Non-Nutritive Sucking Habits in a Child – A Clinical Protocol to their Prevention and Management

Introduction

Anterior open bites (AOBs) are defined by the British Standards Institute (1983) as "an occlusion in which the lower incisors are not overlapped in the vertical plane by the upper incisors and do not occlude with them when the posterior teeth are in maximum intercuspation". AOBs can be genetic or environmental in origin, in most cases both contribute.

AOBs are broadly categorised as either dental or skeletal in origin. Dental AOBs are usually easier to manage and can often be successfully treated in a growing patient (which is the focus of this article). Skeletal AOBs are more significant and related to the genetically inherited skeletal pattern of a patient. These patients will have an increase in their vertical facial dimensions, possibly a backward mandibular growth rotation pattern and many present with only their terminal teeth in contact. They will usually require complex orthodontic or orthognathic management and will not be discussed in this article.

The aetiology of dental AOBs include:

- Anterior tongue interposition habit
- Nutritive sucking habits
- Transition from primary to permanent dentition
- Non-nutritive sucking habits
- Lack of space for permanent teeth to erupt leading to impaction
- Traumatic dental intrusion injuries
- Ankylosed incisors (usually following trauma)
- Iatrogenic development of an AOB

Non-nutritive sucking habits (NNSH) are considered to be the most common cause for AOBs in children. A persistent NNSH can affect the developing dentition and lead to the development of a malocclusion (Borrie et al., 2015). This can be avoided if

identified early and appropriate treatment delivered. It is critical these patients are managed at the right time, therefore general dental practitioners, paediatric dentists as well as orthodontists all have a role to play in effective and timely management. The aim of this article is to provide a clinical protocol for their identification and management.

What is a non-nutritive sucking habit?

Non-nutritive sucking habits (NNSHs) encompass comforting behaviours such as the use of pacifiers, blankets or finger/thumb sucking. They are common in babies and young children with the prevalence of such habits varying depending on the age of the child. The incidence for digit habits was reported to be 30% at 1 year of age, 12% at 9 years and 2% by 12 years, with a higher prevalence in females (Brenchley, 1992)

There have been few epidemiological studies regarding digit habits in the UK, but a study undertaken in Kettering in 2008 found that 12.1% of children had a prolonged digit habit past the age of 7 years (Patel, 2008) and a further study in 2010 reported that reduced overbites and anterior open bites were more prevalent in digit suckers than individuals who did not suck their digits (Mistry et al., 2010).

A digit-sucking habit up to the age of 3 years is considered to be normal, most children stop the habit as they become older and it becomes socially unacceptable (Graber, 1959). In some cases, however, these habits persist. This can be due to physical and emotional stimuli such as boredom, hunger, stress, hyperactivity, pleasure, sadness and various kinds of disabilities (Johnson and Larson, 1993). The dental effects of digit habits are reported to be transient and reversible if ceased before the age of 6 years (Bishara and Larsson, 2007). However, if the habit persists

beyond the age of 7, the position of the adult dentition can be permanently affected and self-correction is less likely to take place (British Orthodontic Society, 2019).

Clinical features of a NNSH

There are various features of a malocclusion that can be seen in patients with prolonged NNSHs (see Figure 1). These include:

- Proclined maxillary incisors
- Retroclined mandibular incisors
- Spaced maxillary dentition
- Reduced incomplete overbite or anterior open bite (AOB)
- Increased overjet
- Posterior crossbite
- Narrowing of the maxillary arch

(Cobourne and DiBiase, 2010)

[Insert figure 1 here]

Managing a patient with an AOB related to a non-nutritive sucking habit

Habit cessation can often result in resolution of AOBs caused solely by these factors or improvement in AOBs with a multifactorial aetiology. However, the management of prolonged NNSHs can include non-orthodontic intervention or orthodontic intervention depending on the age of the patient and the severity of the malocclusion. It is essential that comprehensive orthodontic treatments are not undertaken until the habit has ceased completely. It is also important to highlight that AOB malocclusions can be difficult to treat, and it is necessary to consider the stability of AOB correction, and increased relapse potential in these cases (Greenlee et al., 2011).

The first step in effective management is recognising and identifying the aetiology of the non-skeletal AOB. It is important to obtain a comprehensive history about any habits that may contribute as well as undertake a full clinical examination.

Intervention questionnaires can enable the collection of information by asking questions to patients. In the case of NNSHs, this could be related to age of the patient, habit duration and frequency, and whether any methods of habit cessation have already been tried. Once the aetiology has been identified the next step is to support the child in stopping the non-nutritive sucking habit.

Stopping the Non-nutritive sucking habit

Several methods for NNSH cessation have been documented in the literature, to varying degrees of success, and these can be found in Table 1. Difficulties associated with cessation of NNSHs can be linked to traditional issues with behaviour change, and therefore often a combination of approaches including an element of behaviour intervention and psychological support needs to be employed.

[Insert table 1 here]

Psychological therapies

Psychological therapies can be effective in NNSH cessation, but often need to be used in conjunction with other therapies. Habit reversal training and differential reinforcement of other behaviour are two psychological methods that have been used previously in habit cessation (Azrin and Nunn, 1973; Christensen and Sanders, 1987). Positive reinforcement is when a child is rewarded with something for not pursuing the habit, in the hope this will motivate the child to cease the habit. Negative reinforcement on the other hand involves associating something unpleasant with the habit, for example the application of a bitter tasting substance.

Non-orthodontic interventions

Gloves, socks, thumb guards and plasters can all be used as “barrier” methods to provide a physical barrier to aid digit habit cessation. Proprietary thumb and finger guards are available, such as those illustrated in Figure 2 (Thumbsie website, 2019). These methods are cost effective and easy to purchase, but still rely on patient compliance to ensure the “barrier” is not removed by the patient.

[Insert figure 2 here]

Another intervention involves the placement of a bitter tasting nail substance on the nails of fingers/thumbs, to provide a chemical barrier/deterrent to aid habit cessation. These can easily be purchased from online retailers or from local pharmacies, but should not be used for a prolonged period as this may result in irritation to the skin around nails. They have however, been shown to be effective in digit habit cessation (Friman and Leibowitz, 1990).

Orthodontic interventions

Upper removable habit breaker appliances such as the one shown in Figure 3 can be used to aid habit cessation. The metal prongs do not allow the child to place their digit/s in their mouth comfortably. In patients with a Class 2 division 1 malocclusion with an increased overjet, a functional appliance could also be considered, provided the patient is willing and motivated to stop the habit. This would enable overjet reduction as well as acting as a digit deterrent.

The disadvantage of removable appliances, however, is that the child is able to remove the appliance particularly when unsupervised and may continue to suck their thumb/finger. A removable appliance is therefore only useful if the child needs something to physically remind them to cease the habit, and if they themselves truly are motivated to stop. For certain patients, incentive charts such as those used for headgear wear can be utilised to record the amount the appliance is being worn and may also encourage young patients to wear their appliances more.

[Insert figure 3 here]

For patients who perhaps don’t have the willpower, keep forgetting, or perform the habit unconsciously whilst asleep, a fixed habit breaker appliance may be more beneficial (see Figure 4). These usually cease the habit immediately but need to be kept in place for at least 6 months. Figure 4 shows serial photographs of a fixed habit

breaker in situ, and how this has been successful in correcting a habit related AOB over 9 months, without any other intervention.

[Insert figure 4 here]

Other fixed appliances that have been used in NNSH cessation include the bluegrass appliance (see Figure 5) which has a roller in the palate preventing the child from placing their thumb securely in this region (Haskell and Mink, 1991).

[insert figure 5 here]

Another type of fixed orthodontic appliance that could be used is a quadhelix appliance (see Figure 6). This is particularly useful for crowded cases, or cases where the maxilla is narrow. The appliance will enable expansion as well as acting as a thumb guard by extending the palatal arms more anteriorly. Figure 6 shows how a quadhelix appliance has been successful in treating an AOB and correcting a posterior crossbite simultaneously.

[Insert figures 6 here]

Much of the evidence for habit cessation management is low quality, and made up of case reports, case series and retrospective studies. The sample size in many of these studies is also low. The most recent Cochrane review found low quality evidence that palatal arches, palatal cribs and psychological interventions are effective in sucking cessation, and that more high-quality trials needed to be carried out (Borrie et al., 2015).

However, in light of the limited evidence available, Figure 7 has been developed to aid clinicians in deciding which method to use and at what age. This will of course also depend on clinical examination and the severity of the dental features which have arisen due to the NNSH.

The authors suggest moving to a pacifier if a digit habit persists at 3-4 years. The reason for this is that it is often easier to withdraw a pacifier habit if this persists. Other interventions at such a young age are unlikely to be effective.

After 4 years of age, if a child does not stop the habit on their own, parents should attempt to discourage it, which is in agreement with the American Association of Orthodontists (Khayami et al., 2013). The authors recommend positive reinforcement with the use of a barrier method between the ages of 4-7 years, as orthodontic appliances are less likely to be well tolerated at these ages.

From 7-12 years, more active treatment approaches should be considered for the cooperative orthodontic patient. The authors suggest using fixed habit breakers rather than removable habit breaker appliances, as these have been shown to not only produce favourable dental effects but also more favourable vertical skeletal changes (Giuntini et al., 2008) and are considered to be effective for the early treatment of AOBs (Leite et al., 2016). Beyond 12 years of age, the majority of the permanent dentition should have established, and the upper incisor teeth roots should have fully formed. It is therefore unlikely that AOBs due to persistent digit habits will resolve spontaneously beyond this age.

It is also important to highlight that not all dentitions develop at the same rate, and significant individual variation can exist. This should be taken into consideration in the context of figure 7, which illustrates dental ages of patients rather than chronological ages.

[Insert figure 7 here]

When a decision is made to use an orthodontic appliance, it is important that the patient is reviewed regularly after (initially after 3-4 weeks and then approximately every 6-8 weeks) to ensure the appliance is not left unsupervised and to monitor changes to the dentition. This will involve reviewing oral hygiene, examining the hard and soft tissues around the appliance, the size of the anterior open bite and whether this is reducing. It may be useful to take clinical photographs to illustrate any

changes or improvements in the overbite. Patients should also be advised of initial discomfort and changes to speech following fit of the appliance.

Conclusion

This clinical paper highlights some of the aetiological factors that can result in the development of a non-skeletal AOB and focuses on NNSHs such as thumbsucking, and how certain interventions can be effective in managing this. Early intervention to cease such habits may reduce the need for future complex orthodontic or surgical treatments. It is clear that further high quality research is needed into the different methods and their effectiveness, but it is hoped that this paper will guide clinicians in deciding which intervention method to use and at what age when faced with a patient who presents with a non-skeletal AOB related to a NNSH.

Declaration of Interests

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Table 1: Different methods for digit habit cessation

Psychological therapies	**Non-orthodontic interventions**	**Orthodontic interventions**
Habit reversal	Gloves/socks	Removable appliance/Hawley retainer with palatal crib (see Figure 3)
Differential reinforcement of other behaviour	Thumb guards/finger guards (see Figure 2)	Functional appliance
Positive reinforcement	Plasters	Fixed habit breaker with palatal crib or palatal arch (see Figure 4)
Negative reinforcement	Application of a bitter tasting substance	Bluegrass appliance (see Figure 5)
		Quadhelix-type appliance (see Figure 6)