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Parameters Deciding Orthognathic Surgery or Camouflage? – A Review

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ABSTRACT

Objectives: One of the most controversial issues in treatment planning for borderline skeletal malocclusion in adult patients is the choice between orthodontic camouflage and orthognathic surgery. In order to make a proper diagnosis and treatment plan, we need to correlate the parameters found at extra-oral, intra-oral, frontal, and lateral clinical examination data with the cephalometric data.Our aim was to identify the diagnostic parameters in borderline skeletal discrepancy cases for choosing the proper treatment.**Methods:**The search for articles published between 1990 and 2022 on the topic of borderline skeletal discrepancy cases was performed. The search strategywas implemented on Google Scholar, PubMed, MEDLINE, Cochrane Central Register of Controlled Trials (CENTRAL), ScienceDirect, Scopus, EMBASE, and Ebsco using specific keywords by three subject experts.**Results**: The search articles and abstracts included clinicalstudies, review articles,systematic reviews, meta-analysis.observational studies, and randomised controlled trials (RCTs). The results showed that the camouflage of mild skeletal malocclusion is acceptable. However, precise clinical examination of the patient, cephalometric parameters, and their comparison with the clinical parameters are of utmost importance to differentiate between these borderline cases. Finally, patient compliance is also very important for decision-making regarding the treatment.**Conclusions:** The choice between orthodontic camouflage and orthognathic surgery for borderline skeletal discrepancy cases is a complex decision that should be made on a case-by-case basis. The factors that should be considered include the severity of the malocclusion, the patient's age, their expectations, and their willingness to undergo surgery.

Keywords: Borderline, fixed orthodontic therapy, orthodontic camouflage, non-surgical treatment, stability.

I. INTRODUCTION:

Previous studies have suggested that skeletal discrepancies worsen with age, making it more difficult to treat a developing malocclusion successfully over time[1,2]. Early intervention of skeletal discrepancies during the mixed dentition or even the deciduous dentition period has been emphasized, increasing attention in the field of orthodontics[3,4,5]. The standard approach for adults with dentofacial discrepancies is orthognathic surgical treatment[6,7].

Patients who are in their non-growing phase with mild and moderate skeletal discrepancy and acceptable facial aesthetics can benefit from camouflage orthodontic treatment, while patients with severe skeletal discrepancy must undergo orthognathic surgery to achieve better results[8,9,10].

Generally, the purpose of an orthodontic camouflage treatment is to mask the skeletal discrepancy through dental compensations[12,13]. Correction of upper incisor protrusion is usually done by extracting first premolars in the upper arch[14,15]. Functional appliances are typically used for growth modification in growing patients, but they can also be used in young adult patients to change the position of teeth[16,17].

Orthognathic-surgical treatment is planned to correct the underlying skeletal Class II and Class III discrepancies. In most surgical patients, only mandibular advancement surgery is required to

correct mandibular retrognathism in Class II and mandibular setback in Class III cases[18,19]. However, some patients require bi-jaw surgeries, such as superior repositioning of the maxilla and anterior repositioning of the mandible in Class II situations, or anterior repositioning of the maxilla and posterior setback of the mandible in Class III situations[20]. Single-jaw surgeries are generally considered to be very stable, while the combination of both maxillary and mandibular surgery is only stable with rigid fixation.Previous literature suggests that there are no clear guidelines on the best treatment approach for adult patients, nor have there been any previous systematic reviews on this topic[21,22].

The goal of this review was to compare dental, skeletal, and aesthetic outcomes between orthodontic camouflage and orthognathic surgery treatment, focusing on borderline orthognathic surgical cases treated with camouflage treatment, in patients with a skeletal Class II or Class III malocclusion, a retrognathic or prognathic mandible, who were in their non-growing period.

II. MATERIALS &METHODS:

A literature search was made in databases searches including PubMed, Google Scholar, Cochrane Central Register of Controlled Trials (CENTRAL) Library, Medline, Web of Science, Science Direct, Scopus, Ebscoand EMBASE for clinical studies, review articles, systematic reviews, meta-analysis. observational studies, randomised controlled trials (RCTs) and casestudiesdonein1990-2022. The PubMed database and Google search were conducted using the search by keywords: Fixed Orthodontic Therapy, orthodontic camouflage, borderline, non-surgical treatment, malocclusion, stability. The search included all randomised controlled studies published in English from January 1st,1990 to December 2022. The titles, authors, and abstracts of RCTs, case studies, systematic reviews identified were printed and reviewed independently on the basis of keywords, title, and abstract by three reviewers to determine whether these meet the review objective.

III. DISCUSSION

Based on the literature, orthodontists should plan for treatment with four goals in mind: Acceptable aesthetics, stable occlusion, good masticatory and TMJ function and maintenance of the airway[23,24,25]. We need to weigh the pros and cons between the two procedures, orthodontic camouflage and orthognathic surgery, based on the severity and risk factors[26,27].

The surgical procedure has some potential adverse outcomes, including neurosensory abnormalities, failure to achieve the desired occlusal result, nonunion, malunion, and the associated risks of general anaesthesia [28,29]. However, the low frequency and lack of severity of most complications have made surgical treatment much more commonplace in the correction of skeletal malocclusions[30]. In the past, surgical treatment was often viewed as a "last resort" reserved for those with the most severe abnormalities, but it is now considered a routine treatment option for correction of skeletal malocclusions, especially those that require only mandibular surgery[30,31]. Maxillary surgeries are less common because of the increased risks associated with them.Orthodontic camouflage has the disadvantage of being less stable and having a higher risk of relapse, but it does not have the postoperative complications of surgery[31,32].

Much of the controversy related to treatment may actually result from each practitioner's assessment of the clinical problem[33]. A recent study documented significant disagreement between trained orthodontists and surgeons when evaluating patients with dentofacial deformities[33,34]. The surgeons tend to focus more on skeletal deformity, which can be corrected by performing orthognathic surgeries. Orthodontists, on the other hand, focus on dental malalignment, which can be corrected by fixed appliance therapy[35,36,37]. The differences in opinion regarding the severity of the deformity may be compounded by each practitioner's interest or focus on a specific component of the malocclusion, i.e., skeletal versus dental[30,37,38, 39].

The patient's chief complaint: is given prime importance[40]. If patients describe improvement in facial esthetics as a high priority goal for treatment, and if this is one of the major factors for seeking treatment, the treatment plan is mostly to correct the underlying skeletal discrepancy[40,41]. It is different how each patient evaluates their own face. For instance, two patients may present with nearly identical facial appearances, a mild mandibular deficiency, and Class II malocclusion. Each patient may list improvement in facial esthetics as a primary goal for seeking treatment. One patient may describe dentoalveolar protrusion as the primary facial abnormality[42,43]. In many cases, this will be amenable to orthodontic treatment only. On the other hand, a patient who describes deficiency in projection of the lower jaw as the facial

abnormality, may be treated best with a combination of orthodontics and surgery[30, 42,43].

Medical history: Surgical treatment is least considered in cases of medically compromised individuals[42,43].

Extraoral soft tissue examination: Systematic aesthetic facial evaluation is the most valuable diagnostic procedure.[44] In the past, we used to diagnose patients by only assessing the hard tissue structures on lateral cephalograms. However, we now focus more on the soft tissue structures.[44,45] This is because in some cases, even if a patient has a severe skeletal discrepancy, the soft tissue compensation may mask the skeletal abnormality. In such cases, surgery may not be required and the patient can be treated with dental corrections alone. [46] Therefore, the extraoral examination should start during the initial informal discussion, when the patient is unaware. During this time, the facial function and features will be most natural. The frontal and lateral profile examinations are done when the patient is positioned in natural head position. [45,46] Photographs are essential for accurate assessment and record keeping. Here, we determine the components that are moderately to severely deviating from the normal range, leading to gross facial disharmony. Such cases are advised for correction by orthognathic surgery. Again, the patient's concerns about their facial appearance are taken into consideration before planning the treatment. [47,48,49]

Functional examination: Examination of the path of closure of the mandible and record if any deviations during mandibular closure. Examination for TMJ abnormalities. This functional examination will help us to differentiate between pseudo and true skeletal malocclusion and assess the health of the TMJ. [50,51]

Patient motivation: The use of video imaging has increased as a result of improved computer technology, decreased cost, more accurate imaging projection, and increased acceptance as a treatment-planning modality. [52,53]

Skeletal Class II Malocclusion: A study conducted by Proffit et al. [52] assessed patients who were evaluated for orthodontic and surgical treatment. They found that fewer Class II patients with severe overjet and significant skeletal deficiency were treated with orthognathic surgery. This may be because many clinicians do not focus on the skeletal component of Class II malocclusion or do not consider it severe enough to be treated surgically. Instead, they may choose to treat the malocclusion with orthodontics alone, by compensating the dentition. Most patients who seek orthognathic surgical treatment do so at the recommendation of their orthodontist. At the present time, there are no widely accepted guidelines for determining which cases of Class II malocclusion would best be treated with surgery versus orthodontic camouflage [52, 53].

In general, surgery is most likely to be needed for successful correction of Class II malocclusion in adolescents who are beyond the growth spurt and who have one or more of the following: An overjet greater than 10 mm, A distance from pogonion to nasion perpendicular of 18 mm or more, Mandibular body length of less than 70 mm, Facial height of greater than 125 mm. In these patients, growth modulation with orthodontics alone is typically unsuccessful [53, 54].

In 2010, Fareeha et al. [53] divided Class II malocclusion into mild, moderate, and severe malocclusions, based on Steiner's cephalometric parameters. They found that severe skeletal malocclusions are more likely to require surgical treatment than mild or moderate malocclusions.

Proffit and Ackerman have described the envelope of discrepancy, which can help serve as a guide when selecting appropriate treatment modalities. This is based on the severity of the occlusal discrepancy. [52] In this diagram (Figure 1), the limits of treatment are represented by fine lines separating each type of treatment. In actual clinical practice, such a strict division may not exist. A variety of treatment options continue to exist for each patient, based on his/her primary goals for treatment, as well as practitioner preference and experience.

Skeletal Class III Malocclusion: The severity of Class III malocclusion in adult cases determines whether the patient is suitable for surgery or orthodontic treatment [53, 55].

Kerr et al. suggested that surgery should be performed in patients with ANB and incisor mandibular plane angles of lower than −4° and 83°, respectively [53, 55].

Eisenhauer et al. conducted a study to separate Class III patients who can be treated orthodontically from those who require orthognathic surgery. They suggested a predictive model that was developed on the basis of four variables: Wits appraisal, length of the anterior cranial base, M/M ratio, and lower gonial angle for correct classification of Class III malocclusion in adult cases. The critical score was −0.023. If the score is higher than this, it can be treated by orthodontic therapy alone. If the score is more negative, it would require surgical intervention. Wits appraisal of −7.21 mm was correctly classified as non-surgery patients, and −12.97 mm were classified as patients requiring surgery. The

length of the anterior cranial base was shorter in the surgery group. The lower gonial angle mean was 80.37 degrees in the surgery group, and 75.46 degrees in the non-surgery group [53, 56].

Rabie et al. evaluated borderline Class III patients who had undergone camouflage orthodontic treatment or orthognathic surgery and suggested that the Holdaway angle can be a reliable guide in determining the treatment modality of these patients. They further suggested that patients with a Holdaway angle greater than 12° can be successfully treated by orthodontics alone, while patients with Holdaway angles less than 12° would require surgical treatment [53, 57].

In a similar study conducted by Benyahia et al., a threshold or borderline value of 7.2° was found, thus suggesting that patients with Holdaway angles above this value can be successfully treated by orthodontics without the need for orthognathic surgery. Although both studies have shown the correlation between Holdaway angle values and the need for orthognathic surgery, the big difference between the findings of Rabie et al. [57] and Benyahia et al. [58] in estimation of the threshold value prompted them to conduct another study.

The study by Sara Eslami et al. suggested that H angle > 10.3 can be successfully treated with camouflage, and if H angle is <10.3, the patient needs surgical treatment. Wits appraisal greater than −5.8 can be treated with camouflage, and Wits appraisal less than −5.8 requires orthognathic surgery [53, 58].

IV. CONCLUSIONS:

Orthodontic camouflage treatment of mild to mode rate skeletalmal occlusion is generally acceptable. However, preciseclinical examination of the patient and comparison of cephalometric parameters with clinical parameters are outmost importance to distinguish between the seb order line cases. Based on previous studies, certain cephalometric differentiating parameters can be considered when planning treatment to minimize relapse and improve treatment stability. Lastly, patient compliance and consent are also very important for decision-making regarding treatment.

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Figure legends:

- **Figure 1** – Envelope of discrepancy

Figure 1

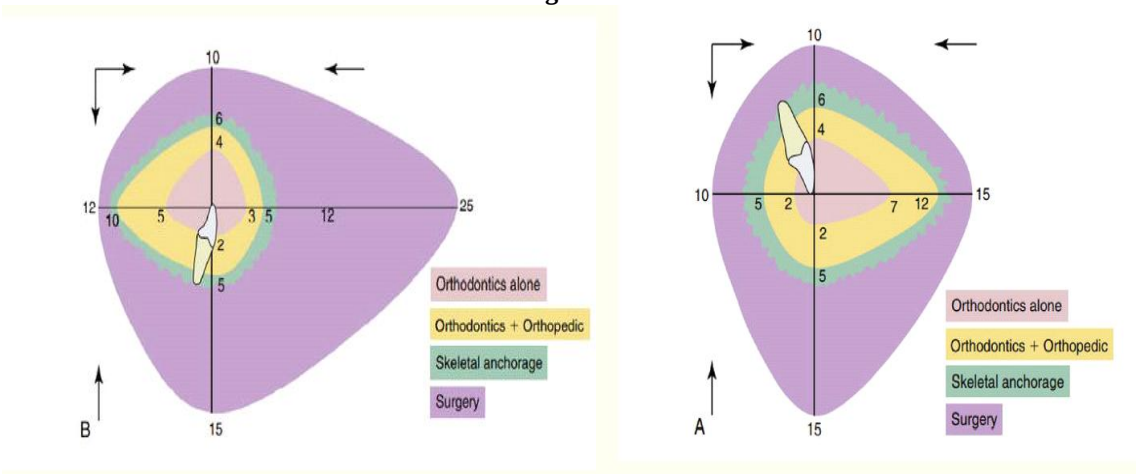

Figure 1: Envelope of discrepancy