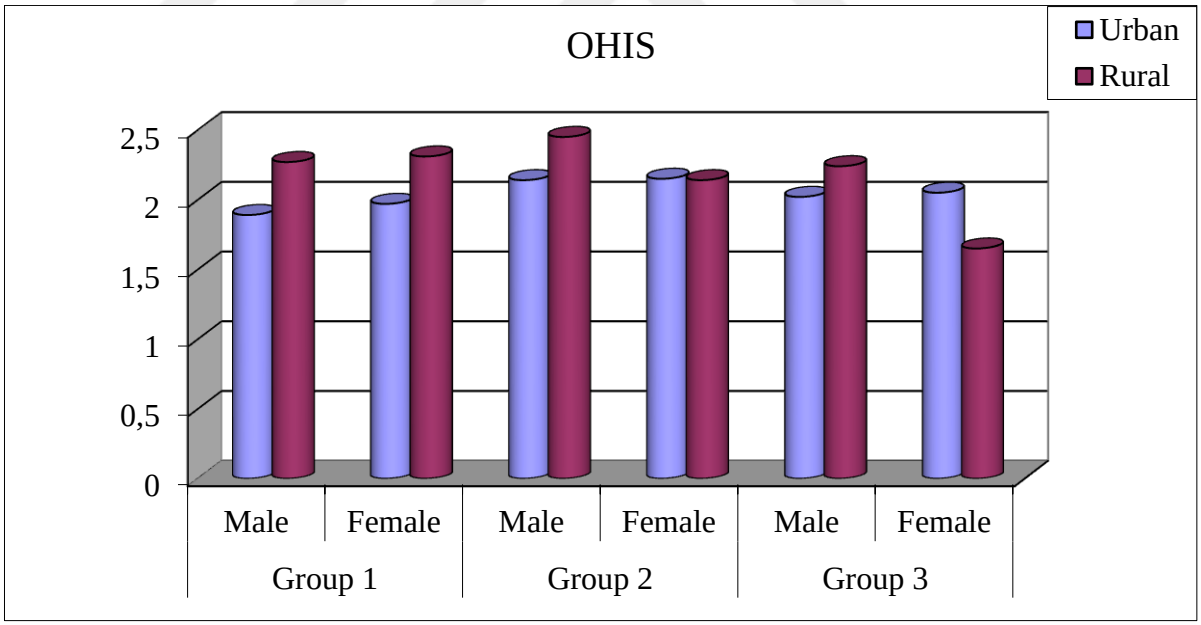


Table (3) The simplified oral hygiene index (OHIS) scores of the 10-12 years children (Group 1, Group 2, and Group 3) and compare the (OHIS) scores between the (Group 1, Group 2, and Group 3) in the rural and urban schools.

		Group 1	Group 2	Group 3	p
Urban	**Male**	1,89±0,3	2,14±0,41	2,02±0,53	0,163
	Female	1,97±0,31	2,15±0,38	2,05±0,54	0,403
Rural	**Male**	2,27±0,5	2,45±0,57	2,24±0,62	0,426
	Female	2,31±0,88	2,14±0,55	1,65±0,53	**0,007**

Figure (8) The simplified oral hygiene index (OHIS) scores of the 10-12 years children (Group 1, Group 2, and Group 3) and compare the (OHIS) scores between the (Group 1, Group 2, and Group 3) in the urban and rural schools.

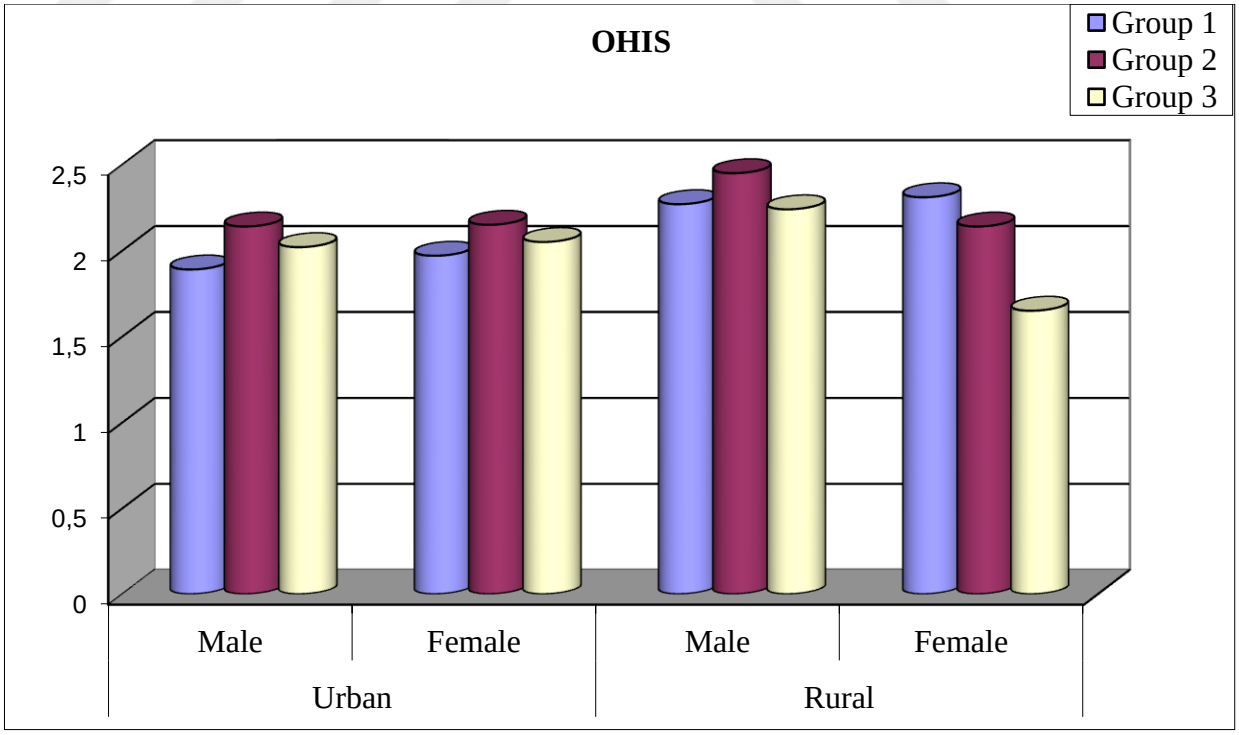


Table (4) The simplified oral hygiene index (OHIS) scores of the 10-12 years children (Group 1, Group 2, and Group 3) and compare the (OHIS) scores between the (Group 1, Group 2, and Group 3) in the rural and urban schools.

	Group 1	**Group 2**	**Group 3**	**p**
Urban	1,93±0,3	2,14±0,39	2,03±0,53	0,067
Rural	2,29±0,7	2,3±0,58	1,95±0,64	**0,02**

Figure (9) The simplified oral hygiene index (OHIS) scores of the 10-12 years children (Group 1, Group 2, and Group 3) and compare the (OHIS) scores between the (Group 1, Group 2, and Group 3) in the urban and rural schools.

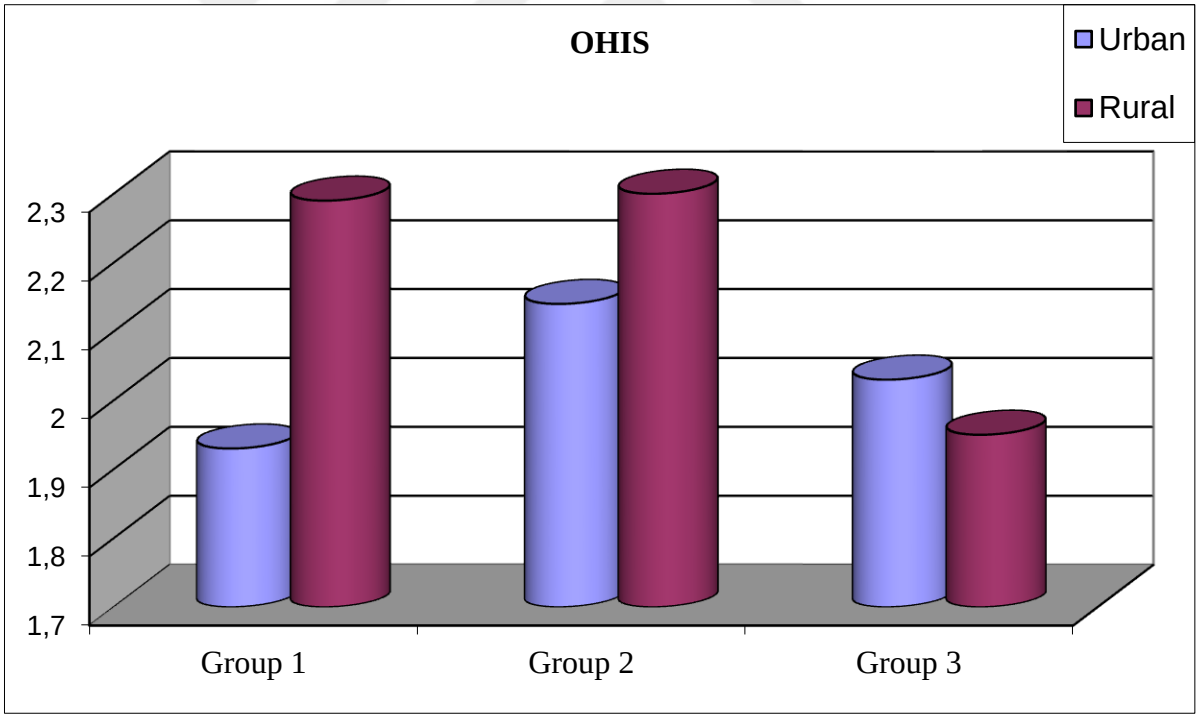


Table (5) The simplified oral hygiene index (OHIS) scores of the 10-12 years children (Group 1, Group 2, and Group 3) and compare the (OHIS) scores between the (Group 1, Group 2, and Group 3) in the rural and urban schools.

	Urban	**Rural**	**P**
Group 1	1,93±0,3	2,29±0,7	**0,003**
Group 2	2,14±0,39	2,3±0,58	0,159
Group 3	2,03±0,53	1,95±0,64	0,503

6. DISCUSSION

The oral health care system in Libya consists of the public and private sectors, which include the majority of dentists. Public dental clinics deliver simple oral examinations, scaling, tooth extractions and dental fillings. For a long time, populations decided to seek treatment only when they noticed symptoms, contrary to preventing disease before its occurrence. Unfortunately, government expenditure in respect to oral health follows this outdated model and it targets on diagnosis of and treatment for oral and dental diseases rather than on oral health prevention programs.

Tooth brushing is considered as the most reliable means of plaque control provided thorough and regular cleaning is accomplished. Nowadays, a wide variation of tooth brush designs, brushing techniques, frequency, and times of tooth brushing are taught, the oral hygiene habits of the school age children are reflected in oral hygiene instruction. (64)

To the best of our knowledge, this is probably the first country- survey to assess oral hygiene status among Libyan school children. The work was driven by the need for baseline data that highlight the magnitude of the problem and can be used to mobilize authorities towards introducing primary dental health care service for children across the country.

The study sample was selected from Tripoli which is the capital city in Libya. The study sample included 2 schools drawn from 2 different districts with different socioeconomic Groups and cultures and was sufficiently large (n = 504), to make the study sample reasonably representative of 10-12 year-olds in Tripoli of Libya. The present study provided useful information about the oral hygiene state in 10-12 year old Libyan schoolchildren in Tripoli and these findings contribute to the overall picture of Libyan school children dental health.

The simplified oral hygiene index (OHI-S) was used are simple, non-time consuming, and easy to use and have proven validity. A sufficiently sample, stratified by geographic, gender and age.

The simplified oral hygiene index (OHI-S) has been widely used to evaluate the level of oral cleanliness in epidemiological studies. OHI-S is easy to use since the criteria are objective, the examinations can be carried out quickly and a high level of reproducibility is possible with minimum training. For these reasons OHI-S was chosen for this study. The disadvantage of OHI-S is that the index is not used internationally like the Community Periodontal Index (CPI) and opportunities for international comparison of results is limited. However, CPI is an index for assessment of periodontal status and does not provide information on the level of debris. CPI measures the outcomes of accumulated plaque: gingival inflammation and periodontal pockets. (65)

Selection of Samples

The specific age group was selected because children at that age can express their own beliefs without the need of parental involvement. Also, children at this age are capable of expressing their opinion more accurately than when their parents answer on their behalf. Moreover, a recent epidemiological study in the word showed that 12 years old children had high prevalence of gingivitis. This finding suggested that oral health education should be implemented at an earlier age in order to improve plaque removal and control gingivitis, later in adolescence. As reported oral health habits formed in early years can lead to healthy habits during adolescence and adulthood.

The informed written consents were obtained from 550 of the total of 675 subjects aged 10 -12 years attending the 2 schools all of whom were invited to participate in the study. This represented a response rate of 81.48%. From those children providing written consents, lists by school were made and the required sample number (504, which represent 91.63% of the consenting children) was selected randomly and included in the study.

Effect of Sex Difference on Oral Hygiene

The relationship between oral hygiene and sociodemographic factors, such as age and gender, was reported by many investigators. (66) In the present study when the mean OHI-S scores are compared between boys and girls showed that in the urban

Group 1, Group 2 and Group 3, there was no significant difference between the means of OHIS scores in the boys and the girls.

In the rural Group 1 and Group 2, there was no significant difference between the means of OHIS scores in the boys and the girls. While in the rural Group 3, there was significant difference between the means of OHIS scores in the boys and the girls, in which the mean value of OHIS scores in the boys Group higher than in the girls Group (p=0,002). In Table (1) and Figure (6) showed the simplified oral hygiene index (OHIS) scores of the 10-12 years children (Group 1, Group 2, and Group 3) and compare the (OHIS) scores between the male and the female in rural and urban schools.

Yee R et al. in 2006 when the mean OHI-S scores are compared between males and females the scores were not statistically different in the 12-13 year-old age school children in Nepal. (65) Rao et al. 1985 reported similar observations in his study of school children where girls had marginally better oral hygiene than boys. (67) Babu et al in 2011 and Das et al. in 2009 reported that 12 year old female subjects exhibited lower prevalence of calculus as compared to their male counterparts; this difference was not statistically significant. (68 and 69)

For the overall well-being of the person, dental health is as essential as total body health. Gingivitis progressed to periodontitis is one of the main causes of tooth loss. Most of the times gingivitis depends on oral hygiene habits of the population, which in turn depends on the factors like cultural background, religious norms, educational level and socioeconomic status.

Deepak P Bhayya et al. in 2010 reported that when gender wise prevalence of gingivitis was considered, boys were affected more than the girls and the reason behind this can be attributed to the cleanliness of the girls. (70) Similar reports were given by Das et al who studied the oral hygiene status of the 6-12 School going children. (69) Contrasting results were reported by Vineeth et al, Jose et al and Kumar et al, who reported higher prevalence in girls. (71, 72 and 73) Babu et al. in 2011 showed that the reason could be due to the behavioral differences in both the genders. (68)

Khaled A. Al-Haddad et al. in 2013 reported that males in the 12- year-old group had poor oral hygiene when compared to females which is also consistent with previous reports in Yemen. This has been attributed to the better tooth brushing behavior in females. (74)

Mohammed Al Nuaimi et al. in 2014 revealed that for South Asia, female India subjects had lower OHI-S scores and the male Bangladesh subjects had the highest scores for OHI-S. Within the Middle East, UAE, Egypt, and Palestine male scores were significantly higher than most female scores; only male Palestine calculus score was higher than male subjects from Syria. (4) Angelopoulou M et al. in 2015 showed that the girls had better oral hygiene than boys of 10 years old school children in Greece. Because girls of that age are more mature than boys. (66) Seth et al. in 2016 reported that oral hygiene status was poor in male school children as compared to female school children in India. (75)

Difference between Rural and Urban on Oral Hygiene

Total well-being of the society is determined by the healthy population inhibiting it; oral health being the integral part of general health plays a key role in improving the general wellbeing of the person/people. Oral health in turn is dependent on the oral hygiene maintenance, thus the present study was undertaken with the main aim to determine the oral hygiene status of school going children (10-12 years) of rural and urban area in Tripoli of Libya.

Geographically in the present study found that, In the male Group 1 and Group 3, there was significant difference between the means of OHIS scores in the urban and the rural, in Group 1 the mean value of OHIS scores in the rural Group higher than in the urban Group while in Group 3 the mean value of OHIS scores in the urban Group higher than in the rural Group (p=0,005) (p=0,022). In the male Group 2, there was no significant difference between the means of OHIS scores in the urban and the rural.

In the female Group 1, Group 2 and Group 3, there was no significant difference between the means of OHIS scores in the urban and the rural. In Table (2) and Figure (7) showed the simplified oral hygiene index (OHIS) scores of the 10-12 years

children (Group 1, Group 2, and Group 3) and compare the (OHIS) scores between the rural and urban schools.

In the Group 1, there was significant difference between the means of OHIS scores in the urban and the rural, in which the mean value of OHIS scores in the rural Group higher than in the urban Group (p=0,003). In the Group 2 and Group 3, there was no significant difference between the means of OHIS scores in the urban Group and the rural Group. In Table (5) showed the simplified oral hygiene index (OHIS) scores of the 10-12 years children (Group 1, Group 2, and Group 3) and compare the (OHIS) scores between the rural and urban schools. The variance noted between these groups based on location may be due to socioeconomic factors and the availability and affordability of toothbrushes and fluoridated toothpaste.

In the study done by Mohanid Almozughi in 2016 in the same schools and on the same samples (Cross section study: dental caries prevalence and its related factors in the school children in Libya), found that there was significant difference in the mean of dental caries prevalence of the school children based on the mothers' education level, the role of mothers' educational level on the oral health of the child is an important factor to be considered and the dental caries was found to be higher in children of mothers with low educational level in both rural and urban area. Highly educated mothers tend to take their children to the dentist early in their lives so as to make regular check-ups and treat dental caries as soon as it appears. In addition the mean of dental caries prevalence was lesser in the lower income group. (76)

Huew et al. in 2012, in Benghazi in Libya, found that higher parental educational levels were statistically significantly associated with a lower prevalence of dental caries in their children. (7) Baccush M. M. et al. in 1991, in Tripoli of Libya, found that the dental caries prevalence have inverse relationship with the level of education of mother. (77) Zafer Azizi in 2014, in the similar study in Palestine, found that there was significant difference in the mean of dental caries prevalence and oral hygiene of the preschool children based on the education level of mother and income of family. (78)

J. Baby John et al. in 2015, in the similar study in India, found that there was no significant difference in the mean of dental caries prevalence of the children based on the education level of mother and income of family. (79)

Children from lower socioeconomic status received irregular care and it was through the school dental services on a pain relief basis. On the other hand most of the children from higher socioeconomic groups received regular dental check-ups and treatment through the private systems. Research in industrialized countries revealed that children of high social class families experience less caries than those of lower social classes. The DMFT scores were high in low socioeconomic status because of their poor oral hygiene practice, lack of awareness, improper food intake and poor family status. (76)

Yee R et al. in 2006 reported that the school children in both age groups enrolled in urban schools had better oral cleanliness than their counterparts in both rural towns and villages. (65) Juan J. Villalobos-Rodelo et al. in 2007 demonstrated that oral hygiene is associated with sociodemographic and socioeconomic factors, children with higher socioeconomic state had better oral hygiene, a probable explanation of that children from the poorest families receive significantly less instruction on oral hygiene from dentists or other knowledgeable sources than their more affluent peers. (80)

Khaled A. Al-Haddad et al. in 2013 reported that school children in the periurban areas showed significantly better oral hygiene than school children in rural areas. These variations may be a reflection of differences in plaque and calculus levels, oral hygiene practices, efficiency of educational programs, food habits. (74) A. Adeniyi Abiola et al. in 2009 showed that oral hygiene habits were observed to be similar in both rural and urban locations. However, the OHI score was significantly correlated with the occurrence of dental caries. (81) Systemic review study by Simone M. Costa et al. in 2012, obtained that the worse socioeconomic indicators, such as subject's schooling, income and occupation are associated with a greater severity of dental caries and oral hygiene. (82)

In the study done by Mohanid Almozughi in 2016 obtained that according to the type of food consumed we could see that in urban and rural areas the responses were

fairly balanced, with the city where the larger number of children ate foods that posed risk factors for tooth decay and deterioration of an oral hygiene than in rural areas like fast food, while in rural area use of a healthy diet, (i.e. housing in rural areas where fruits and vegetables more available than in the city center). (76)

Effect of Age Difference on Oral Hygiene

Juan J. Villalobos-Rodelo et al. in 2007 reported that younger children had worse levels of oral hygiene. The explanation may be that younger children are less skilled at removing dental plaque than older children. It was observed that older children brush more often, which also may help to explain why younger children have worse levels of oral hygiene. However, these trends are not universal; some investigators found that older children had more dental plaque. (80)

In the present study the male group of urban school, there was no significant difference in the means of OHIS scores between the Group 1, Group 2 and Group 3. In the female group of urban school, there was no significant difference in the means of OHIS scores between the Group 1, Group 2 and Group 3.

In the male group of rural school, there was no significant difference in the means of OHIS scores between the Group 1, Group 2 and Group 3. While in the female group of rural school, there was no significant difference in the means of OHIS scores between the Group 1, Group 2 and Group 3. But there was significant difference in the means of OHIS scores between the Group 1 and Group 3, in which the mean value of OHIS scores in the Group 1 higher than in the Group 3 (p=0,006). In Table (3) and Figure (8) showed the simplified oral hygiene index (OHIS) scores of the 10-12 years children (Group 1, Group 2, and Group 3) and compare the (OHIS) scores between the rural and urban schools.

When the overall OHI-S scores of the urban school Groups were compared, there was no significant difference in the means of OHIS scores between the Group 1, Group 2 and Group 3. But in the rural school, there was significant difference in the means of OHIS scores between the Group 1, Group 2 and Group 3 (p=0,02), in which the mean value of OHIS scores in the Group (3) lower than in the Group (1) and Group (2) (p=0,043) (p=0,037). Also there was no significant difference in the

means of OHIS scores between the Group (1) and Group (2). In Table (4) and Figure (9) showed the simplified oral hygiene index (OHIS) scores of the 10-12 years children (Group 1, Group 2, and Group 3) and compare the (OHIS) scores between the(Group 1, Group 2, and Group 3) in the rural and urban schools.

Many studies have reported increased prevalence with increase in age, however Deepak P Bhayya et al. concluded that the age increases the overall prevalence of gingivitis decreased, this is due to progressive accumulation of the brushing knowledge by the children as they develop. (70)

Oral Hygiene and Orthodontic Treatment

In contemporary dental care an increasing number of patients are seeking orthodontic treatments due to malocclusion and aesthetic dental problems causing a range of negative physical, social and psychological effects. However, after the placements of fixed orthodontic appliances, patients continue to deal with other difficulties such as plaque accumulation leading to an increased risk of developing gingivitis.

Patients undergoing orthodontic treatment with fixed appliances are at risk for developing gingival inflammation because of the increased challenge to oral hygiene. Dental plaque is a primary etiologic factor in gingivitis. The patient's inability to clean his or her teeth adequately around fixed orthodontic devices promotes plaque accumulation that can then lead to gingival inflammation. An overall increase in salivary bacterial counts, especially Lactobacillus, has been shown after orthodontic appliance placement. (83)

Shaw et al. reviewed the dental effects of malocclusion and indicated that the role of tooth malposition and periodontal disease was not clearly established. (84) Glickman and Manson pointed out numerous variables are considered predisposing and aggravate to gingival and periodontal disease. Logically, bacterial plaque which is considered the major etiological factor in the development of chronic gingivitis may be more difficult to remove from malpositioned teeth. (85 and 86)

Manschot et al. reported one case of a patient in whom orthodontic treatment and poor oral hygiene resulted in severe mucogingival changes, such as gingival

recession. Orthodontic appliances do not usually cause gingival inflammation, but they can contribute to periodontal disease due to the increase in microorganisms. However, plaque accumulation and gingival inflammation both can be equally reduced in well-motivated patients. Therefore, it is very important to emphasize oral hygiene instructions to orthodontic patients treated with a fixed appliance. (87)

Bjorn U. Zachrisson and Sigrun Zachrisson in two separate studies monitored the periodontal status of patients during and after fixed orthodontic treatment. They found a deterioration of periodontal status of patients within one to two months after the start of fixed orthodontic treatment. Other findings noted by Bjorn and Sigrun were that, proximal areas of teeth were more affected then the buccal areas and after 4- 5 months of appliance removal, periodontal status improved significantly. (88 and 89)

Atassi et al. reported that after three months of orthodontic treatment beginning there is a statistically significant increase in stimulated salivary flow rate, buffer capacity and levels of lactobacilli, as well as increased bleeding on probing (BOP), a higher plaque index (PI), a higher gingival index (GI), and an increase in probing pocket depth (PPD). (90)

Tufekci et al. found that when a prophylactic examination was carried out, 50 percent of patients had one or more white spot lesions by the end of their orthodontic treatment. (91) Khalaf et al. states that the appearance of white spot lesions is three times more likely to occur in males than females, because females more attentively look after their oral health. Because orthodontic appliances increase the accumulation of plaque, the risk of enamel demineralization and periodontal diseases increases also, as well as the risk of halitosis. (92) Zurfluh et al. stated that after four weeks of orthodontic treatment beginning, patients report an unpleasant taste and smell in the mouth and the effect of a dry mouth. (93)

Hobson et al. investigated the oral hygiene advice that orthodontists gave to patients undergoing routine orthodontic treatment. They found that all orthodontists gave advice on tooth brushing, 89.5% gave dietary advice, and 84% suggested that patients to use disclosing tablets. A fluoride rinse was recommended by 73% and a Chlorhexidine mouthwash by 41.9% of orthodontists. Many orthodontists advocate

appropriate oral hygiene measures, but the efficacy of such methods is determined by the patient's motivation. Therefore, orthodontists require skills in behavioral management. (94)

Hobson et al. concluded that the oral health conditions of patients with fixed orthodontic appliances can be improved by proper communication of the required information and repeated motivation and oral hygiene instruction. A high standard of oral hygiene is essential for patients undergoing orthodontic treatment. (94)

The research of Nassar et al. shows that the most effective method of tooth brushing is the modified Bass method because it removes plaque not only from the surface of tooth and gum but also reaches a depth of 0,5mm under the gum. (95) According to Erbe et al. the most effective toothbrush for orthodontic patients is an electric toothbrush with an orthodontic head. It is highly beneficial to use additional measures for oral hygiene such as an interdental toothbrush, dental floss, toothpaste containing fluoride (to avoid enamel demineralization) and an oral irrigator. (96)

Finally we found that boys had worse oral hygiene. This result may be related to what has been documented in previous studies about knowledge, attitudes, beliefs, and oral hygiene practices: girls show better understanding than boys. In the final logistic regression model, younger children had worse levels of oral hygiene. The explanation may be that younger children are less skilled at removing dental plaque than older children. Also children with higher socioeconomic state had better oral hygiene; a probable explanation of the present results is that children from the poorest families receive significantly less instruction on oral hygiene from dentists or other knowledgeable sources.

Results of this study could be used in the future for the design of oral health education programs for this specific age group. Also, it would be interesting to develop similar studies in other cultures do define the facilitators and barriers in other cultures. Moreover, since barriers have been defined, governments, oral health companies and dental professional should focus on taking measures to overcome these barriers. Concerns about how clean were their teeth, oral health literacy of children's and parents' and their choice of tooth paste were found as facilitators for

oral hygiene, whereas, children’s boredom, low oral health literacy, forgetfulness and low socioeconomic level were found as barriers.

7. CONCLUSION

Overall, Libyan school children had OHI-S scores from fair to good oral hygiene, The following conclusions can be drawn from the result of the present study by use of simplified oral hygiene index (OHIS) among school going children (10-12 years) of rural and urban area in Tripoli of Libya:

• Overall, the oral hygiene of these three age groups is ranged from fair to good oral hygiene.

• 12-year-old females have significantly better OHI-S scores than their male counterparts.

• Urban school children have significantly better OHI-S scores than rural school children of the same age.

• The variation in the OHI-S scores of urban and rural children may also be related to socio-economic status or the availability and affordability of toothbrushes.

• 12-year-old rural females have significantly better OHI-S scores than 10 and 11-year-old rural females.

• 12-year-old rural school children have significantly better OHI-S scores than 10 and 11-year-old rural school children.

• 10-year-old urban school children have significantly better OHI-S scores than 10-year-old rural school children.

Oral health promotion through school health programs which including screening, preventive procedures, and health education of school children should be done on the regular basis for generating awareness regarding maintenance of oral health.

It is better that dental health professionals must learn not only to plan and implement the treatment procedures for dental caries but also they must carry out and designing the entire preventive measures taken which help in maintaining the oral health.

8. REFERENCES

1. Solanki J, Gupta S, Chand S. Comparison of Dental Caries and Oral Hygiene Status Among Blind School Children and Normal Children, Jodhpur City Rajasthan, India. Univ Res J Dent 2014; 4:22-5.

2. Shabani LF, Begzati A, Dragidella F, Hoxha VH, Cakolli VH, et al. (2015). The Correlation between DMFT and OHI-S Index among 10-15 Years Old Children in Kosova.

3. Angelopoulou M, Kavvadia K, Oulis C Reppa C. Oral Hygiene Facilitators and Barriers in Greek 10 Years Old Schoolchildren. Int J Clin Pediatr Dent 2015; 8(2 87 93).

4. Mohammed Al Nuaimi et al. OHDM - Vol. 13 - No. 2 - June, 2014 Oral Hygiene Status in School Adolescents: A study of 20,000 School-age Adolescents in 66 Public and Private Schools Comparing Oral Hygiene Status by Gender and Ethnicity.

5. www.libyan population.com.

6. Syed Wali Peeran et al. Libyan J Med 2014, 9: 23564 http: // dx. doi.org /10.3402 ljm.v9.23564.

7. Huew R, Waterhouse P, Moynihan P, Kometa S, Maguire A. Dental caries and its association with diet and dental erosion in Libyan schoolchildren. Int J Paediatr Dent. 2012; 22: 68_76.

8. World Health Organization (2012). Dentists, regional health observatory. WHO. Available from: http://rho.emro.who.int/ rhodata/? vid_2625 [cited 28 November 2013].

9. Tandläkartidningen (Journal of the Swedish Dental Association) and Swedish Dental Journal (the scientific journal of the SDA).

10. Neumann DG, Quiñonez C. A comparative analysis of oral health care systems in the United States, United Kingdom, France, Canada, and Brazil. NCOHR Working Papers Series 2014; 1:2. Available: http://ncohr-rcrsb. Ca/knowledge sharing working-paper-series-content- garbinneumann.pdf

11. Peeran SW, Singh AJ, Alagamuthu G, Abdalla KA, Naveen Kumar PG. Descriptive analysis of tooth brushing used as an aid for primary prevention: a population-based study in Sebha Libya. Soc Work Public Health. 2013; 28: 57582.

12. Nikhil Marwah.3rd edition, textbook of pediatric dentistry, chapter 11 pages 681-693.

13. N. Jürgensen and P.E. Petersen. Promoting oral health of children through schools Results from a WHO global survey 2012 Community Dental Health (2013) 30, 204–218.

14. Greenstein G. Periodontal response to mechanical non-surgical therapy: a review. J Periodontal 1992; 63:118-128.

15. Bakdash B. Current patterns of oral hygiene product use and Practices. Periodontal 2000 1995; 8:11-14.

16. Mandel ID. The plaque fighters: choosing a weapon. J Am Dent Assoc 1993; 124:71-74.

17. Bouwsma OJ, Yost KG, Baron HJ. Comparison of a chlorhexidine rinse and a wooden interdental cleaner in reducing interdental gingivitis. Am J Dent 1992; 5:143-146.

18. Kiger RD, Nylund K, Feller RP. A comparison of proximal plaque removal using floss and interdental brushes. J Clin Periodontol 1991; 18:681-684.

19. Kashani H, Birkhed D, Petersson LG. Fluoride concentration in the proximal area after using toothpicks and other fluoride containing products. Eur J Oral Sci 1998; 106:564-570.

20. Edgar WM. Sugar substitutes, chewing gum and dental caries – a review. Br Dent J 1998; 184:29-32.

21. Binney A, Addy M, Newcombe RG. The plaque removal effects of single rinsing and brushings. J Periodontol 1993; 64:181-185.

22. Forward GC. Role of toothpastes in the cleaning of teeth. Int Dent J 1991; 41:164 170.

23. Jackson RJ. Metal salts, essential oils and phenols – old or new? Periodontol 2000 1997; 15:63-73.

24. Hawley M, Hamilton I, Worthington V, et al. A 30-month study investigating the effect of adding Triclosan/copolymer to a fluoride dentifrice. Caries Res 1995; 29:163-167.

25. Sanz M, Vallcorba N, Fabregues S, et al. The effect of a dentifrice containing chlorhexidine and zinc on plaque, gingivitis, calculus and tooth staining. J Clin Periodontol 1994; 21:431-437.

26. Blake-Haskins JC, Gaffar A, Volpe AR, et al. The effect of a bicarbonate/fluoride dentifrice on human plaque ph. J Clin Dent 1997; 8:173-177.

27. West NX, Addy M, Jackson RJ, et al. Dentine hypersensitivity and the placebo response. A comparison of the effect of strontium acetate, potassium nitrate and fluoride toothpastes. J Clin Periodontol 1997; 24:209-215.

28. Topbasi B, Turkmen C, Gunday M. An investigation of the effect of a desensitizing dentifrice on dentinal tubules in vitro and in vivo. Quintessence Int 1998;29:197-199.

29. Fischman SL. A clinician's perspective on antimicrobial mouthrinses. J Am Dent Assoc 1994; 125:20S-22S.

30. Al-Tannir MA, Goodman HS. A review of chlorhexidine and its use in special populations. Spec Care Dent 1994; 14:116-121.

31. Ayad F, Berta R, Petrone M, et al. Effect on plaque removal and gingivitis of a triclosan-copolymer pre-brush rinse: a six-month study in Canada. J Can Dent Assoc 1995; 61:53-56, 59-61.43.

32. Kjaeheim V, Skaare A, Barkvoll P, et al. Antiplaque, antibacterial, and anti-inflammatory properties of triclosan mouthrinses in combination with zinc citrate or polyvinylmethylether maleic acid (PVM-MA) copolymer. Eur J Oral Sci 1996; 104:529-534.

33. Renton-Harper P, Addy M, Moran J, et al. A comparison chlorhexidine, cetylpyridinium chloride, triclosan, and C31G mouth rinse products for plaque inhibition. J Periodontol 1996; 67:486-489.

34. Ullsfoss BN, Ogaard B, Arends J, et al. Effect of a combined chlorhexidine and Na F mouth rinse: an in vivo human caries model study. Scand J Dent Res 1994; 102:109-112.

35. Moran JM. Chemical plaque control – prevention for the masses. Periodontol 2000 1997; 15:109-117.

36. Smith AJ, Moran J, Dangler LV, et al. The efficacy of antigingivitis chewing gum. J Clin Periodontol 1996; 23:19-23.

37. Audrey Choo et al. Australian Dental Journal 2001; 46: (3):166-173 Oral hygiene measures and promotion: Review and considerations.

38. Astrom Jakobsen R. Stability of dental health behavior: a three year prospective cohort study of 15, 16 and 18 year old Norwegian adolescents. Community Dent Oral Epidemiol 1998; 26:129-138.

39. N. Jürgensen and P.E. Petersen, Promoting oral health of children through schools Results from a WHO global survey 2012 , Community Dental Health (2013) 30, 204–218.

40. Kay EJ, Millar K, Blinkhorn AS, et al. The prevention of dental disease: changing your patients' behaviour. Dent Update 1991; 18:245-248.

41. Lee JH, Abdullah AAA, Yahya NA (2016) Oral Hygiene Practices among Fixed Orthodontic Patients in a University Dental Setting. Int J Oral Dent Health 2:027

42. Löe H, Theilade E, Jensen SB. Experimental gingivitis in man. J Periodontol. 1965; 36: 177-87.

43. Atassi F, Awartani F. Oral Hygiene Status among Orthodontic Patients. J Contemp Dent Pract [Internet]. 2010 July; 11(4):025-032.

44. Saqib Naeem and M Rafique Chatha. Oral Hygiene Status of Patients Undergoing Orthodontic Treatment. Pakistan Oral & Dental Journal Vol 27, No. 1 (67 _ 72).

45. McGlynn FD, LeCompte EJ, Thomas RG, Courts FJ, Melamed BG. Effects of behavioral self-management on oral hygiene adherence among orthodontic patients. Am J Ortho Dentofac Orthop, 91: 15-21, 1987.

46. Boyd RL. Longitudinal evaluation of a system for self-monitoring plaque control effectiveness in orthodontic patients. J Clin Periodontol, 10: 380-388, 1983.

47. O'Reilly MM, Featherstone JDB. Demineralization and remineralization around orthodontic appliances. An in vivo study. Am J Orthod Dentofac Orthop, 92: 33-40, 1987.

48. Twetman S, Ekstrand K, Qvist. Dental caries in an ecological perspective, Ugeskr Laeger. 2010 Nov 1; 172(44): 3026-3029. (Danish).

49. Nyvad B: Fejerskov O, Kidd EAM, eds. Dental caries: The disease and its clinical management, 3d edn. Copenhagen: Blackwell Munksgaard 2003:171-177.

50. Aida Saban et al. Assessments of the Socioeconomic Status and Diet on the Prevalence of Dental Caries at School Children in Central Bosnian Canton, 2014.26.309-3122014.

51. The Association between Socioeconomic Status and Dental Caries in Preschool Children: A Systematic Review by Dr. Poon Pui Lok: University of Hong Kong August 2011.

52. Psoter W, Pendrys D, Morse D, Zhang H, Mayne S. Associations of Ethnicity/Race and Socioeconomic Status with Early Childhood Caries Patterns. Journal Of Public Health Dentistry. Winter 2006; 66(1):23-9.

53. Sayegh A, Dini EL, Holt RD, Bedi R. Caries in preschool children in Amman, Jordan and the relationship to socio-demographic factors. International Dental Journal. 2002; 52(2):87-93.

54. Du M, Luo Y, Zeng X, Alkhatib N, Bedi R. Caries in preschool children and its risk factors in 2 provinces in China. Quintessence International (Berlin, Germany: 1985). 2007; 38(2):143-51.

55. Sgan-Cohen, H.D.; Horev, T.; Zusman, S.P.; Katz, J.; Eldad, A. The prevalence and treatment of dental caries among Israeli permanent force military personnel. Mil. Med. 1999, 164, 562–565.

56. Simone M. Costa et al. Systematic Review of Socioeconomic Indicators and Dental Caries in Adults Int. J. Environ. Res. Public Health 2012, 9, 3540-3574; doi: 10.3390/ijerph9103540.

57. Ellwood R, Fejerskov O: Clinical use of fluoride. In: Fejerskov O, Kidd EAM, eds. Dental caries. The disease and its clinical management, 3d edn. Copenhagen Blackwell Munksgaard 2003:189-222.

58. Alm A, Wendt LK, Koch G, Birkhed D: On Dental Caries and Caries-Related Factors in Children and Teenagers, ISBN 978-91-628-7444-5,2008.

59. Astrom AN, Jakobsen R. Stability of dental health behaviour: a three year prospective cohort study of 15, 16 and 18 year old Norwegian adolescents. Community Dent Oral Epidemiol 1998; 26:129-138

60. Kay EJ, Millar K, Blinkhorn AS, et al. The prevention of dental disease: changing your patients' behaviour. Dent Update 1991;18:245-248.

61. Kantovitz KR, Pascon FM, Rontani RM, Gaviao MB: Obesity and dental caries – A systematic review. Oral Health Prev Dent 2006:4:137-44.

62. Cole TJ, Bellizzi MC, Flegal KM, Dietz WH: Establishing a standard definition for child overweight and obesity worldwide: international survey. Bmj 2000; 320:1240-3.

63. Bailleul-Forestier I, Lopes K, Souames M, Azoguy-Levy S, and Frelut ML, Boy-Lefevre ML: Caries experience in a severely obese adolescent population. Int J Paediatr Dent 2007; 17:358-63.

64. Assessment of Gingival Health Status among 5- and 12 Year-Old Children in Yemen: A Cross-Sectional Study Khaled A. Al-Haddad.

65. Yee r et al. Oral cleanliness of 12-13-year-old and 15-year-old school children of Sunsari District, Nepal, J Indian Soc Pedod Prev Dent - September 2006.

66. Angelopoulou M, Kavvadia K, Oulis C Reppa C. Oral Hygiene Facilitators and Barriers in Greek 1Years Old Schoolchildren. Int J Clin Pediatr Dent 2015;8(2 87-93.

67. Rao NG. Oral health status of certified school children of Mysore state: A report. J Indian Dent Assoc 1985; 57:61-4.

68. Babu M, Nirmala S, Sivakumar N. Oral hygiene status of 7-12 year old school children in rural and Urban population of Nellore District J Indian Assoc Public Health Dent 2011; 18 Suppl III: 1075-80.

69. Das et al.: Prevalence of dental disease among school children, J Indian Soc Pedod Prevent dent | Jan - Mar 2009 | Issue 1 | Vol 27.

70. Deepak P Bhayya et al. Study of oral hygiene status and prevalence of gingival diseases in 10-12 year school children in Maharashtra, India. J. Int Oral Health 2010.

71. Dhar V, Jain A, Van Dyke TE, Kohli A Prevalence of gingival diseases malocclusion and fluorosis in school-going children of rural areas in Udaipur district. J Indian Soc Pedod Prev Dent 2007 25(2):103-5.

72. Jose A, Joseph MR. Prevalence of dental health problems among school going children in rural Kerala. J Indian Soc Pedo Prev Dent 2003; 21:147-51

73. Mahesh Kumar P, Joseph T, Varma RB Jayanth M. Oral health status of 5 years and 12 years school going children in Chennai city: An epidemiological study. J Indian Soc Pedo Prev Dent 2005; 23:17-22.

74. Khaled A. Al-Haddad et al. Assessment of Gingival Health Status among 5- and 12-Year-Old Children in Yemen: A Cross-Sectional Study, Volume 2013, Article ID 352621, 7 pages http://dx.doi.org/10.1155/2013/352621.

75. Seth, et al.: Caries prevalence and oral hygiene status among 7-12 year old school children from rural and urban area of Gautam Budh Nagar, U.P , Journal of Advanced Oral Research / Jan-Apr 2016 / Vol. 7 No. 1.

76. Mohanid Almozughi, Cross section study: dental caries prevalence and its related factors in the school children (comparison between rural & urban children) in Libya, Yeditepe University, faculty of Dentistry, Department of Pediatric Dentistry in 2016.

77. Baccush MM, Nayak CS. Prevalence of dental caries in school children from a suburban area in Tripoli, Libya. 1991; 25(1):11-5.

78. Zafer Azizi, The prevalence of dental caries in primary dentition in 4- to 5-year-old preschool children in northern Palestine. Int J Dent. 2014; 2014:839419. Doi: 10.1155/2014/839419.

79. John JB, Asokan S, Aswanth KP, Priya PR, Shanmugaavel AK. J Public Health Res. Dental caries and the associated factors influencing it in tribal, suburban and urban school children of Tamil Nadu, India: a cross sectional study 2015 Mar 9;4(1):361. Doi: 10.4081/jphr.2015.361.

80. Juan J. Villalobos-Rodelo et al. Socioeconomic and Sociodemographic Variables Associated With Oral Hygiene Status in Mexican Schoolchildren Aged 6 to 12 Years, J Periodontol May 2007; 78:816-822.

81. A. Adeniyi Abiola et al. Dental caries occurrence and associated oral hygiene practices among rural and urban Nigerian pre-school children, Journal of Dentistry and Oral Hygiene Vol. 1(5), pp. 64-70, December 2009.

82. Simone M. Costa et al. Systematic Review of Socioeconomic Indicators and Dental Caries in Adults Int. J. Environ. Res. Public Health 2012, 9, 3540-3574; doi: 10.3390/ijerph9103540.

83. Bloom RH, Brown LR Jr. A study of the effects of orthodontic appliances on oral microbial flora. Oral Surg Oral Med Oral Pathol. 1964; 17:658-67.

84. Shaw WC, Addy M, Ray C. Dental and social effects of malocclusion and effectiveness of orthodontic treatment. A review. Community Dentistry and Oral Epidemiology. 1980; 8: 36-45.

85. Glickman I. Clinical periodontology. (4th Edn.) Philadelphia: Saunders. 1972; pp. 344-364.

86. Manson JD. Periodontics. (3rd Edn.) London: Henry Kimpton. 1975; pp. 38-39.

87. Manschot A. Orthodontics and inadequate oral hygiene compliance as a combined cause of localized gingival recession: a case report. Quintessence Int. 1991; 22(11):865-70.

88. Zachrisson S, Zachrisson BU. Gingival conditions associated with orthodontic treatment. Angle Orthod 1972; 42: 26-34.

89. Zachrisson BU, Zachrisson S. Gingival conditions associated with partial orthodontic treatment. Acta Odont Scand 1972; 30: 127-136.

90. Atassi F, Awartani F. Oral hygiene status among orthodontic

Stomatologija, Baltic Dental and Maxillofacial Journal, 2016, Vol. 18, No. 2 65.

91. Tufekci E, Dixon JS, Gunsolley JC, Lindauer SJ. Prevalence of white spot lesions during orthodontic treatment with fixed appliances. Angle Orthod 2011;81:206-10.

92. Khalaf K. Factors affecting the formation, severity and location of white spot lesions during orthodontic treatment with fixed appliances. J Oral Maxillofac Res 2014; 5:e4.

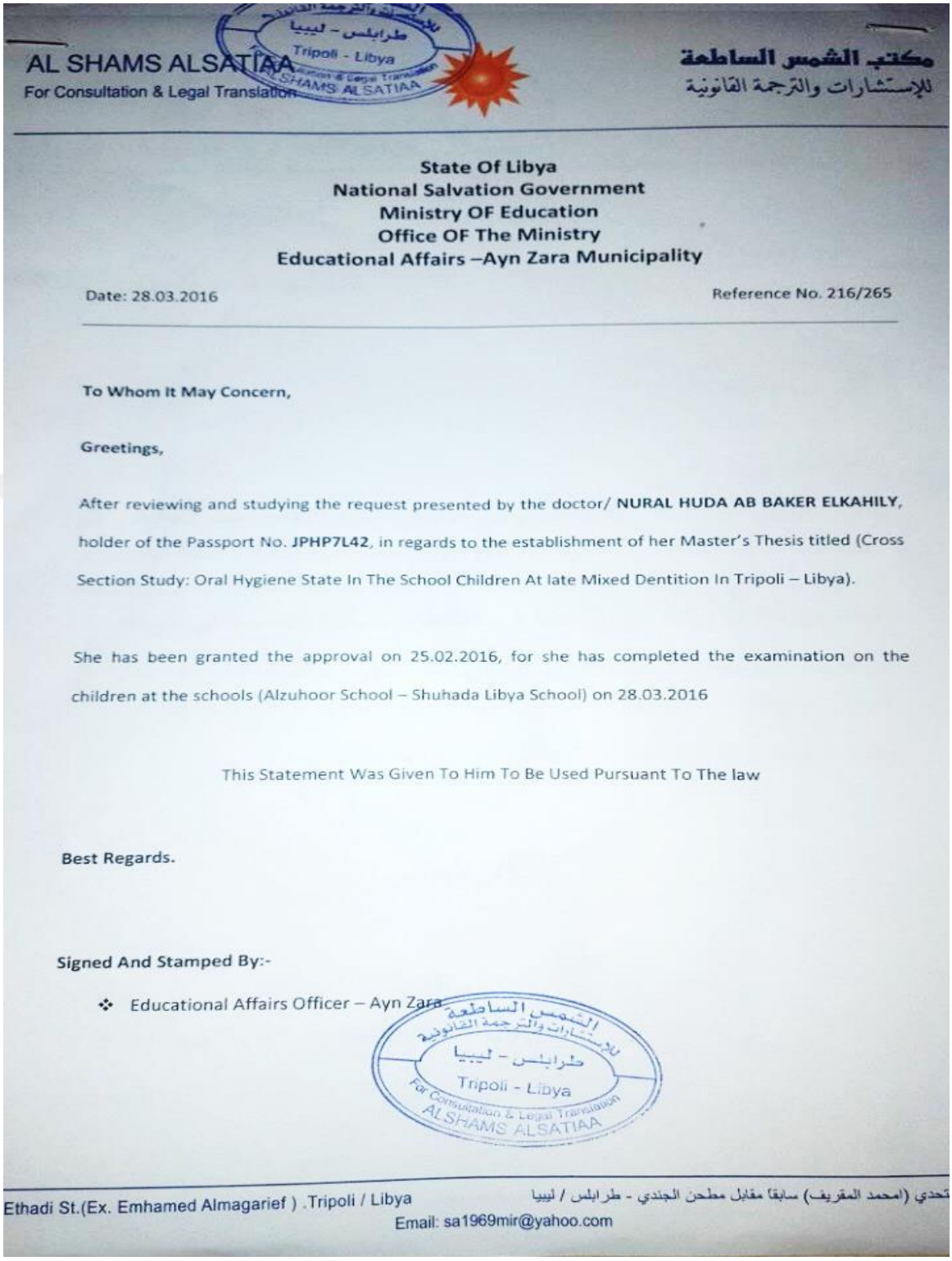
93. Zurfluh MA, Waes HJM, Filippi A. The influence of fixed orthodontic appliances on halitosis. Schweiz Monatsschr Zahnmed 2013; 123:1064-9.

94. Hobson RS, Clark JD. How UK orthodontists advise patients on oral hygiene. Br J Orthod, 25: 64-66, 1998.

95. Nassar PO, Bombardelli CG, Walker CS, Neves KV, Tonet K, Nishi RN, et al. Periodontal evaluation of different tooth brushing techniques in patients with fixed orthodontic appliances. Dental Press J Orthod 2013; 18:76-80.

96. Erbe C, Klukowska M, Tsaknaki I, Timm H, Grender J, Wehrbein H. Efficacy of 3 toothbrush treatments on plaque removal in orthodontic patient's assessd with digital plaque imaging: A randomized controlled trial. Am J Orthod Dentofacial Orthop 2013; 143:760-6.

9. ADDITIONS



AL SHAMS ALSATIAA
For Consultation & Legal Translation

مكتب الشمس الساطعة
للإستشارات والترجمة القانونية

طرابلس - ليبيا
Tripoli - Libya
For Consultation & Legal Translation
ALSHAMS ALSATIAA

State Of Libya
National Salvation Government
Ministry OF Education
Office OF The Ministry
Educational Affairs –Ayn Zara Municipality

Date: 28.03.2016 Reference No. 216/265

To Whom It May Concern,

Greetings,

After reviewing and studying the request presented by the doctor/ **NURAL HUDA AB BAKER ELKAHILY,** holder of the Passport No. **JPHP7L42**, in regards to the establishment of her Master's Thesis titled (Cross Section Study: Oral Hygiene State In The School Children At late Mixed Dentition In Tripoli – Libya).

She has been granted the approval on 25.02.2016, for she has completed the examination on the children at the schools (Alzuhoor School – Shuhada Libya School) on 28.03.2016

This Statement Was Given To Him To Be Used Pursuant To The law

Best Regards.

Signed And Stamped By:-

- Educational Affairs Officer – Ayn Zara

الشمس الساطعة للإستشارات والترجمة القانونية
طرابلس - ليبيا
Tripoli - Libya
For Consultation & Legal Translation
ALSHAMS ALSATIAA

Ethadi St.(Ex. Emhamed Almagarief) .Tripoli / Libya
Email: sa1969mir@yahoo.com

تحدي (امحمد المقريف) سابقا مقابل مطحن الجندي - طرابلس / ليبيا

Informed consent

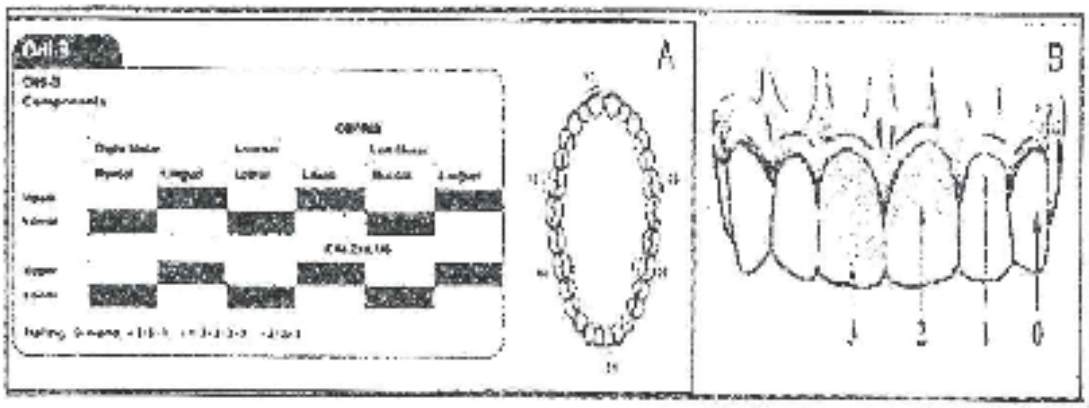
My name is …….……,
I accept the participant of my child ……..
. for the dental examination in …… school and I agree to use the data and the result of the dental examination of my child in the study will be done by doctor **NURAL HUDA AB BAKER ELKAHILY.**

Signature: ……

Date: ……..……

Clinical examination :-

Simplified oral hygiens index (OHI-S) :-



Debris index = **Debris index =**

Calculus index = **Calculus index =**

OHI-S = Debris index +Calculus index

OHI-S = + . OHI-S =

Interpretation :

For the DI-S and CI-S scores	*For the OHI-S score*
Good – 0.0-0.6	Good- 0.0-1.2
Fair- 0.7-1.2	Fair- 1.3-3.0
Poor-1.3-6.0	Poor-3.1-6.0

Substitution :

For tooth 16	Tooth 17
If 17 is missing	Tooth 16
For tooth 11	Tooth 21
For tooth 26	Tooth 27
If 27 is missing	Tooth 26
For tooth 36	Tooth 37
If 37 is missing	Tooth 36