

## **A) Generic Heading**

ORTHODONTICS

## **B) Title**

INTERCEPTIVE MANAGEMENT OF INCREASED OVERJET IN YOUNG CHILDREN:  
A CLINICAL PROTOCOL

## **Abstract**

This paper will describe the different techniques for management of an increased overjet in a child considered too young for conventional orthodontics, as well as the clinical situations in which these techniques may be useful. This is particularly aimed at general dental practitioners and paediatric dentists working in areas with limited access to specialist orthodontic services.

## **Clinical Relevance**

1. Provides an overview of management for an increased overjet in a child often considered too young for conventional orthodontics.
2. Describes different techniques for the early management of an increased overjet.
3. Outlines the clinical situations in which these techniques may be useful.

## **Objective Statement**

The reader should understand the different techniques for management of an increased overjet in a child considered too young for conventional orthodontics, as well as the clinical situations in which these techniques may be useful.

## **Introduction**

Increased incisal overjet is common in the mixed dentition and can be due to a range of factors, such as a digit sucking habit, a soft tissue lip trap or an underlying Class II skeletal base relationship. Severe malocclusions can have a significant negative impact on the quality of life of children and adolescents with evidence to suggest they are associated with bullying and other negative social experiences.<sup>1,2</sup> There is also a strong correlation between an increased overjet and dental trauma which has been widely documented in the literature.<sup>3-6</sup> Children with an overjet greater than 6mm are four times more likely to suffer a traumatic dental injury and it has been shown that traumatic dental injuries are more time consuming and costly to treat than other bodily injuries.<sup>7,8</sup>

Interceptive orthodontic treatment in the mixed dentition has been suggested for those with increased risk. A Cochrane review by Batista et. al., highlights that providing early orthodontic treatment for children with prominent upper front teeth has been shown to be effective for reducing the incidence of incisal trauma and providing more positive and fewer negative social experiences for a young patient.<sup>9</sup> In scientific terms this evidence is considered of low or moderate quality but the positive outcomes mean that it should be considered, particularly for children subjected to teasing and bullying due to their dental appearance.<sup>9</sup>

Clearly this treatment should be carried out by an orthodontist. There will be situations however where one is not available, for example in rural or isolated areas. If the risk of trauma is high, or there are significant psychosocial concerns, then treatment should not be denied. In these cases, treatment may need to be delivered by a primary care dentist. This clinical protocol has been written with this situation in mind.

### **Assessment of a patient for early management of increased overjet**

Factors such as risk of trauma and psychosocial impact should be considered important for early intervention to correct an increased overjet. Patients must understand that this style of early treatment will not address all their orthodontic needs. Further orthodontic treatment is likely to be required in adolescence to comprehensively manage their treatment need, this may include further removable and/or fixed appliances. For severe skeletal discrepancies, orthognathic surgery may be indicated at maturity.

To determine a patient's suitability for early orthodontic treatment to manage an increased overjet, a number of factors must be considered to determine the potential benefit and the type of appliance to be used.

These factors include:

- **Age and compliance of patient:** They must be mature enough to comply with treatment and understand it
- **Skeletal pattern:** If the increased overjet is due to a severe skeletal Class II pattern, full reduction of the increased overjet may not be possible.
- **Inclination of incisors:** The objective of this treatment is to retrocline the incisors. If they are at an average inclination, or retroclined, then treatment objectives may not be possible without adversely affecting their facial aesthetics.

- **History of trauma to the incisors:** Prognosis for traumatised incisors may be compromised by active orthodontic tooth movement, so if there has been recent trauma to the upper incisors this needs to be included in the consent process during treatment planning. Active orthodontic treatment should be delayed after dental trauma depending on the type of injury sustained, ranging from three months at a minimum, up to 12-24 months.<sup>10</sup>
- **Presence of a digit habit:** In the presence of a digit habit incisor retroclination may not be possible or will relapse after treatment if the habit persists. This must be addressed early. There are removable and fixed appliances which can be considered to help break this habit which are described later in this paper.
- **Financial or logistical burden:** The impact of this on the patient and their family might make potential early orthodontic intervention less achievable. Aspects such as travel, time out of school and cost to the family may make the delivery of this treatment difficult, and the pressures on orthodontic care may delay the patient being seen early in an orthodontic setting. These factors, however, do not take away the fact that it may be the most clinically and psychologically appropriate treatment. In the end it must be the patient and their carer that makes the decision whether to undertake early interceptive treatment for the increased overjet.

As early treatment is normally carried out in the mixed dentition great care needs to be given to choosing the teeth to provide retention for the brace, to ensure that exfoliation does not destabilise the appliance or make it uncomfortable to wear. Patients with poor oral hygiene or with a high caries risk are not suitable for early orthodontic treatment until these issues have been addressed. Once a patient has shown their oral hygiene and caries risk will support orthodontic treatment, treatment may commence to reduce the increased overjet.

*What records should be taken for early treatment?*

For all patients, a thorough clinical and radiographic examination (including an orthopantomogram) should be completed prior to any intervention. This is to ensure the patient is free from any dental diseases and to serve as a baseline record to monitor for any pathology, such as root resorption, during treatment. It will also show if there is hypodontia of teeth or any teeth developing in ectopic positions. Where relevant a full trauma history should be taken along with sensibility testing and periapical radiographs prior to treatment. The clinical examination should include the basics of dental charting and a basic periodontal examination but in these cases should also include orthodontic measurements.

Extraorally, the patient should be assessed in natural head position (unsupported focusing on a point in the distance, with the face not tilted upwards or downwards).<sup>11</sup> The skeletal class can be determined by bimanual palpation (Kettle's method) of the point of maximum concavity on the anterior maxilla (soft tissue point A) and anterior mandible (soft tissue point B). It can be described as:

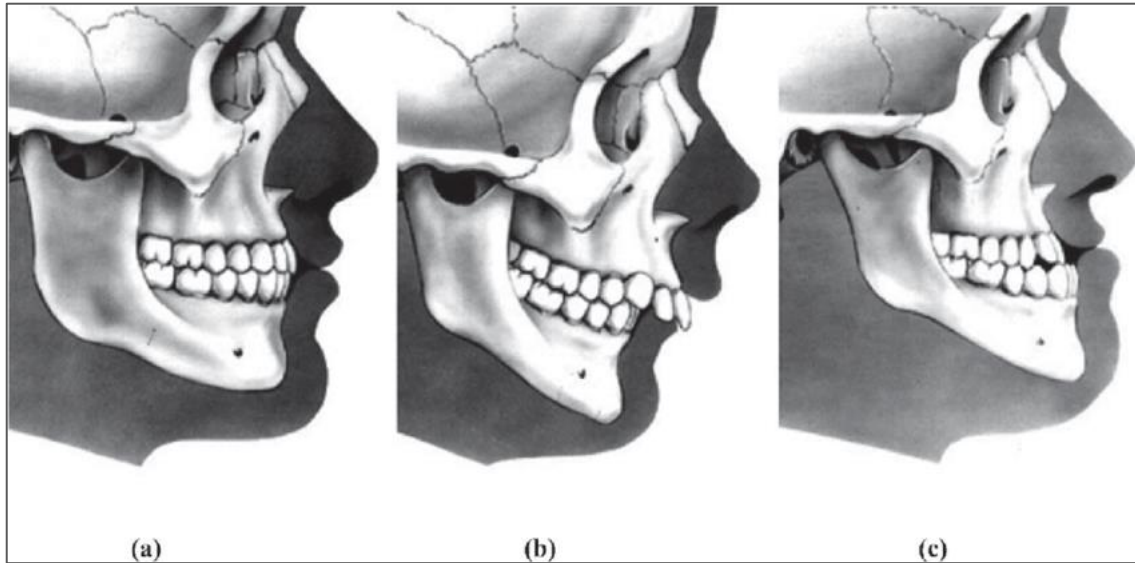
Class I - mandible 2-3mm posterior to the maxilla

Class II - mandible is greater than 3mm posterior to the maxilla

Class III – mandible lies equal or anterior to the maxilla

Figure 1 shows a diagrammatic representation of each skeletal class.

**Figure 1. Skeletal patterns in orthodontic assessments: (a) Class I skeletal pattern, (b) Class II skeletal pattern, and (c) Class III skeletal pattern**



The severity of a skeletal Class II can be further classified as mild, moderate or severe.

The soft tissues should be assessed and the form, tonicity and fullness of the lips should be noted i.e. full, thin, hyperactive, or with little tone. Lip competence is an important factor, does the patient form an anterior seal at rest? If so, they have competent lips at rest. Lips apart at rest can be caused by a retrognathic mandible, an increased lower face height, proclined upper incisors or short lips. Finally assess resting lip height, the lower lip should cover the incisal third of the upper central incisors.

Intraorally, the incisor classification should be recorded in occlusion (Table 1).

**Table 1. Incisor classification**<sup>12</sup>

<p><b>Class I</b></p>	<p>Lower incisor edges occlude with or lie immediately below the cingulum plateau of the upper incisor.</p>
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<b>Class II Division 1</b>	Lower incisor edges lie posterior to the cingulum plateau of the upper incisor.  Overjet is increased and the upper incisors are usually proclined.
<b>Class II Division 2</b>	Lower incisor edges lie posterior to the cingulum plateau of the upper incisor.  Upper incisors are retroclined, overjet is usually minimal but may be increased.
<b>Class III</b>	Lower incisor edges lie anterior to the cingulum plateau of the upper incisors.  Overjet is reduced or reversed.

Incisor inclination is generally measured in orthodontics using linear and angular measurements, compared with the cranial base or the maxilla, and requires a lateral cephalogram which may not be available to a general dental practitioner. In these cases it is acceptable to look at the inclination of the incisors and make an aesthetic assessment of their position. As it is most likely that further comprehensive orthodontic treatment will be undertaken at a later time, the focus at this stage of treatment is on reducing the prominence of the upper incisors to reduce their vulnerability. Only if they are clearly retroclined would they not be acceptable for early treatment, as further retroclination would have a significant adverse effect on facial aesthetics. The overjet, which is the horizontal distance measured from the tip of the upper central incisor to the labial surface of the lower central incisor, should be noted. The ideal is 2mm. Any other factors such as the presence of an overbite,

crowding and crossbites should be noted but unless they appear to compromise the functional occlusion should not impact on the decision to provide early treatment.

Extra-oral and intra-oral photographs should be taken pre-operatively to use for reference when assessing progress throughout and after treatment. Taking photographs can be useful for any onward referral as they can be remotely accessed, particularly in the current times with COVID-19 restrictions. Helpful photographs to take are;

*Extra oral:*

- Frontal view (not smiling)
- Frontal view (smiling)
- Profile (lateral view)

*Intra oral:*

- Frontal view in occlusion
- Frontal view with teeth apart (to see incisal edges of lower incisors)
- Left buccal in centric occlusion
- Right buccal in centric occlusion
- Upper occlusal view
- Lower occlusal view

**Figure 2: Checklist of factors to assess and records to take prior to treatment**



**History**

- Age and compliance assessment
- Medical history
- Dental history
- Trauma history
- Involvement in contact sports
- Habits such as digit sucking
- Reports of teasing/bullying associated with dental appearance

**Clinical examination**

- Dental charting, including missing teeth and caries
- Basic Periodontal Examination and oral hygiene assessment
- Deciduous teeth close to exfoliation
- Trauma review if appropriate, including sensibility testing

**Orthodontic assessment**

- Skeletal class
- Lip competence
- Incisor classification
- Inclination of maxillary incisors
- Overjet (in millimetres)
- Overbite
- Crossbites
- Crowding

**Radiographs**

- Bitewings if suspected caries
- Periapical/occlusal radiographs if history of trauma
- Orthopantomogram if considering early intervention

**Photographs**

- Extraoral: frontal view, not smiling
- Extraoral: frontal view, smiling
- Extraoral: profile, lateral view
- Intraoral: frontal view in occlusion
- Intraoral: left buccal in occlusion
- Intraoral: right buccal in occlusion

The assessment and records should uncover the aetiology of the increased overjet. The three most common causes of an increased overjet include:

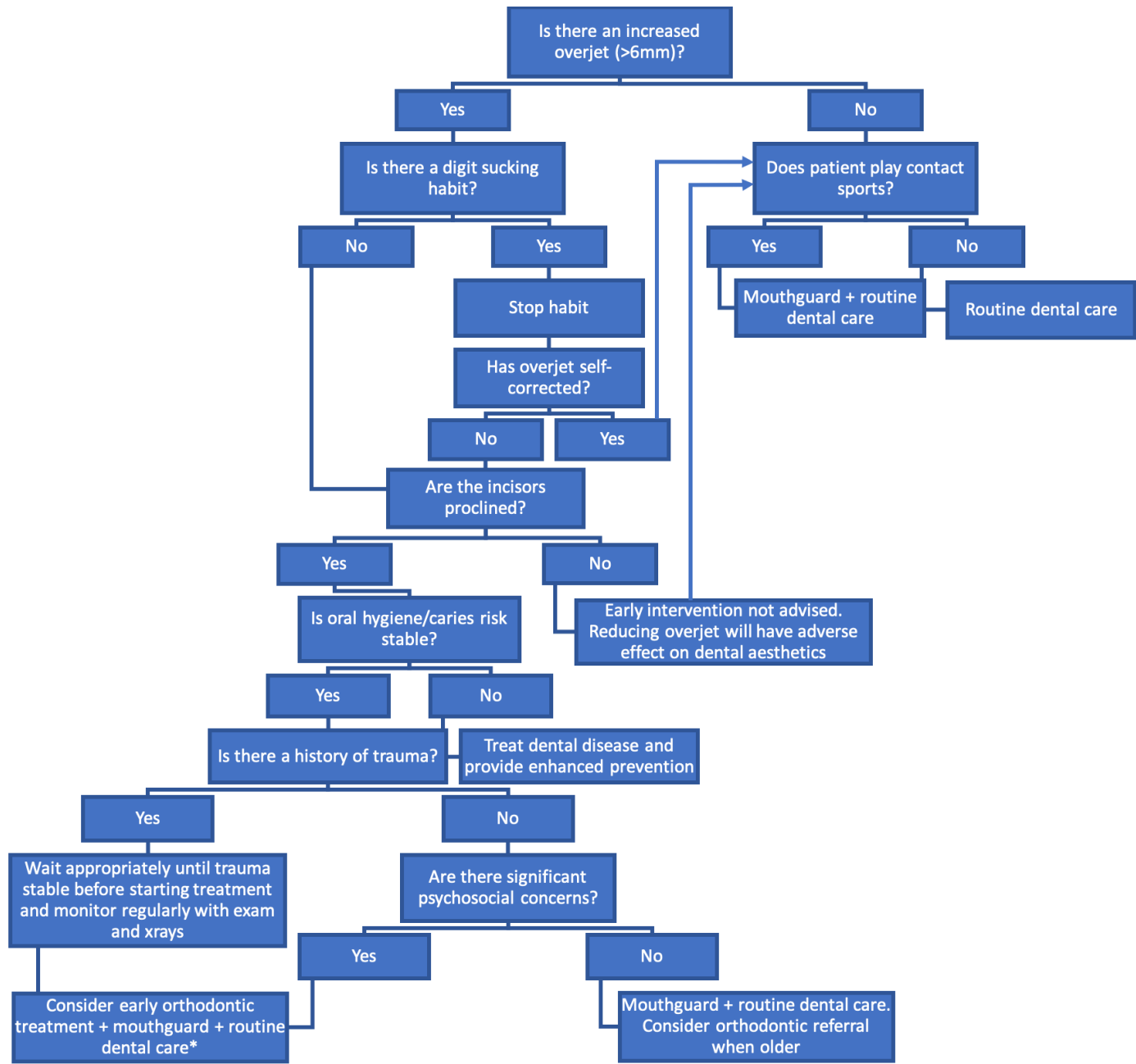
1. Skeletal Class II (retrognathic mandible)
2. Digit habit
3. Lip trap

Correct diagnosis of the cause is essential in providing the correct treatment.

**When to consider intervention?**

If a young child has an overjet of greater than 6mm and is at increased risk of dental trauma, or is being teased or bullied significantly because of their teeth, then intervention should at least be considered. Failure to treat the overjet may lead to significant psychosocial impact on the child, or dental trauma with potential lifelong repercussions of trauma sequelae. There are several questions the clinician must ask themselves to help decide on the best management for the child, which are highlighted the clinical protocol shown in Figure 3.

**Figure 3. Clinical protocol to aid clinical decision making for when and how to intercept an increased overjet**



\*If severe skeletal class II, full reduction of increased overjet may not be possible

**What options for treatment are there?**

*Reduce risk of trauma*

A sports mouthguard can be used to protect the upper incisors during active play but of course will not reduce the overjet in any way. Providing a mouthguard won't have any impact on the psychosocial concerns if they exist, but will prevent trauma. Mouthguards should be worn for all patients who play contact sports. The two main mouthguards to consider are; 1) "boil and bite" mouthguards, and 2) custom-made mouthguards. If making a custom-made mouthguard through a laboratory, the patient must be advised this may need to be changed regularly if the teeth are being moved. A "boil and bite" mouthguard that can be adjusted by the patient may be a better option as the overjet reduces. Unfortunately these cannot be worn continuously and therefore the child will still be at significant risk of trauma when not playing sport.

*Remove cause of overjet - Removable and fixed habit breakers to stop a digit habit*

Habit breakers can be fixed or removable and aim to stop digit habits by making it more difficult for the child to continue. This in itself may reduce an overjet by removing the "active" component in causing the increased overjet and allow the soft tissues to reduce the induced overjet. These should be considered if a child has not responded to non-physical methods, or simpler physical methods such as placing a sticking plaster on the digit or using a glove at night. If the digit sucking occurs for a number of hours a day or is particularly intense it can cause multiple dentoalveolar problems; including increased overjet, anterior open bite and posterior crossbite due to narrowing of the maxillary arch.<sup>13</sup> If digit sucking is stopped before a child turns 7 years old, it can often prevent a malocclusion as the teeth can self-correct. After the age of 7 years, self-correction is less likely.<sup>14</sup>

Fixed appliances (Figure 4) can be cemented in place with bands on the first permanent molars and this removes the need for compliance. If the first permanent molar is not fully erupted, the second deciduous molars can be used instead. These appliances should be kept in

place for at least 6 months. If a digit habit is eliminated, a correction in the overjet due to reduced proclination of the upper incisors may be seen without the need for additional treatment. Fabrication of a fixed habit breaker requires the placing of orthodontic bands on the molar teeth to provide stabilisation of the appliance. Bands are chosen that fit closely to the retention teeth, an impression taken with the bands in place and the bands placed in the impression before it being sent to the technician to fabricate the appliance.

Removable appliances may work for the patient who is motivated to stop the digit habit and just needs some reinforcement. The difficulty with a removable appliance is that if the habit is significant the patient is likely to remove the appliance at the time they wish to suck their thumb or finger, as a result no benefit will be seen at recall. The authors advocate a fixed deterrent where appropriate.

**Figure 4. Fixed habit breaker: a) occlusal view b) anterior view**



*Reduce overjet*

### Overjet is non-skeletal:

Simple removable appliances can be used to reduce or eliminate the overjet if it is non-skeletal in nature. If the cause is not skeletal in nature but simply due to proclination of the upper incisors or a soft tissue lip trap, the clinician may consider an upper removable appliance. Use of an upper removable appliance can be effective for skeletal Class I or mild skeletal Class II cases with an increased overjet. The use of an activated labial bow can retrocline proclined upper incisors to reduce an increased overjet, and they can also incorporate an anterior bite plane to reduce an overbite. Space in the upper labial segment is preferable for overjet reduction and can be obtained through early removal of the maxillary deciduous canines. Retention is usually achieved by placing Adam's cribs on posterior teeth, typically the permanent first molars, with or without accessory cribs on deciduous molars. Figure 5 demonstrates an example of an upper removable appliance.

Fitting of removable appliances is a relatively fast and simple procedure. Ideally, the patient will return for the fit appointment within two weeks of sending the initial impressions to the laboratory for fabrication of the appliance. This reduces the risk of the appliance not fitting correctly due to unwanted tooth movement between visits. It should be explained to the patient and their parent/guardian that the appliance should be worn almost 24 hours a day. The only exceptions to this are when eating, playing sports and brushing teeth. When the appliance is not being worn, it should be placed in a safe sturdy container so it does not get damaged or lost. At the end of active treatment the appliance can be worn at night to maintain the retroclination of the incisors.

**Figure 5. Upper removable appliance: a) occlusal view b) anterior view**



Overjet is skeletal:

Functional appliances can be used if the overjet is primarily due to a moderate-severe Class II skeletal pattern. Ultimately in cases where the cause of the increased overjet is skeletal in nature, the ideal pathway for this patient is a referral to be seen by an orthodontist to prescribe overjet-reducing appliances based on a specialty knowledge. If that is not possible, due to geography or limitations in service availability or the wait for that in your clinical opinion is leaving the patient at risk of trauma, the benefits of early treatment could well outweigh the risk.

Functional appliances are the gold standard and most appropriate management in these situations. The effects of functional appliances are primarily dental (70%), with a variable element of skeletal changes (up to 30%).<sup>15</sup> There are several types of custom-made functional appliances in existence, such as Clark's Twin Block appliance and Frankel's Function Regulator, which have successfully been used by orthodontists for many years., alongside more recent prefabricated functional appliances (PFAs).

The key aspect with a skeletal discrepancy causing an increased overjet is that the clinician recognises that it needs to be treated. Understandably, general dental practitioners may feel uncomfortable prescribing custom-made functional appliances in the absence of access to local orthodontic services, therefore one option might be to develop a system of shared care

with an orthodontist. The orthodontist can review the records, which are sent electronically, and via a video consultation can assess the patient's suitability for functional appliance therapy. They can then provide a design for the most appropriate functional appliance and would be able to help supervise the case remotely, reviewing the patient via video consultation every three months.

If this is not an option for the general dental practitioner, consideration should be given to using a simple, off-the-shelf PFA. If an increased overjet has been noted, and treatment is indicated, it is frustrating to not be able to offer some form of management. It is the authors opinion that in instances where specialist orthodontic services are unavailable, that this treatment may be the most appropriate early management, assuming the family are aware of the limitations and the likely need for further orthodontic treatment at a later stage.

Prefabricated functional appliances will not produce the full range of movements that a custom made appliance will offer but may impact on the overjet enough to reduce the potential risk to the anterior teeth. Prefabricated functional appliances (Figure 6) are removable appliances that can provide a Class II traction effect. Commercial options exist, such as Myobrace<sup>®</sup>. There is evidence to suggest that there is little difference in the relative effectiveness of these compared to other custom-made appliances.<sup>16,17</sup> There is generally less cost involved and no need for impressions compared to custom-made appliances but they rarely fit as well.

**Figure 6. Prefabricated functional appliance**



### **Managing an overjet with multiple causes**

There may be instances where an increased overjet is multifactorial in nature. Table 2 summarises the appropriate management for situations where several treatment options may



be required to achieve a satisfactory result. Support from a specialist orthodontist may be required and should be sought where possible, either face to face or remotely.

**Table 2. Management of increased overjets which are due to multiple causes**

<b>PRIMARY CAUSE</b>	<b>SECONDARY CAUSE</b>	
<b>Digit Habit</b>	<i>Lip Trap</i>	<i>Skeletal</i>
	<ol style="list-style-type: none"> <li>1. Attempt self-cessation</li> <li>2. Habit breaker appliance</li> <li>3. Upper removable appliance to reduce remaining overjet and improve lip posture</li> </ol>	<ol style="list-style-type: none"> <li>1. Attempt self-cessation</li> <li>2. Habit breaker appliance</li> <li>3. Functional appliance</li> </ol>
<b>Lip Trap</b>	<i>Digit Habit</i>	<i>Skeletal</i>
	<ol style="list-style-type: none"> <li>1. Attempt self-cessation</li> <li>2. Habit breaker appliance</li> <li>3. Upper removable appliance to reduce remaining overjet and achieve lip competence</li> </ol>	<ol style="list-style-type: none"> <li>1. Functional appliance to reduce overjet and achieve lip competence</li> </ol>
	<i>Digit Habit</i>	<i>Lip Trap</i>

<b>Skeletal</b>	<ol style="list-style-type: none"> <li>1. Attempt self-cessation</li> <li>2. Habit breaker appliance</li> <li>3. Functional appliance</li> </ol>	<ol style="list-style-type: none"> <li>1. Functional appliance to reduce overjet and achieve lip competence</li> </ol>
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### **What to check for at review appointments**

Review appointments following appliance fit are essential to check the fitting of the appliance, patient compliance if it is a removable appliance and progress with tooth movement, both wanted and unwanted. A general check should also take place to ensure good dental habits are being maintained as behaviours can often change throughout prolonged treatment. Any custom-made mouthguard should be brought to review appointments to ensure it still fits even as dentoalveolar changes are taking place. It may be necessary to either relieve tight areas or remake the mouthguard.

For patients with a digit sucking habit, the patient and parent/guardian should be informed that some overjets will self-correct after the digit sucking habit ceases. However, not all malocclusions will self-correct so the patient still require further orthodontic treatment after the habit has stopped.

After a removable or functional appliance is fitted, the patient should be reviewed four weeks later to assess both tolerance and progress. Speech is an excellent indicator as to whether an appliance is being worn alongside the physical appearance of the appliance. At recall appointments progress can be measured by recording the overjet and molar relationship. Generally 9-12 months of removable or functional appliance wear will correct an increased overjet if the appliance is being worn as instructed.

### **When to stop early treatment?**

The discriminator of when to cease active treatment should be when an overjet has been reduced and any soft tissue lip traps have been eliminated. If there is no further reduction in overjet, this implies the appliance is not being worn correctly or is having no effect.

Maintaining the achieved result is often dependent on the lip competence. If there is a lip together posture, the reduction may be self-retaining. If the lips are apart at rest then any reduction in overjet may not be stable. In this situation the patient may need to wear the appliance at night times to maintain the result until ready for comprehensive orthodontic treatment when the permanent dentition has established.

### **Conclusion**

This clinical paper has described the different techniques for management of an increased overjet in a child too young for conventional orthodontics, as well as the clinical and social situations in which these techniques may be useful. These include psychosocial benefits, particularly in a child being bullied, a reduction in the risk of dentoalveolar trauma and that it may reduce the need for, or complexity of, a second phase of treatment. It is hoped that this paper will be useful for general dental practitioners and paediatric dentists, particularly those working in areas with limited access to specialist orthodontic services.

### **Declaration of interests**

No potential conflict of interest was reported by the authors.

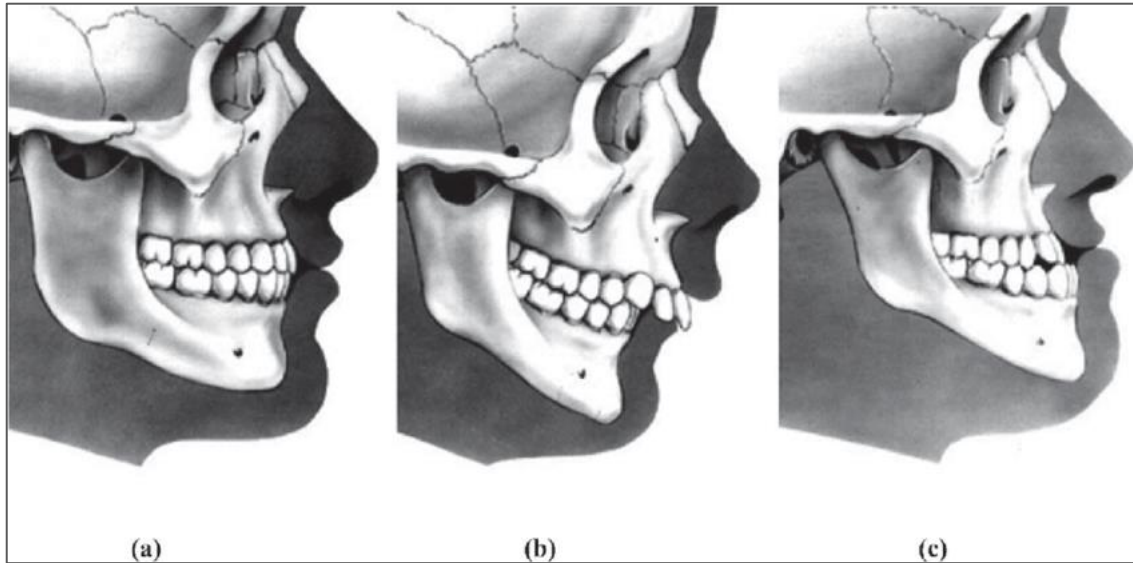
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**Figure 1. Skeletal patterns in orthodontic assessments: (a) Class I skeletal pattern, (b) Class II skeletal pattern, and (c) Class III skeletal pattern**



**Figure 2: Checklist of factors to assess and records to take prior to treatment**

**History**

- Age and compliance assessment
- Medical history
- Dental history
- Trauma history
- Involvement in contact sports
- Habits such as digit sucking
- Reports of teasing/bullying associated with dental appearance

**Clinical examination**

- Dental charting, including missing teeth and caries
- Basic Periodontal Examination and oral hygiene assessment
- Deciduous teeth close to exfoliation
- Trauma review if appropriate, including sensibility testing

**Orthodontic assessment**

- Skeletal class
- Lip competence
- Incisor classification
- Inclination of maxillary incisors
- Overjet (in millimetres)
- Overbite
- Crossbites
- Crowding

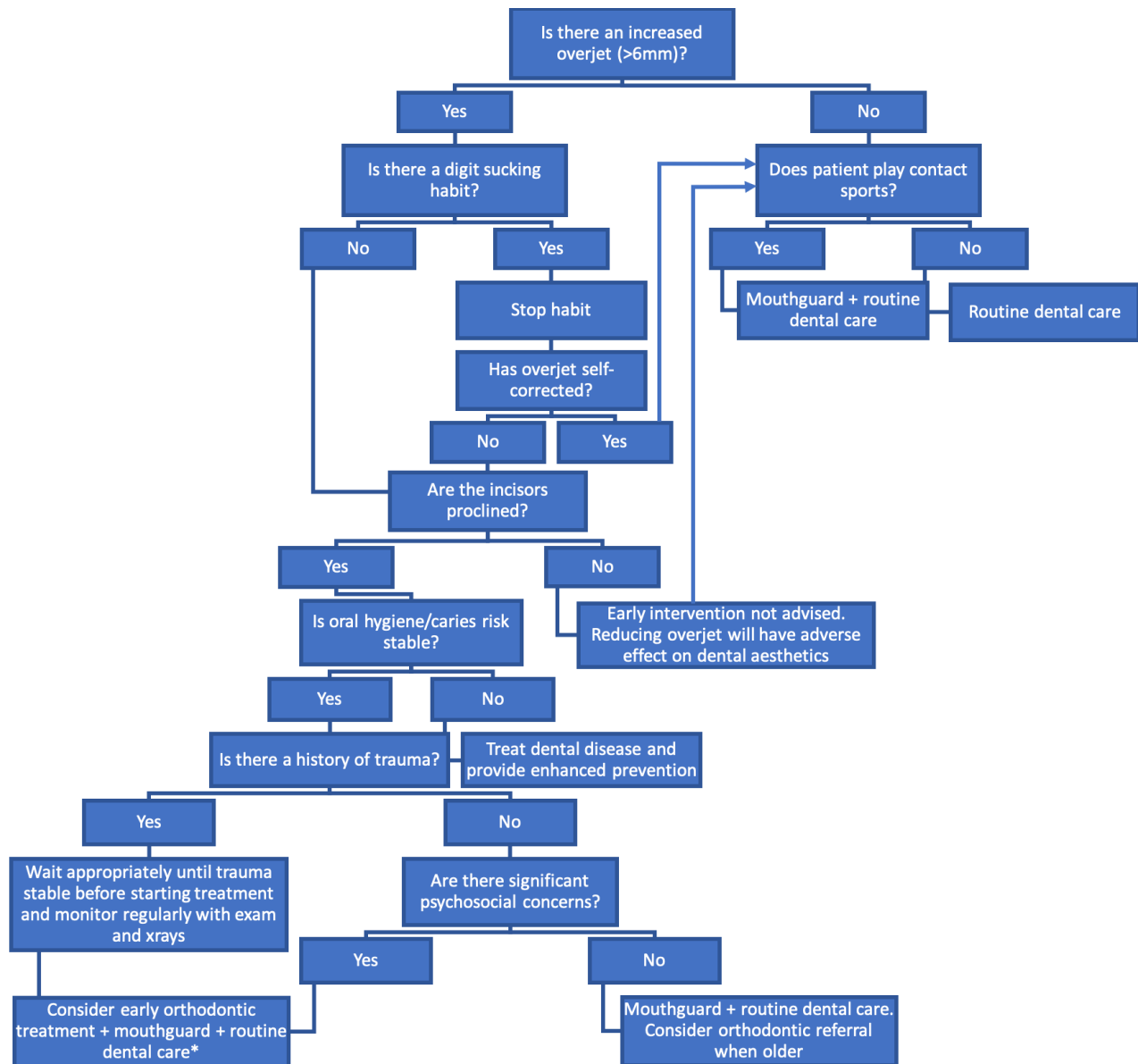
**Radiographs**

- Bitewings if suspected caries
- Periapical/occlusal radiographs if history of trauma
- Orthopantomogram if considering early intervention

**Photographs**

- Extraoral: frontal view, not smiling
- Extraoral: frontal view, smiling
- Extraoral: profile, lateral view
- Intraoral: frontal view in occlusion
- Intraoral: left buccal in occlusion
- Intraoral: right buccal in occlusion

**Figure 3. Clinical protocol to aid clinical decision making for when and how to intercept an increased overjet**



\*If severe skeletal class II, full reduction of increased overjet may not be possible

**Figure 4. Fixed habit breaker: a) occlusal view b) anterior view**



**Figure 5. Upper removable appliance: a) occlusal view b) anterior view**



**Figure 6. Prefabricated functional appliance**







**Table 1. Incisor classification(13)**

<p><b>Class I</b></p>	<p>Lower incisor edges occlude with or lie immediately below the cingulum plateau of the upper incisor.</p>
<p><b>Class II Division 1</b></p>	<p>Lower incisor edges lie posterior to the cingulum plateau of the upper incisor.</p> <p>Overjet is increased and the upper incisors are usually proclined.</p>

<b>Class II Division 2</b>	<p>Lower incisor edges lie posterior to the cingulum plateau of the upper incisor.</p> <p>Upper incisors are retroclined, overjet is usually minimal but may be increased.</p>
<b>Class III</b>	<p>Lower incisor edges lie anterior to the cingulum plateau of the upper incisors.</p> <p>Overjet is reduced or reversed.</p>

**Table 2. Management of increased overjets which are due to multiple causes**

<b>PRIMARY CAUSE</b>	<b>SECONDARY CAUSE</b>	
	<i>Lip Trap</i>	<i>Skeletal</i>
<b>Digit Habit</b>	4. Attempt self-cessation 5. Habit breaker appliance 6. Upper removable appliance to reduce remaining overjet and improve lip posture	4. Attempt self-cessation 5. Habit breaker appliance 6. Functional appliance
	<i>Digit Habit</i>	<i>Skeletal</i>
<b>Lip Trap</b>	4. Attempt self-cessation 5. Habit breaker appliance	2. Functional appliance to reduce overjet and achieve lip competence

	6. Upper removable appliance to reduce remaining overjet and achieve lip competence	
<b>Skeletal</b>	<i>Digit Habit</i>	<i>Lip Trap</i>
	4. Attempt self-cessation 5. Habit breaker appliance 6. Functional appliance	2. Functional appliance to reduce overjet and achieve lip competence