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Orthodontic Treatment of Medically Compromised Patients

A Project Submitted to
The College of Dentistry, University of Baghdad, Department of Orthodontics in Partial Fulfillment for the Bachelor of Dental Surgery

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بسم الله الرحمن الرحيم

﴿وَلَقَدْ آتَيْنَا دَاوُودَ وَسُلَيْمَانَ عِلْمًا وَقَالَا الْحَمْدُ لِلَّهِ الَّذِي فَضَّلَنَا عَلَى كَثِيرٍ مِنْ عِبَادِهِ الْمُؤْمِنِينَ﴾

صدق الله العظيم

سورة النمل

آية (15)

Certification of the Supervisor

I certify that this project entitled" Orthodontic treatment of medically compromised patients" was prepared by **Abbas Mazin Khazaal** under my supervision at the College of Dentistry/University of Baghdad in partial fulfillment of the graduation requirements for the Bachelor degree in dentistry.

Supervisor's name: **Lecturer Ihsan Sadiq Mohammed**

May, 2023.

Dedication

I would like to dedicate my research to my family, especially my mom for her unlimited support throughout the years of my study from childhood until now.

Also, this is dedicated to my friends who have always supported me.

Finally, my appreciations and thanks to everyone taught me a letter from my childhood until today.

Abbas Mazin Khzaal

Acknowledgment

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List of Abbreviations

Bp	**Bisphosphonate.**
DDAVP	**1-desamino-8-darginine vasopressin.**
DM	**Diabetes Mellitus**
DS	**Down syndrome.**
HBV	**Hepatitis B virus.**
HIV	**Human immunodeficiency virus**.
IE	**Infective endocarditis.**
MRI	**Magnetic resonance imaging.**
NRL	**Neural Retina Leucine Zipper.**
NSAIDs	**Non-steroidal anti-inflammatory drugs.**
SCD	**Sickle cell disease.**
TADs	**Temporary anchorage device.**
TMA	**Titanium molybdenum alloy.**

Introduction

There has been an increase in the number of patients seeking orthodontic treatment. Some of them are medically compromised or on medications. Orthodontists need to be aware of these conditions and how to modify their protocol of treatment accordingly **(Patel *et al*., 2009).**

They are obligated to coordinate with their patients' physicians about some orthodontic procedures and whether any modification to the treatment will be needed during the treatment **(Ansar *et al*., 2012).**

Orthodontists need to be aware of the possible clinical implications of these diseases. They must have a basic working knowledge of patient's disease process and should inform the general physician about the type of procedures planned **(Ansar *et al*., 2012).**

Orthodontic treatment is not contraindicated in most of these conditions unless it is uncontrolled because the tissues' response to orthodontic treatment is jeopardized during the active or acute phase of an illness.

However, medically compromised patients can be seen and treated in the orthodontic clinic with appropriate management. communication with their physicians is very important before commencing orthodontic treatment. An orthodontics needs a good patient cooperation, consent before treatment, proper referral when required and constant monitoring of the progress of the treatment that are necessary to minimize physical damage and to maximize treatment outcome **(Alqahtani, 2019).** So, this review is to have knowledge about these compromised patients to treat them appropriately in orthodontic practice.

Aims of the study

Our aims of study are:

1- Identify and discuss the common medical conditions that may be seen by orthodontist and it effect on orthodontic treatment

2- To evaluate the potential risks for medically compromised patients and the recommended consideration in orthodontic management for each condition

3- To treat them appropriately and avoiding the potential complication that may arise during treatment.

Chapter one
Review of literature

1.1-Cardiovascular Diseases

1.1.1-Infective endocarditis

Bacterial endocarditis is a relatively uncommon, life-threatening infection of the endothelial surface of the heart, including the heart valves **(Dajani, 1998).** The infection usually develops in individuals with underlying structural cardiac defects. It can occur whenever these persons develop bacteremia with the organisms likely to cause endocarditis. Both the incidence and the magnitude of bacteremia of oral origin are proportional to the degree of oral inflammation and infection **(Wilson, 2007).**

1.1.1.1- Relation between orthodontic and Infective Endocarditis

Orthodontic therapy should not be initiated unless the patient's oral hygiene and dental health is impeccable because inadequate oral hygiene during orthodontic treatment with fixed appliances can increases plaque accumulation and lead to gingival inflammation **(Fig.1),** which increases in the presence of orthodontic appliances, but bacteremia found in 10% patients while fitting orthodontic bands **(Burden *et al*., 2001).** Most orthodontic treatment is minimally invasive. However, the placement and removal of orthodontic bands, taking an impression, separator placements **(Fig.2)** and surgical exposure of teeth have been suggested to produce bacteremia **(Sonis, 2004).** Extraction is most likely lead to bacteremia, from an orthodontic perspective, extractions are sometimes required as part of

the treatment plan for overcrowding or dental protrusion **(Vandersluis *et al.*, 2020).**

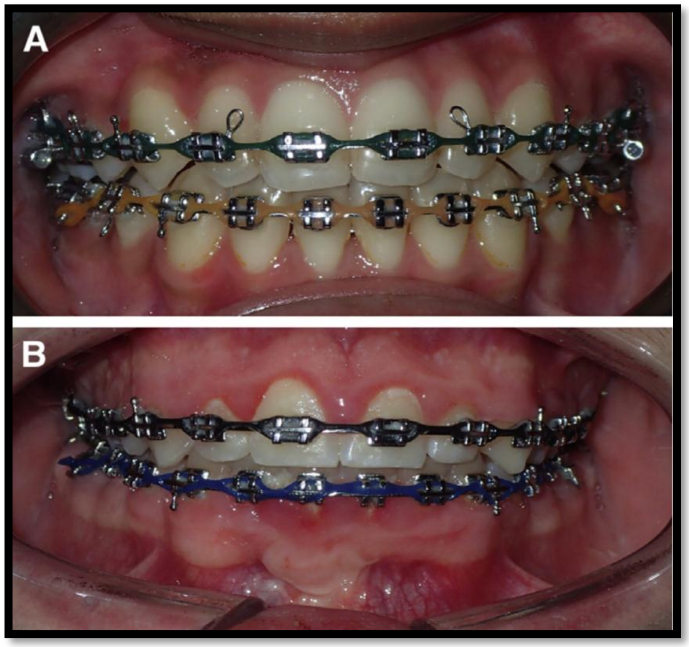

Fig.1 (A, B): Orthodontic patient with IE **(Vandersluis *et al.*, 2020)**.

Fig.2: Elastomeric separator **(Vandersluis *et al.*, 2020)**.

1.1.1.2- Orthodontic considerations

- Orthodontist should communicate with the patient's physician to confirm the risk of IE. Informed consent requires that a patient is aware of any significantly increased risk **(Karunakar *et al.*, 2009).**
- The importance of maintaining an exemplary standard of oral hygiene and that it is their responsibility to protect themselves **(Ansar *et al.*, 2012).**
- When a patient is at risk, prior to any orthodontic procedure a 0.2% chlorhexidine mouthwash may be used **(Khurana and Martin, 1999).**
- The main orthodontic procedure that has been postulated to cause a bacteremia has been placement of a separator **(Lucas, 2002).**
- Orthodontics should avoid using orthodontics bands instead use, bonded attachments. If banding is required use of antibiotic prophylaxis is must **(Burden, 2001).**
- Antibiotic prophylaxis is only required in high-risk patients and the drug of choice is penicillin **(Wilson *et al.*, 2007).**

1.1.2- Hypertension

Hypertension is one of the most significant risk factors for morbidity and mortality that affecting the heart and blood vessels, it occurs when blood pressure increases to unhealthy levels. Blood pressure measurement takes into account how much blood is passing through blood vessels and the amount of resistance the blood meets while the heart is pumping **(Popescu *et al.*, 2013).** Hypertension is divided into two main categories: essential/primary

hypertension and secondary hypertension (Normal blood pressure 120\80mmHg) **(Whalen *et al*., 2015).**

1.1.2.1- Orthodontic considerations

- No contraindications for well-controlled hypertensive patients but avoid treatment if patient uncontrolled **(Burden *et al*., 2001).**
- Ca-channel blockers can cause gingival hyperplasia in addition to the irritation caused by the fixed appliance. Surgical resection of the enlarged tissues is effective **(Sonis,2004).**
- Appointments should be short to minimize stress. Good oral hygiene and educating the patient to maintaining of periodontal health **(Kumer *et al*., 2014).**

1.2- Hematological Disorders

1.2.1- Hemophilia

Hemophilia is the most common congenital bleeding disorder. Hemophilia A is a sex-linked disorder due to a deficiency of clotting factor VIII, hemophilia B or Christmas disease due to factor IX deficiency and von Willebrand's disease due to a defect of von Willebrand's factor **(Meechan and Greenwood, 2003).** The normal concentrations of clotting factor are between 50% and 150% of average value and the minimum level of a factor for adequate hemostasis is 25% (**Gómez *et al*., 2010).**

Fig.3: Gingival hemorrhage in a hemophilic orthodontic patient **(Agarwal *et al*., 2016)**.

1.2.1.1- Orthodontic considerations

● Orthodontic treatment is not contraindicated in patients with bleeding disorders **(Grossman, 1975).**

● Duration of treatment should be given careful consideration. Lengthier the treatment duration may increase potential complications (**Van Venrooy, 1985).**

● Self-ligating brackets are preferable to conventional brackets **(Fig.5).** If conventional brackets are used, arch wires should be secured with elastomeric modules **(Fig.4)** instead of wire ligatures **(Alqahtani, 2019).**

● Chronic irritation from orthodontic appliances should be avoided. Fixed appliances are preferable to removable appliances as the latter can cause gingival irritation **(Fig.3) (Burden *et al*., 2001).**

● If extractions or surgery is to be performed increase factor VIII production with 1-desamino-8-darginine vasopressin (DDAVP). Parenteral DDAVP can be used to raise factor VIII levels 2-3-fold to prevent surgical hemorrhage **(Sankar *et al*., 2010).**

Fig.4: Use of elastic modules ***(*Agarwal *et al., 2016)***

Fig.5: Self-ligating bracket in a hemophilic patient ***(*Agarwal *et al., 2016)***.

1.2.2- Sickle cell anemia

Sickle cell disease (SCD) is a hereditary blood disorder characterized by abnormally shaped red cells. It decreases their plasticity and ability to pass through microcirculation. This increases the viscosity of the blood, obstructs capillaries, limits blood flow to organs, and leads to pain, ischemia, and tissue damage. Common orthodontic problems include delayed tooth eruption, class II malocclusion, increased overjet and overbite, prognathic midface, prognathic maxilla, retrognathic mandible, increased vertical dimension, and convex profile **(Fig.6) (Amoah *et al*., 2015).**

Fig.6: (SCD) Pre-treatment extra-oral and intra-oral photographs **(Amoah *et al*., 2015)**.

1.2.2.1- Orthodontic considerations

● Orthodontic treatment is not contraindicated. Careful communication with the patient's physician is recommended **(Alqahtani, 2019).**

● Appointments should be scheduled early in the morning, and the patient should be in a chronic phase of the disease. Emotional stress should be minimized **(Amoah *et al.*, 2015).**

● A non-extraction treatment plan is preferable, if possible. rest periods between activations should be included in the treatment plan to allow local microcirculation to be restored **(Alves *et al.*, 2013)**.

● Bleeding should be avoided during orthodontic procedures. If extra anchorage is needed, extra-oral anchorage is preferred over TADs or mini-plates, and the applied forces should be managed carefully **(Pithon, 2011).**

Fig.7: *(SCD) post-treatment (extra and intra) oral photograph*

1.2.3- Thalassemia

Thalassemia is an inherited disorder of hemoglobin synthesis. It can be classified as α-thalassemia, β-thalassemia, γ-thalassemia and δ- thalassemia indicating which blood hemoglobin chains are affected. Based on their clinical and genetic orders they are classified into major (homozygous) and minor

(heterozygous) types **(Ansar *et al.*, 2012).** B Thalassemia major (Cooley's anemia) is considered to be the most severe type. Orthodontic problems include skeletal class II malocclusion, small teeth size, reduced dental arch dimensions, everted lips, anterior teeth spacing and flaring, open bite, protrusion, maxillary enlargement, and increased overjet. Maxillary bone marrow undergoes hyperplasia more than the mandible, which causes a distinctive "chipmunk face'' **(Fig.8) (Mulimani *et al*., 2019).**

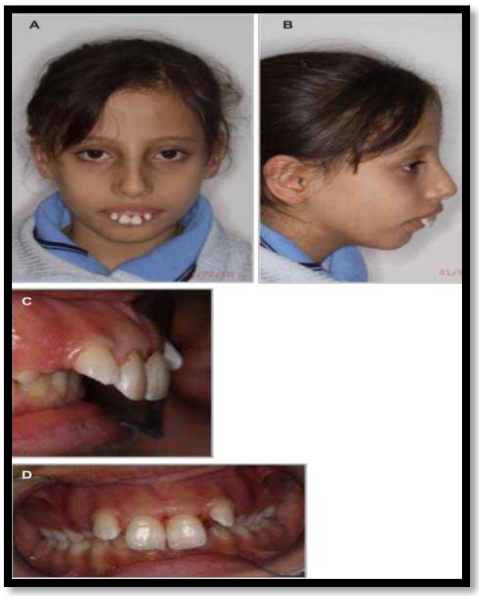

Fig.8: Pretreatment βT patient views: A. Facial repose. B. Facial profile. C. Intraoral lateral anterior. D. Intraoral frontal. (**Einy *et al*., 2016).**

1.2.3.1- Orthodontic considerations

● A hematologist should be consulted before the treatment due to orthodontic problems that might occur at an early age, orthodontic diagnosis and interceptive treatment are recommended to begin early **(Kumar *et al.*, 2014).**

● Functional appliances and extra-oral appliances can be utilized to treat dentofacial problems in young patients **(Mulimani *et al*., 2019).**

● In the case of using high pull headgear, it is recommended to apply a medium force in short intervals. This is because thalassemic patients are more prone to pathological fractures due to thin cortical plates.

● In the case of a protruded premaxilla, the orthopedic force should be directed anterior to the maxillary center of resistance. This will produce a counterclockwise rotational and translator movement to reduce the prominence of the premaxilla, incisors, and gingiva.

● If the mandible is intended to be treated with growth modification, a combined twin block with high pull headgear for vertical control can be utilized (**Einy *et al.*, 2016).**

● The distinctive thalassemic facial appearance is mainly due to a maxillary problem. Thus, segmental osteotomy is usually recommended to impact and set the premaxilla into an appropriate position.

● Presurgical orthodontic treatment can be accomplished to close spaces and align incisor teeth. These patients have a spongier maxillary cancellous bone. Therefore, they have more tendency to bleed during surgery. This issue needs to be discussed carefully with the surgeon before starting the treatment **(Bouguila *et al.*, 2015).**

Fig.9: Post-treatment βT patient views: A. Facial repose. B. Facial profile. C. Intraoral lateral anterior. D. Intraoral frontal. **(Einy *et al*., 2016).**

1.3- Metabolic Disorders

1.3.1- Diabetes Mellitus

DM is one of the most common endocrine disorders. It is characterized by persistently raised blood glucose levels (hyperglycemia), resulting from deficiencies in insulin secretion, insulin action, or both **(Little, 2007).**

Diabetes can be Type 1 (insulin dependent diabetes mellitus or juvenile onset diabetes) results from defects in insulin secretion or Type 2 (non-insulin dependent diabetes mellitus or mature-onset diabetes) develops as a result of defects in insulin secretion, insulin action or both.

1.3.1.1 Oral manifestation: **(Fig.10)**

1. Salivary gland dysfunction (Xerostomia).
2. Fungal infection (Candidiasis).
3. Recurrent oral infections.
4. Oral burning and test impairment (Ketone breath).

5. Poor periodontal health.

6. Multiple carious teeth.

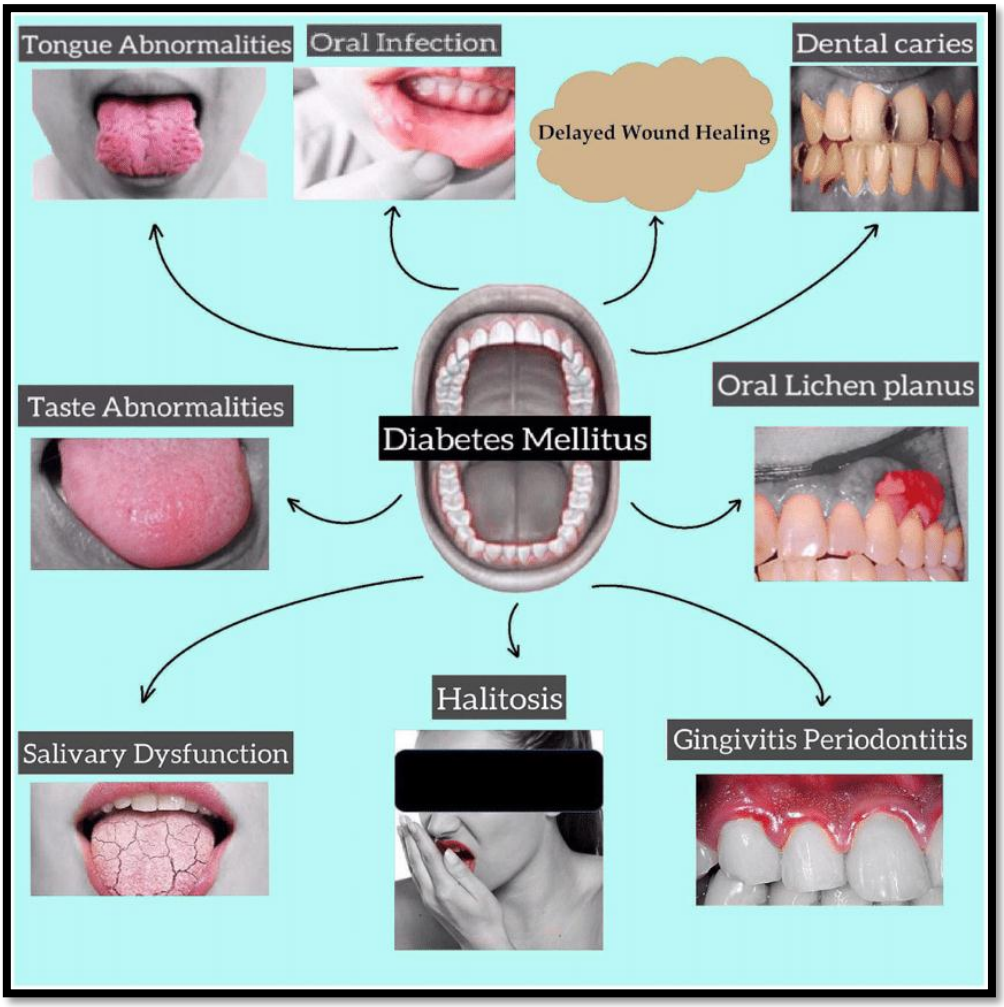

Fig.10: oral manifestation of DM **(Ahmad *et al.*, 2017).**

1.3.1.2- Orthodontic considerations

● Orthodontic treatment is not contraindicated for well-controlled DM. Thus, communication with the patient's physician is required to determine DM status before and during treatment **(Burden *et al.*, 2001).**

● Appointments early in the morning are preferable, and the patient is encouraged to eat a regular meal and take usual medication before the visit. light orthodontic forces should be used **(Patel *et al.*, 2009).**

● Oral hygiene should be very well maintained and should be reinforced every time the patient is seen at the office. Also, any deterioration in oral health should be monitored at every visit. A periodontist should be involved, especially with

adult patients, to evaluate periodontal condition before and during orthodontic treatment **(Bensch *et al.*, 2004).**

● Orthodontists and staff should be trained and ready to deal with any diabetic emergencies, especially sudden hypoglycemia **(Almadih, 2018).**

1.3.2- Thyroid Disorders

Hyperthyroidism is caused by unregulated thyroid hormone synthesis. In contrast, hypothyroidism results from a reduction in thyroid gland function and its hormone production. Orthodontic problems with hyperthyroidism include high bone turnover and accelerated dental eruption. Orthodontic problems with hypothyroidism include anterior open bite, macroglossia, delayed eruption of teeth, impaction of the mandibular second molars, and low bone turnover **(Chandna and Bathla, 2011).**

1.3.2.1- Orthodontic considerations

● First, the patient should be consulted with a physician before the treatment to confirm the stability of the condition a stress reduction protocol should be implemented with hyperthyroidism **(Fabuel *et al*., 2010).**

● Pain medications should be selected carefully with hyperthyroidism. NSAIDs and aspirin are not recommended, and alternative pain medication should be prescribed **(Pinto and Glick, 2002).**

● Treatment procedures such as banding and bonding should have brief appointments and stress management is important for patients who have hyperthyroidism **(Loganathan, 2014)**.

1.4- Liver diseases

1.4.1- Hepatitis

Liver diseases are very common and can result from acute or chronic damage to the liver, usually caused by infection (hepatitis A, B, C, D, and E viruses, infectious mononucleosis), injury, exposure to drugs or toxic compounds, an autoimmune process, or by a genetic defect **(Pamplona *et al*., 2011).**

The liver has a broad range of functions in maintaining homeostasis and health: it synthesizes most essential serum proteins (albumin, transporter proteins, blood coagulation factors V, VII, IX and X, prothrombin, and fibrinogen). Liver dysfunction alters the metabolism of carbohydrates, lipids, proteins, drugs, bilirubin, and hormones **(Ansar *et al*., 2012).**

1.4.1.1- Orthodontic considerations

● Liver disease can result in depressed plasma levels of coagulation factors. If extraction is required or any dental procedures with the potential to cause bleeding should be consulted with physician before the treatment **(Lockhart *et al*., 2003).**

● Care should be taken when prescribing any medication for patients with liver disease. Hepatic impairment can lead to failure of metabolism of some drugs and result in toxicity. Caution should be used in prescribing medications metabolized in the liver, such as acetaminophen, NSAIDs **(Greenwood and Meechan, 2003).**

● Aerosols generated by dental hand pieces could infect skin, oral mucous membrane, eyes or respiratory passages of dental personnel. The main orthodontic procedures to result in aerosol generation are removal of enamel during interproximal stripping, removal of residual cement after debonding and prophylaxis **(Toroglu *et al.*, 2003).**

● Viral hepatitis is surely of importance to the orthodontist. Hepatitis B, hepatitis C virus, and hepatitis D virus are blood borne and can be transmitted via contaminated sharps and droplet infection. HBV can survive on innate subjects for 7 days. Impressions can be one of the links in transmitting the HBV to orthodontics. The impressions must be disinfected by dipping them in glutaldehyde or by spraying sodium hypochlorite and leaving it for 10 min **(Gutiérrez *et al.*, 2006).**

● Post-exposure for HBV infection blood or body fluids through percutaneously or through mucus membrane, If the exposed person is unvaccinated or antibody level is less than 10m IU/ml, hepatitis B immunoglobulin (0.6 ml/kg) should be administered (preferably within 24h) along with the vaccine series given at a different site **(Ansar *et al*., 2012).**

1.5- Immunocompromised states

1.5.1- Acquired immunodeficiency syndrome

AIDS is an infectious disease caused by the HIV, and is characterized by profound immunosuppression that leads to opportunistic infections, secondary neoplasm and neurologic manifestations **(Little *et al*., 2017).** Oral lesions are usually detected first in these patients. These lesions include hairy leukoplakia and oral candidiasis, which are associated with a high virus level and a low CD4+ cell number. Depending on the progress and stage of HIV infection, patients with HIV/AIDS may become medically compromised and require special considerations **(Alqahtani, 2019).**

1.5.1.1- Oral manifestations: (Fig.11-17)

1- Oral Candidiasis.

2- Oral Hairy Leukoplakia.

3- Non-Hodgkin’s lymphoma.

4- Kaposi’s sarcoma.

5- Periodontal diseases.

6- Significant bacterial infections.

7- Melanotic pigmentation.

8- Salivary gland disease.

9- Recurrent aphthous.

Fig.11: oral candidiasis on the dorsum of tongue **(Lomelí *et al*., 2022).**

Fig.12: Erythematous candidiasis on the hard palate **(Lomelí *et al*., 2022).**

Fig.13: Upper and lower chronic periodontitis **(Lomelí *et al*., 2022).**

Fig14: Kaposi's sarcoma of the gingiva, hard, and soft palate **(Lomelí *et al.*, 2022).**

Fig.15: Oral hairy leukoplakia on the lateral border of the tongue **(Lomelí *et al.*, 2022).**

Fig.16: Major aphthous ulcers on the lateral borders of the tongue and coated tongue **(Lomelí *et al*., 2022).**

Fig.17: Oral hyperpigmentation on the cheeks due to the use of the antiretroviral drug dine. Zidovudine ***(*Lomelí *et al.*, 2022).**

1.5.1.2- Orthodontic considerations

● For patients with detected HIV infection, communication with the patient's physician is important to determine the progress and stage of the disease. An orthodontist can aid in detecting a possible HIV infection by recognizing the first oral manifestations of the disease. Xerostomia has been observed in pediatric patients. Clinicians should recommend sugarless gum and frequent consumption of water or highly diluted fruit juices to alleviate xerostomia **(Wig, 2003).**

● HIV patients with no symptoms should be treated as regular patients. These patients can receive regular orthodontic treatment after ruling out the possibility of neutropenia, immunosuppression, or thrombocytopenia **(Little *et al*., 2018).**

● HIV-positive patients may use certain medications for a long time. Orthodontist needs to be aware of some drug interactions acetaminophen and aspirin should be used with caution. In fact, acetaminophen may worsen anemia and granulocytopenia associated with the use of zidovudine (Retrovir) medication. In the case of thrombocytopenia, aspirin and NSAIDs should not be used **(Moswin and Epstein, 2007).**

● During the visits the patient must be stimulated to recognize their fundamental importance in maintaining oral health. patients must also be stimulated to use additional auxiliary procedures such as antiseptic mouthwashes **(Winkler *et al*., 1992).**

● The potential for allergic reactions and drug resistance increases over time with increased usage and may increase with decreased immune function, therefore, the judicious use of antibiotics is warranted **(Ansar *et al*., 2012).**

1.6- Respiratory disease

1.6.1- Asthma

Asthma is a chronic disease that affects the lower airways. It is characterized by recurrent and reversible airflow limitation due to an underlying inflammatory process **(Lepore *et al*., 2003).** Signs and symptoms of asthma, include intermittent (wheezing, coughing, dyspnea, and chest tightness).

Xerostomia is a common problem with asthmatic patients due to prolonged use of steroid-containing inhalers. This makes them more prone to decalcification and periodontal problems **(Patel *et al*., 2009).**

1.6.1.1- Orthodontic considerations

● Medical history of the illness, frequency and severity of acute episodes, medications and determining the specific triggering agents. Preventing a sudden episode of airway obstruction is essential when treating an asthmatic patient **(Malamed, 2000).**

● Schedule these patients' appointments for late morning or later in the day, to minimize the risk of an asthmatic attack.

● Inhaled corticosteroids are the most widely used and most effective asthma anti-inflammatory agents **(Weltman, 1999).**

● Up to 10% of adult asthmatic patients have an allergy to aspirin and other non-steroidal anti-inflammatory agents **(Fischer *et al*., 1993).** A careful history concerning the use of these types of drugs needs to be elicited. The orthodontist should ensure the patient has their inhaler nearby**.**

● Orthodontist needs to be aware for dental materials and products that exacerbate asthma. These items include dentifrices, fissure sealants, tooth enamel dust (during inter-proximal slicing) and methyl methacrylate. Therefore, fixed appliances and bonded retainers without acrylic are preferable **(Singaraju *et al*., 2010).**

1.7- Nervous system disorders

1.7.1- Epilepsy

Epilepsy is the most common serious chronic neurological condition. It is as a chronic neurological disorder characterized by frequently recurrent seizures **(Jacobsen and Eden, 2008).** The risk of developing epilepsy is 2-5% over a lifetime. It affects about 0.5-2% of the population **(Sheller, 2004).**

Injuries to the tongue, buccal mucosa, facial fractures, avulsion, luxation or fractures of teeth and subluxation of the temporomandibular joint can occur during seizures **(Johnestone *et al.*, 1999).** Both the condition and the medical management of condition can affect oral health.

1.7.1.1- Orthodontic considerations

● The patient's physician should be consulted about the stability of the condition, type of medication used, and history of the disease if seizure episodes occur. A well-controlled seizure is not considered a contraindication to orthodontic treatment. In contrast, patients with poorly controlled seizures who have episodes of falling or uncontrolled movement of body parts are contraindicated to receive orthodontic treatment **(Sheller, 2004).**

● Gingival overgrowth associated with phenytoin is the most widely known complication of anti-epileptic medication. Gingivectomy is recommended to remove any hyperplasic tissue that interferes with appearance or function **(Lux and Osborne, 2006).**

● Removable appliances should be used with caution as they can be dislodged during a seizure **(Fiske and Boyle, 2002).**

● Wherever possible removable appliances should be designed for maximum retention and made of high impact acrylic.

● The metal in a fixed orthodontic appliance may distort images obtained by magnetic resonance imaging (MRI). An acceptable MRI may be obtained if arch wires and other removable components are removed before the scan **(Ansar *et al.*, 2012).**

● If a seizure episode occurs during the visit, the following steps are recommended to be followed by the orthodontic team: avoid restraining the patient, lay him\her down or on the side, remove all instruments from the area, write down when the seizure started, speak calmly, and stay with the patient until he\she is alert. Call for emergency medical assistance if the seizure continues for more than 10 minutes, if it is associated with apnea, or if three or more episodes occur at a short time **(Alqahtani, 2019).**

1.8- Renal disorders

The most common renal condition to present to the orthodontist is **chronic renal failure**. Chronic renal failure is a progressive and irreversible decline in renal function. The number of functional units of the kidney or nephrons diminishes, the glomerular filtration rate falls, while serum levels of urea rise **(De Rossi and Glick, 1996).** Up to 90% of patients with renal insufficiency show oral signs and symptoms in soft and hard tissues, some of them being a cause of the

disease itself and others deriving from the treatment. Initially treatment is conservative with dietary restriction of sodium, potassium and protein. As the disease progresses dialysis or transplantation are required. Many patients are prescribed steroids to either combat renal disease or to avoid transplant rejection **(Jover *et al.*, 2008).**

1.8.1- orthodontic considerations

● Extraction should be done cautiously in such patients. Abnormal bone healing after extraction can result due to alterations in calcium and phosphors metabolism and secondary hyperparathyroidism which result in bone demineralization **(De Rossi and Glick, 1996).**

● Due to the increase in circulating parathyroid hormone. It has been suggested that orthodontic treatment forces should be reduced and the forces re-adjusted at shorter intervals.

● Renal insufficiency is considered a risk condition for IE if the patient does not have a good control of the disease **(Bascones *et al*., 2006).** Antibiotic prophylaxis should be considered in hemodialyzed patients who were undergoing an invasive dental procedure.

● During hemodialysis, the patient's blood is anticoagulated with heparin to facilitate blood transit. For this reason, dental treatments with a risk of bleeding must not be performed on the day of hemodialysis. Appointments should be scheduled on non-dialysis days. The day after dialysis is the optimum time for treatment for surgical procedures as platelet function will be optimal and the effect of heparin will have worn off.

● Many antibiotics are actively removed by the kidney, so adjustment of the dosage by amount or by frequency is required **(Bagan *et al*., 2007).** Penicillin and

its derivates are the preferred antibiotics for these patients. In the case of non-narcotic analgesics, paracetamol is the best choice.

● In renal transplant patients' corticosteroid are given to minimize the risk of transplant failure. In such patients to minimize the risk of adrenal crisis in patients during surgical procedure, double the dose of corticosteroids on the day of the surgery **(Miller *et al*., 2001).**

1.9- Osteoporosis

Osteoporosis is chronic, systemic, degenerative disease characterized by decreased bone mass, a micro architectural deterioration of the bone and consequent increase in bone fragility **(Geurs *et al*., 2003).** Risk factors that cannot be altered include advanced age, being female, estrogen deficiency after menopause **(Prestwood *et al*., 1994)**.

Potentially modifiable risk factors include excessive alcohol intake, vitamin D deficiency, and smoking. Drugs most commonly used in treatment of osteoporosis are bisphosphonate (BP), estrogen, and calcitonins **(Wong *et al*., 2007).**

1.9.1- Orthodontic considerations

● Orthodontic treatment therefore, must include the consideration of problems such as bone loss, retention instability, and temporomandibular dysfunction **(Miyajima *et al*., 1996).**

● Problem associated with medication must also be given consideration. Estrogen decreases the rate of tooth movement ***(*Bartzela *et al*., 2009).** However, if these drugs are not used during orthodontic treatment in patients with osteoporosis, resorption of alveolar bone and possibly tooth roots could occur.

● Use of BP can affect orthodontic treatment by delaying tooth eruption, inhibited tooth movement **(Igarashi *et al*., 1994)**, impaired bone healing, and by causing BP-induced (ORN) of the jaws.

• Extraction protocol and use of temporary anchorage devices should be avoided **(Graham, 2006).**

• BP inhibits osteoclasts, decreases microcirculation and thus impedes tooth movement.

1.10- Down syndrome

Down syndrome is one of the most common genetic syndromes, occurring in one of 800-1000 live births **(Baird, 1989*).*** John Langdon Down who published an accurate description of a person with Down syndrome discovered Down syndrome in 1866, although he did not know the cause of the syndrome. He was then termed the "father" of the syndrome.

The primary skeletal abnormality affecting the orofacial structures in Down syndrome is an underdevelopment of the midfacial region. The bridge of the nose, bones of the midface and maxilla are relatively smaller in size. In many instances this causes a prognathic class III occlusal relationship, which contributes to an open bite **(Pilcher, 1998).** Individuals with Down syndrome have delayed eruption pattern. There is usually some sort of enamel defect affecting the teeth. There is usually congenitally missing teeth and they can have unusually shaped teeth.

1.10.1- Orthodontic considerations

● Congenital heart defects are present in 40-60% of infants with Down syndrome. Children with heart defects who are undergoing dental procedures should be given antibiotic prophylaxis against subacute bacterial endocarditis **(Korenberg et al., 1996).**

● Reduced muscle tone causes less efficient chewing and natural cleansing of the teeth. More food may remain on the teeth after eating due to this inefficient chewing. hence oral hygiene instruction should be given in every visit.

● It is ensure that patient is vaccinated for hepatitis before starting dental treatment. This is necessary because persons with Down syndrome are at increased risk of developing the carrier state if they are infected with HBV **(Lang, 1992).**

● Seizures occur in 5-10% of children with Down syndrome **(Cooley *et al*., 1991).** Generalized tonic clonic seizures are the most common. Seizures are diagnosed and treated similarly in children with and children without Down syndrome.

● Impressions using quick‑set materials with fun flavors should be used as these may reduce the tendency for activation of the more sensitive gag reflex frequently experienced with Down syndrome patients.

● High-memory wires allow a longer activation interval between appointments. Self-ligating brackets allow a more patient-friendly activation appointment.

Fig.18: Pre-treatment DS patient photographs and radiographs **(Aksakalli *et al.*,2012).**

Fig.19: Post-treatment DS patient photographs and radiographs **(Aksakalli *et al*.,2012).**

1.11- Allergies

1.11.1- Latex allergies

Allergy to latex is a common in dental office **(Fig.20).** Atopic individuals are at increased risk of allergy. Allergic history should be evaluated during taking of case history **(Hain *et al*., 2007)**. Two types of latex allergy are important; **Type IV**: is a late and localized reaction between 48 and 96 hours after the contact, skin rash with blistering and oozing of the skin, may extend beyond the area of contact of irritant. **Type I**: The most serious and rare form of latex allergy. It occurs from 2 to 3 minutes after contact and is caused by NRL proteins, rather than to chemical additives **(Akhoon *et al*., 2020).**

Fig.20: latex allergy.

1.11.1.1- Orthodontic considerations

● In orthodontic treatment Self-ligating brackets to avoid elastomeric ties. Early morning appointments can reduce patient exposure to airborne natural rubber latex particles. Elastomeric separators can be replaced with self-locking separating springs **(Field, 2001).**

● Some authors suggest administering prophylactic antihistamines, such as diphenhydramine, or corticosteroids, such as prednisone, before dental treatment to those at known risk **(Nainar, 2001).**

● Type IV allergy may be managed with topical corticosteroids. Mild type I reactions without respiratory distress can be treated with topical steroids and antihistamines (50 mg diphenhydramine 4 times a day until swelling resolves) while Severe type I required to emergency treatment **(Little et al., 2002).**

● In latex allergy cases, use of powder free and low free latex protein gloves substitute with alternative ones made of other components such as nitrile, neoprene, vinyl, polyurethane, and styrene-based rubbers **(Singaraju *et al.*, 2010).**

1.11.2- Nickel allergies

Nickel is the most common component of the super-elastic nickel-titanium (Ni-Ti) arch-wires used during the initial leveling and aligning phase of orthodontic treatment with a concentration of 47-50% **(Eliades *et al*., 2002).**

It is also a component in stainless steel (present in both arch-wires and brackets), representing approximately 8% of the alloy. Re-exposure to nickel can results in contact dermatitis or mucositis and develops over a period of days or rarely up to 3 weeks **(Noble *et al*., 2008).** Oral clinical signs and symptoms of nickel allergy can include the following: a burning sensation, gingival hyperplasia, angular chelitis, labial desquamation, erythema multiforme,

periodontitis, stomatitis with mild to severe erythema, loss of taste or metallic taste, numbness, soreness of the side of the tongue **(Patel *et al*., 2009).**

1.11.2.1- Orthodontic considerations

● In the rare event that the patient continues to manifest an allergic reaction, all stainless-steel arch-wires and brackets should be removed. If any severe allergic reaction develops, the patient should be referred to the physician **(Dou *et al.*, 2003).**

● If diagnosis of nickel hypersensitivity is established, the nickel titanium arch-wire should be removed and replaced with a stainless-steel arch-wire which is low in nickel content or preferably a titanium molybdenum alloy (TMA) and Resin coated Ni-Ti wires are also an option **(Leite and Bell, 2004).**

● Alternative nickel free bracket materials include ceramic, polycarbonate, titanium and gold. Fixed appliances may be substituted with plastic aligners in selected cases **(Noble *et al*., 2008).**

● Patients with a defined history of atopic dermatitis to nickel containing metals should be treated with caution and closely monitored during orthodontic treatment **(Patel *et al*., 2009).**

Chapter Two

2- Discussion

The number of medically compromised patients seeking orthodontic care is increasing. This trend is likely to continue. While orthodontic therapy is typically viewed as being of low risk compared with more invasive dental procedures, specific orthodontic manipulations, associated with fixed therapy, are potentially harmful to certain patient populations **(Akhoon *et al*., 2020).**

In addition, the potential for increased plaque accumulation resulting from orthodontic appliances might adversely impact gingival health, and predispose patients at risk for advanced periodontal disease. Medically compromised patients can be seen and treated in the orthodontic clinic if their conditions are well-controlled. Prevention is the most important aspect of risk management **(Ansar *et al*., 2012).**

A good medical history, communication with the patient's physician, and clinical vigilance are critical in the medically compromised patient population. Orthodontists and staff are encouraged to have basic knowledge about these conditions and be prepared to handle any emergencies that might occur during orthodontic appointments **(Alqahtani, 2019).**

A slight modification of the normal orthodontic treatment protocol is obligatory in such patients according to the underlying medical condition.

Recommendations which can be of great help during treatment procedure for these patients are:
1. Two-phase or multiphase treatment program is advocated to correct skeletal malocclusions (maxillary transverse deficiency and class III).
2. Bonding should be preferred over the complex banding procedure.
3. Self-etching primers should be used over conventional etchants.

Chapter Three
3- Conclusion and Suggestion

3.1- Conclusion:

1- An orthodontist needs to recognize various medical conditions and their impact on treatment procedures.

2- Medically compromised patients can be seen and treated in the orthodontic clinic if their conditions are well-controlled.

3- Good patient cooperation, consent before treatment, proper referral when required and constant monitoring of the progress of the treatment are necessary to minimize physical damage and to maximize treatment outcome.

4- A slight modification of the normal orthodontic treatment protocol is obligatory in such patients according to the underlying medical condition.

3.2- Suggestion:

1- Further study is needed for the medications used to control medical condition.

2- It which might accelerate or retard orthodontic tooth movement.

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