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Prevalence of class III

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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CERTIFICATION OF THE SUPERVISOR

I certify that this project entitled "**Incidence of class III**" was prepared by **Zinah Omar Nawfal Al-Nuaimi** under my supervision at the College of Dentistry/University of Baghdad in partial fulfilment of the graduation requirements for the Bachelor Degree in Dentistry**.**

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DEDICATION

I would like to dedicated this project to ***my mother Assist. Prof. Alhan Ahmed Qasim***, my father and brother,for their effort ,support for me in all difficult times and prays at day and night made me able to succeed

They did not leave me in my difficult moments and continued to support me and give me positive.

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LIST OF ABBREVIATIONS:

N-S	**NASION-SELLA**
S-AR/BA	**SELLA-ARTICULARE/BASION**
N-S-AR	**NASION-SELLA-ARTICULARE**
AR-GO-GN	**ARTICULARE –GONION-GNATHION**
RZS OR ZS	**RECURVED Z SPRING OR Z SPRING**
RA+3DE	**REMOVABLE APPLIANCE +3 DIMENSIONAL EXPANSION**
BAMP	**Bone-Anchored Maxillary Protraction**
CO	**CENTRIC OCCLUSION**
CR	**CENTRIC RELATION**
RPE	**Rapid Palatal Expansion**

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INTRODUCTION

Class III malocclusion is best described by discrepancies of dental or skeletal components in antero-posterior and/ or vertical directions. Retrognathic and narrow maxilla, prognathic and wider mandible, and/ or a combination of both are the common clinical presentations of skeletal class III malocclusion. The magnitude of the discrepancy may affect facial esthetics variably and motivates individuals to seek orthodontic correction **(Sobral, 2012)**.

The least common type of malocclusion is class III malocclusion in many communities, accounting for approximately less than 5% of all cases **(Phulari, 2017)**.

The prevalence and presentation of Class III malocclusion vary significantly with ethnic background. The highest occurrence of class III malocclusion is observed among East Asian populations, such as in Japanese, Koreans and Chinese, can range from 4% to 19%, whereas in European populations the prevalence is much lower: 1–4%. **(Ngan *et al*., 2014)**, however, a reported incidence of 5% in Caucasian populations and 9%–19% in Asian populations, is suggestive of a significant genetic contribution **(Hardy *et al*., 2012).**

The etiology of class III malocclusion has been shown to have both genetic and environmental factor. **(Jha and Chandra, 2021)** Certain types of malocclusion, such as Class III relationship, run in families, which gives a strong relation between genetics and

malocclusion. Likewise, is the ethnic factor, where the bi-maxillary protrusion, for example, affects the African origin more frequently than other ethnicities. On the other hand, functional adaptation to environmental factors affects the surrounding structures including dentitions, bone, and soft tissue, and ultimately resulting in different malocclusion problems. Thus, malocclusion could be considered as a multi-factorial problem with no specific cause so far **(Heimer *et al*., 2008)**. The management of Class III malocclusion is one of the most challenging treatments in orthodontics **(Al-Mozany *et al*., 2017).**

Existing literature regarding the global prevalence of Class III malocclusions has shown that its prevalence varies greatly among and within different population, thus this project was conducted to investigate the incidence of class III malocclusion among group of Iraqi patients who are getting their treatment at fifth grade orthodontic clinic at College of Dentistry/ University of Baghdad.

AIM OF THE STUDY

This study is conducted to investigate the prevalence of class III malocclusion among a group of patients of fifth stage clinic at the Affiliated Hospital of college of Dentistry University of Baghdad. Our objectives are how gender and age affect the prevalence of class III patients who are seeking for treatment.

Chapter 1 Review of Literature

1.1 Occlusion

The term occlusion has both static and dynamic aspects. Static points to the form, alignment and articulation of teeth within and between dental arches and the relationship of teeth to their supporting structures. Dynamic refers to the function of the stomatognathic system as a whole comprising teeth, supporting structures, temporomandibular joint, and neuromuscular and nutritive systems.

Normal occlusion defines as class I relationship of the maxillary and mandibular first molars in centric occlusion. Normal occlusion is an absence of large or many facets, bone loss, closed vertical dimension, bruxing habit, freedom from joint pain, and crooked and loose teeth. (Phulari, 2017)

1.2 Malocclusion

The word malocclusion refers to any abnormal or incorrect relation among teeth of the upper and lower arches. Most people have some degree of deviation from the ideal occlusion; it is usually passed down from one generation to another **(Baskaradoss *et al*., 2022).**Several studies have been carried out in several countries all over the world. The majority of them expressed different results from one country to another.

To acquire the essential knowledge for the treatment protocol choice and to adopt a communication term among consultants, different researchers have classified malocclusion into groups of clinical cases based on certain analogies through their experiences and clinical relevance. Class I occlusion represents a normal occlusion where the mesiobuccal cusp of the upper first molar occludes with the groove of the lower first permanent molar. Class II Malocclusion or post-normal occlusion, when the mesiobuccal cusp of upper first molar occludes

anterior with the groove of the lower first permanent molar (distal by at least half cusp). Class III Malocclusion when the mesiobuccal cusp of upper first molar occludes posterior with the groove of the lower first permanent molar (mesial by at least half cusp) or in the embrasure between the lower first and second molar **(Yadav *et al.*, 2021)**. (figure 1-1)

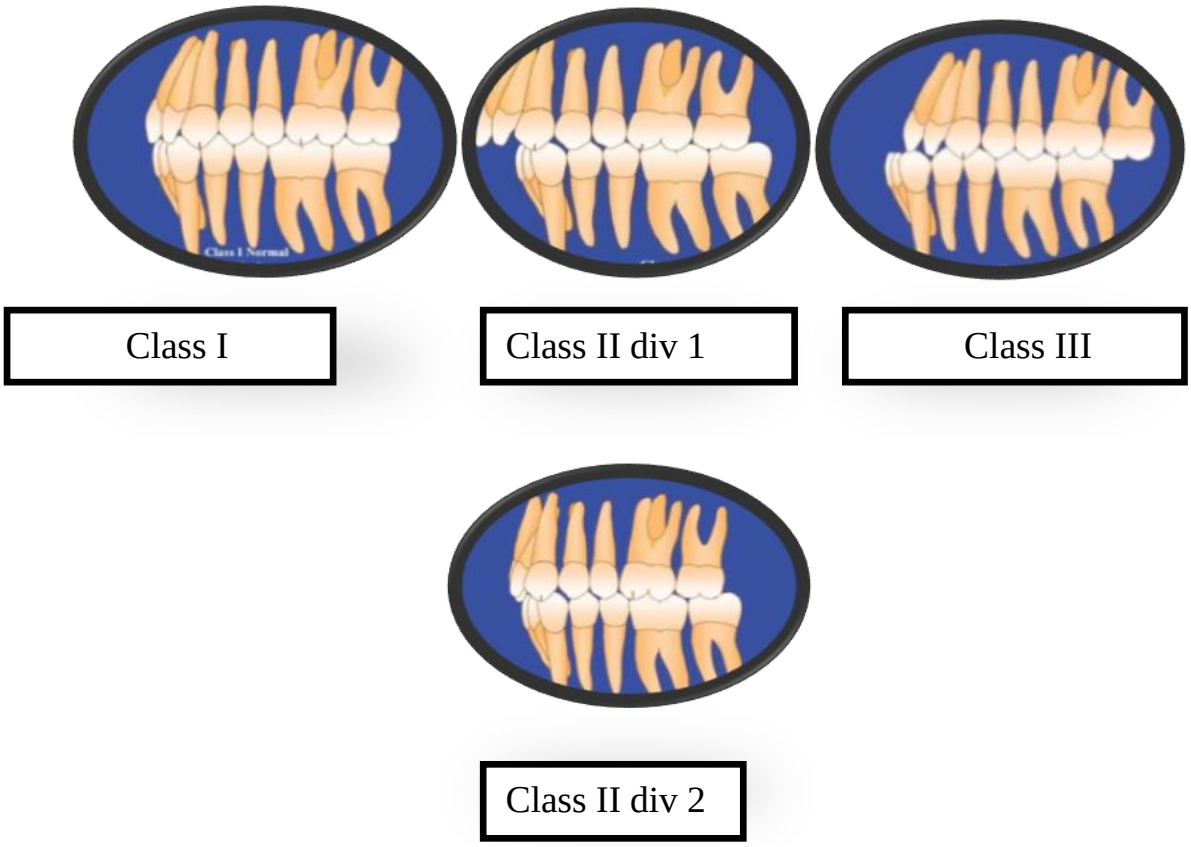

Figure 1 Schemata of class I, II, III (Robert and Neil, 2011)

1.3 Prevalence

In 2012, a study by Professor Bourzgui has been piloted to determine the prevalence of malocclusion in Morocco. Out of 1000 samples, the result conducted a high prevalence of class I malocclusion, with a 61.4%, class II lie in the middle 24% and a lower prevalence of class III malocclusion 10% **(Alam *et al.*, 2021).**

Existing literature regarding the global prevalence of Class III malocclusions has shown that its prevalence varies greatly among and within different races, ethnic groups, and geographic studied regions. There is a wide range of reported prevalence, even with conflicting results, and the discrepancies in the prevalence rate might be attributed to the variation among samples, the timing of investigation, and type of analysis performed **(Hardy *et al*., 2020)**

A recent systematic review reported a global prevalence of Angle Class III malocclusion within the interval of 0%–26.7% for different populations. Prevalence rates of 15.80%, 15.69%, and 16.59% were revealed for Southeast Asian countries, Chinese, and Malaysian groups, respectively. Among Japanese it was around 14%, for Koreans 9%–19%, and about 1.65% for Taiwanese. For Indian children aged from 5 to 15 years, the prevalence varied within 0%–4.76% **(Hardy *et al*., 2012**). A prevalence of 10.18% was reported for Middle Eastern populations, and among them, for, Iranians about 15.2%, Turkish about 10.30%–11.5%, and Egyptians showed a rate from 4% to 11.38%. Regarding African countries, the prevalence rate was found to be 4.59% and varying for Kenya, Tanzania, and Nigeria (between 1% and 16.8%). Class III malocclusions have been found to be more prevalent in Hispanic than in African or Caucasian groups. Prevalence of about 9.1% and 8.3% were reported for Americans and Mexican Americans, respectively.**(Silva and Kang , 2001)** Factors such as the method of malocclusion study and the age group studied may influence the varying prevalence in Caucasians between 3% and 5%.Prevalences of ~5% and from 2% to 6% have been found in Latin and European populations, respectively. **(Silva and Kang, 2001)**Furthermore, the White population in United Kingdom and Scandinavia had a Class III incidence of about 3%–5% **(Prabhat *et al*., 2013)** and about 6% for Sweden.

For Americans, the prevalence was found to be about 5% **(Garner *et al*., 1985)**. Studies on US African-American population group found the prevalence in the range of 3%–6%. Similar studies conducted on other nationalities revealed that Class III malocclusion prevalence of about 3% for Brazilian, **(Da Silva Filho *et al*., 1990)** 14% for Syrian, **(Mouakeh and Sulaiman, 1993)** and 9.4% for Saudi Arabian individuals**.(Toms, 1989),** from a global viewpoint, Indians had the lowest prevalence of 1.19% among all other racial groups.**(Silva and Kang , 2001)**

1.4 Components of Class III malocclusion

Class III malocclusion represents a complex three-dimensional facial skeletal imbalance between maxillary and mandibular growth along with varying degrees of dentoalveolar and soft tissue compensations which can be expressed in many morphological ways **(Sanborn, 1955).** Class III malocclusion may be associated with maxillary growth deficiency (and/or maxillary retrognathia), mandibular growth excess (and/or mandibular prognathism), or a combination of both along with vertical and transverse malformations (**Staudt and Kiliaridis, 2009**). Park and Baik classified Class III malocclusions based on the position of the maxilla relative to the craniofacial skeleton into three basic types: type A – true mandibular prognathism (individual with normal maxilla and prognathic mandible), type B – individual with excessive growth of maxilla and mandible, but with relatively more growth of mandible, and type C – individual with maxillary hypoplasia, obtuse nasolabial angle, and concave facial profile. Type C individuals can easily be camouflaged orthodontically by dentoalveolar compensation **(Park and Baik, 2001**).

1.7.1 Skeletal features of Class III individuals

Common skeletal features such as shortened anterior (N-S) and posterior (S-Ar/Ba)cranial base, reduced saddle angle (N-S-Ar), and an increased gonial angle (Ar-Go-Gn) were identified to lead to a more forward positioning of the glenoid fossa resulting in Class III malocclusion **(Innocenti *et al*., 2009**). Studies about the dental and skeletal components of Class III malocclusions have revealed the establishment of a facial pattern at early childhood which has a tendency to worsen with growth **(Reyes *et al*., 2006).**

Skeletal Class III malocclusions can be a result of various factors:

1. Prognathic and/or macrognathic mandible with a normal maxilla both in position and in size

2. Retrognathic and/or micrognathic maxilla with a normal mandible both in position and in size

3. Combination of retrognathic and/or micrognathic maxilla with prognathic and/or macrognathic mandible

4. Normal skeletal jaw relationship with reverse overjet in the presence of centric relation (CR)–centric occlusion (CO) discrepancy, also known as a "pseudo" Class III relationship.

1.7.2 Dental features of Class III individuals

This includes Class III molar and canine relationship, maxillary incisors protrusion and mandibular incisors retrusion with edge-to-edge bite or anterior cross bite. Based on various combinations of skeletal components, patients with Class III malocclusion exhibit a wide range of underlying skeletal and craniofacial features similar to the prevalence of Class III malocclusion, which can vary among different racial and ethnic groups as shown by comparative studies. For example, Mongoloid populations (Japanese, Koreans, and Chinese) with Class III phenotypes present with characteristic features such as acute

anteriorcranial base angle and a prominent and elongated mandible with a short and hypoplastic maxilla, while normal maxillary size and position were observed for Caucasians**. (Ngan and Moon, 1997)**

1.5 Etiology of Class III malocclusion

Similar to most of the malocclusions and dentofacial deformities, the etiology of Class III malocclusion is multifactorial. It results from a distortion of normal development, rather than from any pathological process. Expressions of Class III malocclusion are results of interaction between innate factors or genetic hereditary with environmental factors **(Kawla *et al*., 2007;Jena *et al*., 2005)**

Studies of human inheritance have provided sufficient evidence to establish the fact that mandibular growth is mainly affected by heredity **(Jena *et al*., 2005; Harris *et al*., 1973).** Familiar genetic inheritance has a strong influence on skeletal craniofacial dimensions contributing to Class III malocclusion and a significantly higher occurence of this malocclusion has been found to have a familial occurrence between members of many generations **(Nakasima *et al*., 1982 ; Mossey, 1999**).The best known example of familial inheritance is Habsburg Jaw,(is a specific facial deformity that is marked by a very elongated and prominent lower jaw. Nine successive generations of the Habsburg family had this pronounced jaw line, which is why it came to be known as the Habsburg jaw). in which mandibular prognathism recurred over multiple generations in the European royalty **(Hodge, 1977;Chudley, 1998**).The pattern of transmission of Class III malocclusion still remains an issue of controversy. According to some authors, the transmission is autosomal dominant with complete or incomplete penetrance , and according to others, it is autosomal recessive; yet, some others support the polygenic transmission mode

(Huang *et al*., 1981;Cruz *et al*., 2008) The ADAMTS1 Gene Is associated with familial mandibular prognathism.

Environmental factors known to contribute and influence this malocclusion include wrong postural habits of the mandible which pathologically alter the mandibular condyle positioning within the fossa and as a result the final mandibular spatial position expressed with a forward slide of the mandible. Various factors such as growth stimulus, history of prolonged sucking or resting tongue habits, nasal airway obstruction, mouth breathing, functional mandibular shifts because of respiratory needs, atypical swallowing, tongue size and pharyngeal airway shape and size altered, enlarged tonsils, large tongue, adenoids, hormonal imbalances and disturbances such as gigantism or pituitary adenomas, trauma, premature loss of primary teeth, congenital anatomic defects (ie, cleft lip, cleft palate), and muscle dysfunction alone or in combination with other environmental factors play a definitive etiological role **(Rakosi and Schilli, 1981) (Sugawara *et al*., 2016).**

1.6 Classification:

I. Class III Malocclusion can be Classified into the following two types based on True or Habitual:

1. True class III malocclusion

2. Pseudo-class III malocclusion(Habitual/postural class III malocclusion)

II. Classification of class III Malocclusion based on the structural components (dental or skeletal) involved in the malocclusion

1. Dental class III malocclusion

2. Skeletal class III malocclusion **(Phulari, 2017)**

1.7 Diagnosis of class III malocclusion

Diagnosis of class III malocclusion should be aimed at evaluating whether the condition is skeletal or dental and true or pseudo-class III malocclusion. The diagnosis should be based on clinical examination and radiographic evaluation of skeletal growth pattern using lateral cephalogram.

1.7.1 Extra-oral Assessment

A profile analysis will look at facial proportions, mid-facial position and chin position, as well as vertical proportions. This will help to determine the presence and location of any skeletal discrepancy. For patients with a retrusive maxilla, there may be increased sclera show below the pupil and flattening of the infra-orbital rims in addition to flattening of the area adjacent to the nose.

1.7.2 Intra-oral Assessment

An anterior cross bite of one or more teeth is a common presentation in Class III malocclusions. Whenever there is a cross bite, it is important to look for an anterior mandibular displacement. This premature contact may lead to the mandible being positioning further anteriorly, to allow the patient to close into full intercuspation and obtain a more comfortable bite.

It is also important to look at the inclinations of the upper and lower incisors. In patients with skeletal discrepancies, the soft tissues may tilt the teeth towards each other to allow a lip seal to be achieved. This is known as dento-alveolar compensation, and the degree of existing compensation may dictate what is possible with orthodontic movements of the teeth alone or whether movements of the underlying bones are required.

1.7.3 Cephalometric Assessment

In addition to the clinical analysis, a cephalometric analysis may be required to confirm the relative positions of the maxilla and mandible to each other and to the base of the skull and to determine the inclinations of both the upper and lower incisors. The combination of clinical and cephalometric information will identify which type of Class III malocclusion can be treated in the mixed dentition and help decide the best interceptive approach.

1.8 Treatment modalities

Here in this report we are targeting the patients of orthodontic clinic for the fifth grade at College of Dentistry University of Baghdad who are seeking for treatment at early ages in most of the cases so it worth to mention that in class III in the mixed dentition there are effectively three types of Class III malocclusions **(Ngan *et al*., 2014):**

• Skeletal: True skeletal discrepancies in the maxilla and/or mandible.

• Dental: Incorrect inclination or position of maxillary or mandibular incisors.

• Pseudo: Anterior positioning of the mandible as a result of premature dental contacts deflecting the mandible anteriorly to allow the patient to achieve full intercuspation.

It is very critical to make a decision for developing Class III malocclusion on whether to treat or wait for further growth and dental development. Although a Class III malocclusion may be identified in the developing dentition, a decision needs to be made as to whether it is better to treat it at this stage or wait for further dental development and growth. The timing of early treatment is crucial for a successful outcome. Some studies have reported that treatment should be carried out in patients <10 years of age to enhance the orthopedic effect (**Campbell, 1983; Baccetti and Tollaro, 1998; Battagel and orton,**

1995). In contrast, some studies found that age of the patient had little influence on treatment response and outcome. **(Kapust *et al*., 1998; Ataly and Tortop, 2010)**.

1.7.1 2 * 4 Fixed appliance

This appliance is often referred to as a “2 by 4” or “2 by 6” appliance as it is only bonded on the two upper first permanent molars and the four upper incisors or six anterior teeth. Fixed appliances mostly use for late mixed dentition or early permanent dentition. An open coil NiTi spring often compressed between the molars and the incisors to procline the incisors or a 0.016-inch stainless steel stoppered arch wire may be used to increase the arch length. Glass ionomer cement may be placed temporarily on the molars as bite raiser if disclosure is required. Fixed appliances allow tipping, bodily movement, and correction of rotations as and when required.

Fixed appliance treatment is cheaper, quicker and has less effect on the patient’s speech than a removable appliance, but patients may complain of slightly more difficulty in chewing and biting initially with the fixed appliance. **(Ngan *et al*., 2014; Wiedel *et al*., 2016)** (figure 1-2).

1.7.2 Chin cup

Chin cup appliance treatment is indicated in young growing patients with mandibular prognathism. It has been found that chin cup therapy has several short-term orthopedic effects:1. Does not restrain mandibular growth but redirects the mandible growth vertically, causing a backward rotation of the mandible **(Uner *et al.*, 1995)** 2. retardation of mandibular growth, and 3.

remodeling of the mandible and the TMJ **(Asano, 1986).** These changes in the direction of mandibular growth help to improve Class III malocclusion.

Recent systematic reviews showed that there is considerable agreement between studies in that chin cup therapy may be used for interceptive treatment of growing Class III malocclusion based on short-term favorable results. (**Tsolakis *et al.*, 2016; Chatzoudi *et al.*, 2014)** It has been seen that these changes are not maintained in the long term and the normal growth pattern of the mandible reestablishes itself, if chin cup appliance therapy is discontinued before growth completion. **(Sugawara *et al.*, 1990)** Hence, it is recommended that patients with Class III malocclusion with mandibular prognathism wear the chin cup appliance until growth is completed to maintain the treatment effects of chin cup therapy. Special care should be taken while deciding chin cup therapy in patients who present in the mixed dentition with marked mandibular prognathism, particularly if associated with increased vertical proportions, as these patients are often best treated by surgical orthognathic approach, when their growth is completed. As the long-term prognosis of chin cup therapy is unpredictable, patient caregivers should always be fully informed of this before initiating chin cup therapy.While trying the chin cup appliance on patients, care should be taken to ensure that the chin cup does not impinge on the lower lips as it may cause retroclination of the lower incisors and r The force applied on the chin was oriented along a line from the gnathion to the sella turcica and ranged from 250 to 300 g per side of the chin. Patients were instructed to wear the chin cap for at least 14 hours daily. All subjects attained a normal anterior bite with the initial chin cap treatment but two cases showed anterior crossbite. Seven subjects had edge-to-edge bites at the final observation.ecession of labial gingiva (figure 1-3).

1.7.3 Protraction facemask

Protraction facemask also referred to as reverse headgear is one of the most commonly used interceptive tools to intercept developing skeletal Class III malocclusion. (Watkinsom *et al*., 2013) facemask therapy is recommended for young patient, ideally 5 to 7-8 years old, but also 8to 10 years old. For most patients with Class III malocclusion seen in the early mixed dentition or late deciduous dentition, Facemask is the customary choice (Gencer *et al*., 2015) The appliance is composed of two components: an extraoral framework (facemask) that fits on the forehead and chin, and an intraoral attachment to the maxillary dentition. The chin and forehead part of the extraoral framework are connected by a middle bar for the connection of the elastics to the intraoral attachment to the maxillary dentition. The intraoral attachment is of various designs, including removable, banded, and acrylic-bonded versions. They all incorporate hooks bilaterally positioned near the maxillary canines. To minimize unwanted rotation of the palatal plane, elastics should be attached near the maxillary canines at 30° to the occlusal plane. Bonded expansion appliance is preferred as it provides a temporary bite plane effect in hyper-divergent cases and facilitates the jumping of anterior cross bite in deep bite cases. The elastic forces are typically 400–450 g per side (14 to 16 OZ) and need to be worn 12–14 hours per day. The total treatment time is usually 6–9 months. An increased release of growth hormone and other growth promoting endocrine factors has been observed during evening and night than during the day. As a result, it is recommended to wear the appliance during evening and nighttime (figure 1-4).

1.7.4 Bone-anchored appliances

Interceptive treatment of Class III malocclusions with a tooth-borne protraction appliance (eg, facemask) often poses problems of unwanted dental changes such as: buccal tilting of maxillary molars and extrusion may lead to an

increase in vertical dimensions and downward and backward growth of the mandible, decreased arch length due to mesial movement of maxillary molars leading to crowding in the anterior teeth.

In an attempt to overcome the limitations of tooth-borne appliances in the interceptive treatment of Class III malocclusions, bone-anchored maxillary protraction (BAMP) appliances have recently been used. **(De clerck and Profit ., 2015)** BAMP appliances typically involve the use of Class III elastics attached between mini-plates placed in the infra-zygomatic crest to mini-plates placed in the mandibular symphysis region or attached to the extra-oral facemask. The success of these mini-plates is related to the surgical technique and the thickness and quality of the bone. Particularly in the maxilla, the bone quality is often not as good until the patient is at least 11 years old; so, this interceptive technique tends to be used in slightly older patients than the tooth-borne appliances. The results of an initial study on the effects of BAMP compared with growth of the untreated Class III subjects showed that the BAMP protocol induced an average increment on skeletal and soft tissue advancement of maxillary structures of about 4 mm with negligible changes in the maxillary incisor inclination and vertical skeletal pattern. **(De Clerck *et al*., 2010)** Recent research also found that a Hybrid Hyrax bone-anchored rapid palatal expansion appliance minimized the side effect encounter by tooth-borne rapid palatal expansion appliances for maxillary expansion and protraction and may serve as an alternative treatment appliance for correcting Class III patients with a hyper-divergent growth pattern. **(Ngan and Moon, 2015)** Hence, BAMP has demonstrated promising initial results in its potential to offer greater skeletal changes, with less unwanted displacement of the dentition. However, there are unpredictable variations in individual outcomes, and high-quality research is needed to further investigate this technique (Figure 1-5).

1.7.5 Modification of treatment

Delaire et al **(Delaire, 1971; Delaire, 1976; Delaire, 1972; Delaire, 1978)** are credited with introducing the concept of protraction headgear to treat Class III malocclusions. Nanda introduced a modified protraction headgear in 1980, (**Nanda, 1980**) based on biomechanical concepts. The rationale for protraction headgear is to apply heavy forces on the midface in order to advance the maxilla anteriorly. In patients with a normal sized mandible and retrusive maxilla, forward displacement of the maxilla is conceptually good. Several studies in the past 3 decades have shown that 25% to 41% of Class III problems in children are primarily the result of a retrognathic maxilla. **(Dietrich, 1970; Guyer et al., 1986; Williams and Andresen, 1986).**

Components of Modified Protraction Headgear:

There are two main components of a protraction headgear: intra-oral setup and extra-oral setup.

Intra-oral Components

The protraction headgear force is applied via elastics to teeth or other devices supported by teeth and/or the palate. The primary aim is to transmit the force to the mid-face sutural interfaces. To achieve this, it is important to stabilize the maxilla as one unit. In the primary dentition, it is advisable to use a cemented acrylic occlusal bite block or a removable acrylic plate with occlusal coverage). In patients with the mixed dentition and early permanent dentition, a removable acrylic plate (figure 1-6) should be used, supported by bands with headgear tubes on the molars or a rigid archwire with a palatal arch. Probably the best stabilization in patients with maxillary first molars is provided by a fixed rapid palatal expansion device (figure1-7). We prefer a Hyrax type of non

bonded device, as bonded RPEs (figure1-8) interfere with the primary exfoliating teeth or teeth in the eruptive phase. Studies have also indicated that a

-Extra-oral Components

The extra-oral components (Figure 1-9) of a modified protraction headgear have two parts. The first is a facemask and the second is an intraoral-to-extraoral connecting force device that uses a modified headgear bow instead of intraoral elastics. Commonly used facemasks have chin and forehead support connected by a heavy metal arch that has a horizontal bar for attachment of a force module. The forehead and chin supports are adjustable. The horizontal bar also must be adjustable vertically to vary the point of force attachment. A conventional headgear bow with a standard outer and inner bow without loops can be easily converted into a modified bow for use with the facemask. It is important that the molar band has a headgear tube. In cemented acrylic stabilization devices, a headgear tube can be embedded in acrylic. For pre-adolescent patients (5 to 8 years), a force of 200 to 250 g on each side is adequate and for early adolescent patients (8 to 11 years), a force of 300 to 450 g on each side may be desirable. In late adolescent patients (12 years and up), higher forces (450 to 600 g) can be used but, in our experience, protraction of the mid-face in the latter group is minimal. It is advisable to start with lower force values that can be increased if needed, especially in late adolescent patients**. (Nanda, 1978).**

1.7.6 New updates in the treatment

Currently, the most frequently used treatment procedure involves the combination of Rapid Maxillary Expansion and Facemask **(Baccetti *et al*., 2000; Smyth and Ryan, 2017**), but there is still a need of high-quality evidence about the effectiveness of this treatment, particularly regarding long-term

stability (**Rongo *et al*., 2017**). On the contrary, many authors demonstrated that the desired forward movement of the maxilla is accompanied by a downward mandibular movement which also determines a clockwise rotation of the mandible. The overall effect appears to be an increase in vertical dimensions of the lower third of the face that is obviously inappropriate for patients with increased vertical skeletal relationships (**Rongo *et al*., 2017**). Therefore, the control of vertical dimension appears to be a key objective in Class III hyper-divergent patients. The use of a pushing splint 3 appliance originally presented by Ferro et al (**Ferro *et al*., 2003).**

The really important advantage of PS3's force system is the control of the vertical growth. The appliance (Pushing Splints 3, PS3) consists of three components: two acrylic splints and a Forsus™ L-pin module per side. The two splints are built-up through a traditional acrylic appliance construction procedure by a dental technician. A 2 mm high construction bite is used in order to leave the space necessary to have a flat occlusal plane on both of the splints. The two splints cover all the tooth crowns usually from the left first permanent molar to the right first permanent molar 6 to 6 in both arches. The Forsus™ L-pin modules are used in order to deliver a force of 200 g per side in a forward direction to the upper splint and in a backward direction to the lower splint. In an opposite way from Class III elastics, the vertical component of the force delivered by the Forsus™ L-pin module is directed upward and forward) in the maxilla and downward and backward in the mandible Working with a pushing system is important to obtain a good retention of the splint even if some grinding is needed now and then to avoid interference with the eruption of permanent teeth. Patients are instructed to use the splints as much as possible, with a minimum time of 14 hours per day, which probably exceeds the average wear time of the Facemask, whose wearing is certainly more invasive than the intraoral splints **(Ferro *et al*., 2003).**

Chapter 2 Materials and Methods

2.1 Sample

This is a cross sectional study. We have enrolled 166 subjects (90 females and 76 males), who were seeking orthodontic treatment on orthodontic fifth stage clinic at the Affiliated Hospital of college of Dentistry University of Baghdad from September 2022 to March 2023. The subjects age ranged from 5 to 26years, with a median age of 12years. The participants' sagittal occlusion ranged between class I, class II and class III based on the clinical examination. Lateral cephalometric radiograph analysis was used on occasion especially when orthopaedic appliances were the choice of treatment.

2.2 Data collection and arrangement

The data of the participant were introduced in excel spreadsheet. The data includes participant demographic data (age, gender), type of sagittal malocclusion, when the malocclusion is Class III on dental or skeletal base.

2.3 Selection criteria

All cases were included in this study except in the table (3-2), 7 cases were excluded from this table because either one side doesn't include the first molar (Angle's classification based on it) or both sides don't include the first molars.

2.4 Statistical analysis

Descriptive statistics were conducted using excel program. Percentage was used to determine the frequency of class III malocclusion among other type of malocclusion and gender prevalence, median was used for age of the participants.

Chapter 3 Results

3.1 Demographic data

This study has been conducted on 166 subjects. These patients were seeking for orthodontic treatment on orthodontic fifth stage clinic at the Affiliated Hospital of college of Dentistry University of Baghdad.

Females were dominant (54.22%), while males made only 45.78% of total sample size (Figure 3-1). The participants' age ranged between 5-26years of age with a median of 12years of age (Table 1).

Table 1 Demographic data of the study participants.

Demographic Data	**N**	**%**	
Gender			
Female	90	54.22%	
Male	76	45.78%	
Total	166	100.00%	
	Minimum	Maximum	Median
Age (years of age)	5	26	12

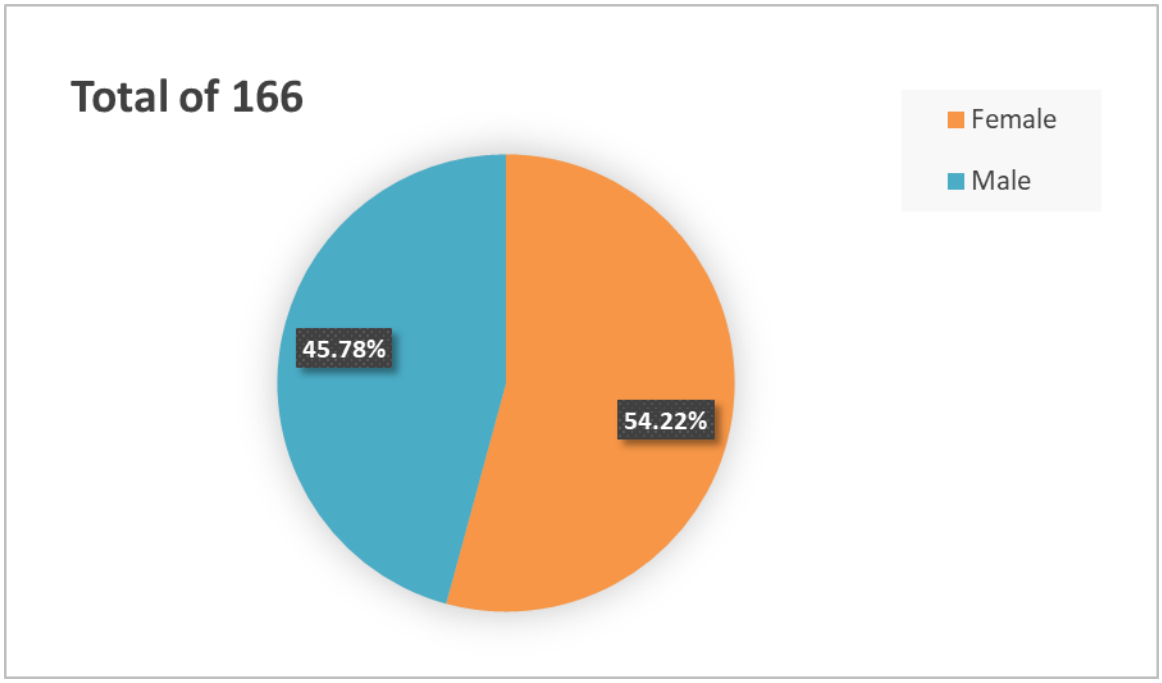

Figure 2 Female patients were more than males.

3.2 Sagittal occlusion

The distribution of the participants on sagittal bases was as follow, 54.2% for class I, 30.7% for class II, and 15.1% for class III malocclusion (Table 2), (Figure3).

Table 2 Distribution of Sagittal Discrepancy.

Sagittal Discrepancy	Female N (%)	Male N (%)	Total N (%)
Class I malocclusion	50 (55.56%)	40 (44.44%)	90 (54.2%)
Class II malocclusion	29 (56.86%)	22 (43.14%)	51 (30.7%)
Class III malocclusion	11 (44%)	14 (56%)	25 (15.1%)
Total			166 (100%)

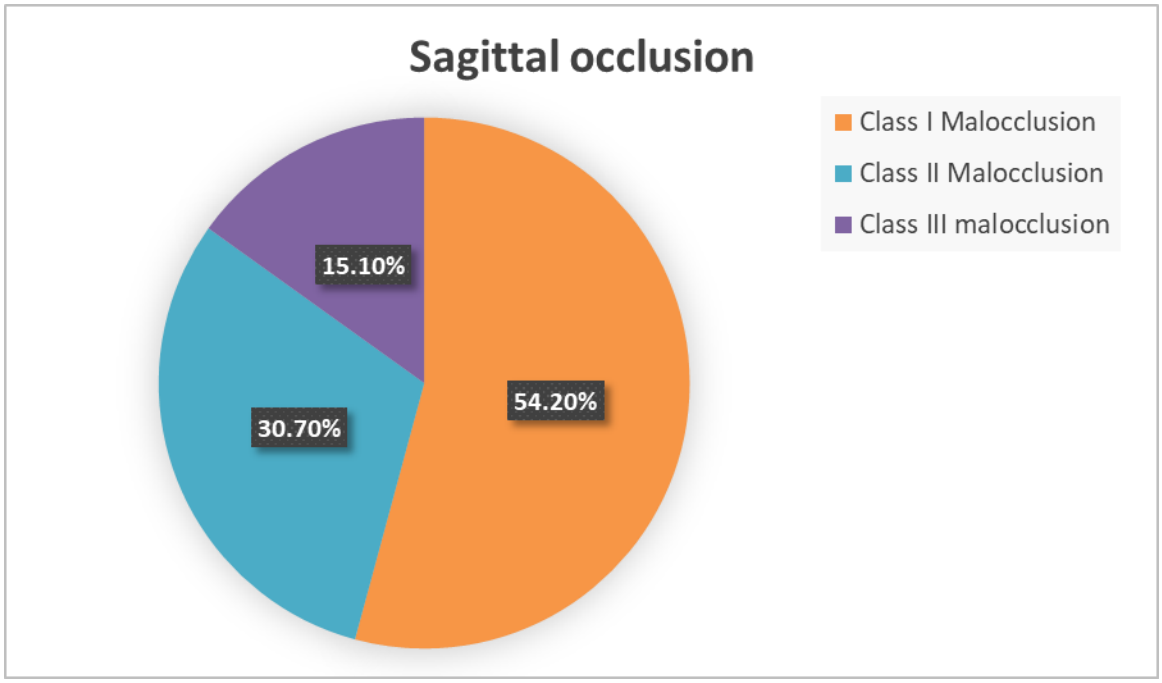

Figure 3 Distribution of Sagittal discrepancy.

3.3 Class III occlusion in relation to gender

A total of 25 patients among our sample present with Class III malocclusion, 14(56%) were males and 11(44%) were females (Figure 4).

Generally, females dominant the total sample size and this was the condition for class I and class II malocclusion patients (Table 2). Yet males were more than females for patients present with class III malocclusion (Table 2) (Figure 4).

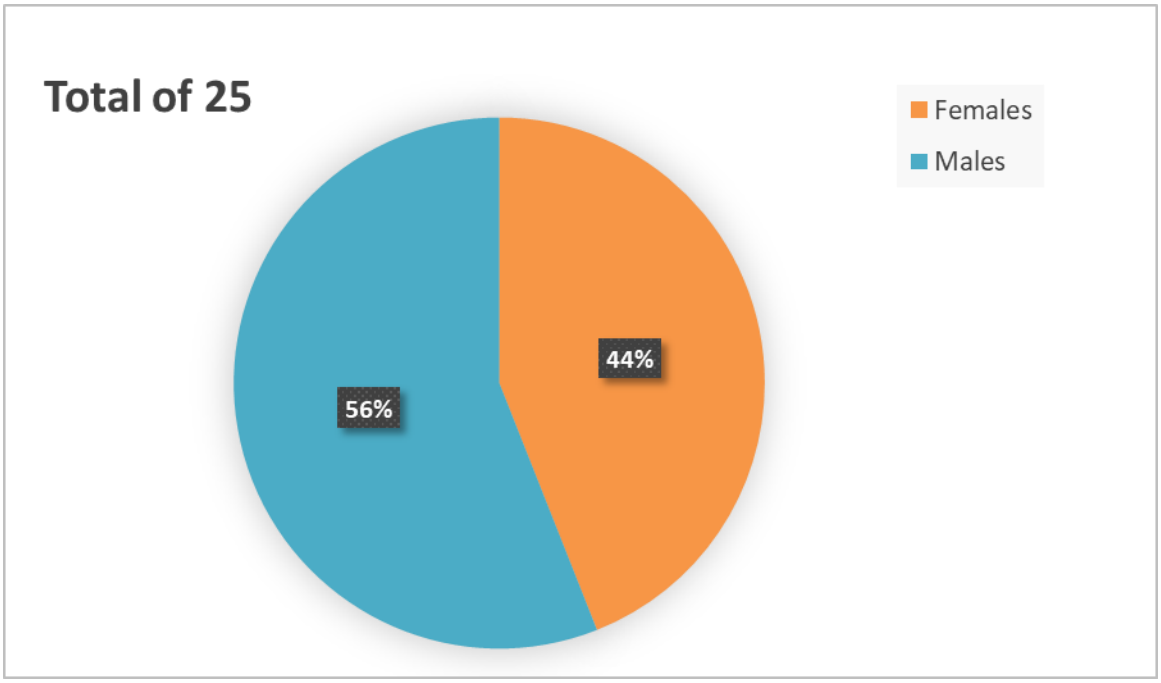

Figure 4 Class III gender distribution.

3.4 Class III malocclusion treatment in relation to age

Twenty-five patients among our sample present with class III malocclusion. They were distributed into two age groups, 5-10 years old group and 11-15 years old group. The majority of the sample present in the first age group with 19 patients (76%) and only 6 patients present in the second age group (24%) (Table 3).

Table 3 Age distribution for Class III patients.

Age range	N	%
5-10 years of age	19	76%
11-15 years of age	6	24%
Total	25	100%

Chapter 4 Discussion

Class III malocclusion has long been considered a complicated maxillofacial disorder that is characterized by a concave profile, which may exhibit mandibular protrusion, maxillary retrusion or a combination of both**.** As well as possible anatomic heterogeneity of this malocclusion in permanent dentition **(Chang *et al*., 2006)**. Although Angles classification has been the topic of many discussions in the literature (**Brin *et al*., 2000**), it remains a fairly easy and accurate way to categorizing malocclusion and its widely used in dental profession. Based on the distribution of data, result in the current study of Iraqi patients who sought orthodontic treatment we have found that the prevalence of class III skeletal malocclusion was the lowest 15.1%, while class I and class II were 54.2% and 30.7% respectively, furthermore the prevalence of Angle class III malocclusion was the lowest 12.6%, while class I and class II were 48.7%, 18.6% respectively, this finding agree with the result of (**Oshagh *et al*., 2012**) in Iran who reported that skeletal and dental class III was the lowest prevalence12.0% and 12.3% respectively, and the data of this study coincide with (**Sari *et al*., 2003)** in Turkey who reported that 10.2% had class III Angle dental malocclusion. Indeed a previous study observes that 52.8% has Angle's Class I occlusion, 31.8% has Class II, and 15.4% has Class III which is close resemblance to our findings **(Rwakatema *et al*., 2006),** while a previous studyin Korea by (**Yang, 1990),** found that the prevalence of Angle class III 49.1% was higher than the result of this study. little difference between these result may be related to ethnic origin, sample selection and sample size, The prevalence of different type of malocclusion may show considerable variability, even in a population of the same origin. The criteria of normality vary from one examiner to another, and this may affect the results of different studies.

Another finding of our study is that females were seeking for orthodontic treatment more than males. This was not surprising because of the aesthetic demands of females as demonstrated by (Dali *et al.*, 2012; Lagorsse and Gebeile-Chauty, 2018). Yet what we have found interesting is that males were seeking treatment more than female patients only for patients with class III malocclusion,. We may contribute that to bullying, maybe children with class III malocclusion are more prone to bullying, which will put pressure on them and their parent and motivate them to undergo orthodontic treatment. This finding disagrees with previous studies (**Willems *et al*., 2001**; **Sayin and Türkkahraman, 2004; Oshagh *et al*., 2012**).

Finally, we found that patients of younger age group were more than relatively older ones. This reflects the level of education of Iraqi community now a day and the awareness of parents on the importance of treating this type of malocclusion early in life.

However, these results might not represent the prevalence of class III malocclusion in the reference population because we have targeted only one clinic, fifth grade orthodontic clinic at College of Dentistry University of Baghdad. To standardise epidemiological data of malocclusion it is crucial to design multicentre study. It may ultimately be impossible to accurately sample every population for a general prevalence rate from both a logistical and theoretical standpoint. Populations can always be broken down into smaller groups which may or may not represent the population as a whole. However, given these limitations, it is important to remember the need for data of Angle class III malocclusion prevalence. Angle class III malocclusions can be both socially and functionally handicapping, and identifying populations that require greater attention may help clinicians and politicians in deciding how to best address helping them find treatment **(Daniel *et al*., 2012).** At the end of this

report, I would like to highlight the importance of increasing the level of awareness of starting the treatment for class III malocclusion cases early in life to avoid more sophisticated treatment like orthognathic surgery. For example, it happened that the case that I am following the treatment as part of my graduation program under specialist supervision at fifth grade orthodontic clinic has been diagnosed with class III malocclusion. As the mother of this patient understood the importance of early diagnosis and treatment, she has then motivated a relative of her who has more than one child with the same condition and advised them to go and seek treatment.

Chapter 5 Conclusions and Suggestions

CONCLUSIONS

- There is an increase in the prevalence of class III malocclusion, yet it is still the lowest among sagittal occlusion.
- Females seeking orthodontic treatment more than males.
- Males with class III malocclusion seek orthodontic treatment more than females.
- Patients with class III malocclusion are seeking treatment at younger ages

SUGGESTIONS

- Do multicentre study to see the prevalence of malocclusion and increase sample size.

- A more standardized protocol for reporting malocclusion prevalence data would be helpful in drawing meaningful comparisons across geographic and racial groups in the future.

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