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Review Article

Association of orthodontic treatment and aspiration pneumonia

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ABSTRACT

Foreign body aspiration or ingestion is an uncommon potential complication during orthodontic dentistry, and it can produce a medical emergency. Obstruction of the airways can be life-threatening, and delayed recognition and management can result in pulmonary complications such as recurrent pneumonia. Dental treatment has been identified as an important cause of the misplacement of foreign bodies in the airway. Objects used in orthodontic treatment are mainly used due to their manufacturing limitations, such as their shape and size, and because they are made of radiolucent materials, which make them easy to aspirate or ingest and difficult to detect with a radiograph. However, few reports have been published on orthodontic dentistry-related foreign body aspiration and pulmonary complications. Furthermore, micro-aspiration due to poor oral hygiene in patients undergoing orthodontic procedures has been investigated in this review since poor oral hygiene is a well-established risk factor for aspiration pneumonia in the elderly population. The association between the aspiration of orthodontic material and aspiration pneumonia is not well established. Aspiration pneumonia is a secondary symptom of misdiagnosis or delayed diagnosis of dental material aspiration. Additionally, poor oral hygiene can also increase the risk of aspiration pneumonia in elderly patients since poor oral hygiene during orthodontic treatment leads to plaque retention, which can lead to increased development of hyperplastic gingivitis and periodontal breakdown, established risk factor for aspiration pneumonia.

Keywords: Aspiration, Pneumonia, Foreign body, Dental, Oral hygiene

INTRODUCTION

Orthodontic treatments are a common occurrence in dental practice and are a key reason patients seek dental care. However, complications during routine dental procedures, such as swallowing or aspiration of foreign bodies, can occur. Although both children and adults tend to aspirate foreign bodies, aspiration in dentistry is reported to be higher in the adult population. Accidental ingestion of orthodontic products occurs between 3.6% and 27.7% of the time; of those, 2% to 3.7% require immediate medical attention because foreign bodies clog

the digestive or respiratory tract and cause consequences that could be fatal.[1] Most of the aspirated material passes through the gastrointestinal tract without any problems, while 10-20% require endoscopic removal and 1% require surgical removal.[2-4]

In older adults, most pneumonia cases are caused by aspiration, which is termed "aspiration pneumonia," which is a function-based category of pneumonia. In the older population, aspiration pneumonia is a significant source of morbidity and mortality. Moreover, 30% of those who die of pneumonia are diagnosed with aspiration pneumonia. Many case reports have emphasized the incidence of foreign bodies during dental treatment and its fatal complications, such as pneumonia and other respiratory complications. The type of appliance aspirated or ingested depends on the stage of the orthodontic treatment. The most commonly reported aspirated orthodontic materials are orthodontic brackets, wire fragments, transplant arches, molar bands, activation keys, frayed twin blocks, removable retention appliances, and lingual retainers.[5-9] However, the incidence of broken orthodontic appliances or components constitutes the vast majority.[8]

Even if the orthodontic treatment enhances the quality of life, it may harm oral hygiene since orthodontic appliances frequently collect food particles and plaque and are difficult to clean.[10] Maintaining good oral health requires adherence to oral hygiene routines, especially during orthodontic treatment. Poor oral hygiene can lead to permanent damage to dental tissues, ranging from white spot lesions to dental caries and periodontitis. These elements contribute to aspiration pneumonia in older people.[11]

DISCUSSION

Accidental aspiration of foreign bodies in orthodontic dentistry

Iatrogenic accidents during routine clinical procedures are unpredictable and can occur sometimes regardless of all the possible precautions taken, although they can occur after the completion of dental treatment. Foreign body aspiration is a well-recognized complication of routine dental care such as orthodontic treatment and endodontic procedures. A wide variety of aspirated foreign bodies have been reported in dentistry from teeth, fixed orthodontic materials, restorative materials, and instruments. Patient groups that are at increased risk of aspiration include the elderly, complete denture wearers, sedated patients, patients with organic brain diseases such as Parkinson's, and those with neurological disabilities.[12] These patients may have a decreased gag reflex, functional swallowing impairment, or other abnormalities of the protective airway mechanism. Karmani et al reported that patients who are more prone to the ingestion of orthodontic appliances are those suffering from intellectual disability, epileptic seizures, hyperkinetic disorder, an intense vomit reflex, and panic attacks.[9] Furthermore, a patient lying in the supine position increases the risk of aspiration during dental treatment.[13] In a 10-year institutional review study, Tiwana et al observed that among all dental specialties, fixed prosthodontic treatment had the highest frequency of negative outcomes, followed by orthodontic treatment.[14] A systematic review of 113 case studies by Sonwane et al revealed that 80% of accidentally ingested orthodontic appliances passed eventually through the gastrointestinal system.[1] The reported aspirated orthodontic appliances are the expansion key, archwire and archwire segments, fixed orthodontic brackets, removable appliances, retainer, twin block, orthodontic band material and molar bands and mini screws.[4-21] Some accidents happen in the dental clinic due to the operator's carelessness, while others happen outside the clinic. In a systematic review, 617 cases reported by 45 articles showed that aspirated and ingested dental material cases were more common in older patients.[22] Male patients suffered more than female patients. And the cases were more frequently seen in this fine, time-consuming, and cumbersome procedure. Compared to endodontic materials, aspiration or ingestion of orthodontic appliances is less common and depends on the kind of appliance. However, regardless of shape, size, or even length, any foreign object can be aspirated or ingested.[22] Orthodontic appliances are usually small and difficult to use, especially when covered with saliva. The risk of objects falling back into the oropharynx and being ingested or aspirated is higher when the patient is in the supine position, and it gets worse if you break the appliance.[23]

Most of the accidentally aspirated foreign orthodontic particles entering the oropharynx will pass through the alimentary canal uneventfully. While the presence of a foreign body in the airway can be life-threatening in some cases and necessitates immediate intervention (< 4%).[1] A complete obstruction caused by a foreign body in the larynx may necessitate life-saving first aid and the Heimlich maneuver. According to a previous study, inhaled dental instruments and dental items required statistically more frequent hospitalization than ingested items.[24] Patients are susceptible to this complication, mainly due to the manufacturing limitations of orthodontic materials such as their shape and size, which are smaller and made up of radiolucent materials, which make them easy to swallow and difficult to detect with radiographs. The presence of saliva, difficulty in approaching posterior teeth due to positioning, difficulty with direct vision, and the patient's age can all worsen the risk for aspiration or swallowing.

Despite rare occurrences, endodontic instruments could be ingested or inhaled during the procedure and cause some dangerous secondary complications. Some dental materials are sharp, and therefore, there is a high risk of perforation.[8] With the increasing risk of morbidity, the expenses of specialty care, and the potential liability for negligence and malpractice, which are too high to be

ignored, early recognition and diagnosis are the keys to preventing serious consequences. Any delay in the proper management or timely intervention of such accidents may cause severe sequelae and can be lethal. The symptoms of aspirating a foreign body after dental treatment vary depending on where the object becomes impacted. If it gets stuck above the vocal cords, it could cause acute respiratory discomfort. while dental material of small size typically passes through the cords.[25] Dyspnea, coughing, and stridor are the earliest problems of laryngotracheal foreign bodies; coughing, limited air entry, dyspnea, and wheezing are the initial complications of bronchial foreign bodies.[26] Depending on whether the obstruction is partial or full, hoarseness will accompany obstruction of the larynx or trachea, either with or without cyanosis.[27] Small foreign bodies may not have any immediate impact and go unnoticed until later when secondary symptoms like pneumonia appear.[28] Long-term retention of a foreign body in the lung can result in pneumonia, pneumothorax, paralysis of the vocal cords, and even death.[12] Prior case reports produced evidence of recurrent pneumonia due to aspirated dental restorative material, implants, and prostheses.[13,29,30] When a patient has a history of asthma or when the history of inhalation is unclear, aspiration symptoms may also be disregarded. On the other hand, less commonly encountered chronic diseases such as COPD, asthma, pneumonia, and even tumors might mimic the signs of incorrectly identified foreign bodies when the initial event goes unnoticed, especially in elderly patients or patients with altered mental status.[31-34]

When the diagnosis is not established immediately, retained foreign bodies may lead to recurrent pneumonia and other lung complications such as bronchiectasis, recurrent hemoptysis, pneumothorax, lung abscesses, and pneumomediastinum. A large systematic review of the adult population reported non-resolving pneumonia (30.6%) as the most observed radiological finding in patients with a history of foreign body inhalation, which includes patients who aspirated dental appliances, dental prostheses, dental crowns, etc.[32] Case reports have been published indicating that an unidentified dental treatment foreign body is one of the suspected causes of persistent obstructive pneumonia.[13,35,36] Case reports or epidemiological studies of aspiration pneumonia caused by the inhalation of orthodontic material are not well reported. Even though the probability of misdiagnosis or delayed diagnosis and the development of secondary symptoms due to orthodontic material cannot be omitted due to the possibility of a false positive diagnosis, recurrent pneumonia cases that do not respond to antimicrobial medication should prompt a bronchoscopic test to rule out an obstruction from a foreign body or tumor. Studies have shown that bronchoscopy is superior to radiographs when there is a suspicion that foreign material has been aspirated.[37] Late diagnosis of foreign material aspiration due to the aspiration of orthodontic appliances is rarely encountered in the literatur.[1] Even though, based on the case reports and narrative reviews of other dental materials, early detection of aspirated materials is critical for avoiding complications, Unnoticed or unestablished aspiration of dental material is noticed primarily in geriatric patients. In elderly patients, there is a decrease in psychological and neurological function, which puts them in a greater risk group in this regard. The extraction of aspirated foreign bodies should be undertaken as soon as possible to alleviate acute symptoms and prevent long-term complications. Acute obstruction can be life-threatening, and delaying the removal of foreign objects may make a bronchoscopy technically more difficult. When treating patients who are at high risk of aspiration or swallowing, extreme caution should be exercised. In our opinion, orthodontic material inhalation occurs not only during but also after dental treatment. A patient's failure to properly care for an orthodontic appliance can also cause it to become loose, so it's crucial to teach them how to do so and to promptly notify their doctor if anything goes wrong.[38]

Poor oral hygiene in orthodontic patients and incidence of aspiration pneumonia

It was hypothesized that poor oral hygiene increases the rate of colonization of dental plaque and oral mucosa to cause aspiration pneumonia because aspiration of oropharyngeal flora into the lung is the main pathogenesis of aspiration pneumonia.[39] The colonization of dental plaque and oral mucosa represents a reservoir of potential pathogens that can reach the lung.[40] Even if orthodontic treatment has various recognized benefits like enhancing esthetics, function, and quality of life, orthodontic appliances can cause unwanted complications like enamel demineralization, tooth decay, and gingivitis because of poor oral hygiene. Inadequate pre-treatment oral hygiene and poor oral hygiene during orthodontic treatment led to plaque retention, which can lead to increased development of hyperplastic gingivitis and periodontal breakdown.[41,42] Hence, it is a challenging task to maintain acceptable oral hygiene in patients undergoing fixed orthodontics to prevent dental caries and gingival inflammation. Geriatric people are more at risk for aspiration pneumonia because of poor dental hygiene. It is the second most prevalent infection in nursing facilities, where it is highly lethal, accounting for 86.7% of cases of aspiration pneumonia in the older population.[43] Further, it has been noted that 71% of elderly patients with pneumonia experience silent aspiration while sleeping, and oral bacteria-induced quiet aspiration is likely to be the primary cause of aspiration pneumonia in older individuals.[44] Poor oral hygiene can lead to the aspiration of food particles, fluids, and saliva that are infected with bacteria, which can result in potentially fatal complications like pneumonia. As dental health deteriorates, oral activity's bacterial load rises, and bacteria-filled oropharyngeal material inhaled into the lungs raises the risk of aspiration pneumonia.[45]

Academic disciplines have recognized the importance of oral care in preventing aspiration pneumonia. A cohort study from Korea showed that the risk of pneumonia was

higher in groups with a higher number of dental caries and missing teeth.[46] In contrast, the risk of pneumonia was lower in the frequent tooth brushing group and the regular professional dental cleaning group. Which indicated that improved oral health may reduce the risk of pneumonia.

According to a recent study, patients with pneumonia who have poor dental hygiene have more obligatory anaerobes in their lungs.[47] Due to an older adult's weakened immune system, when oral bacteria in the saliva enter the bronchi and lungs, it is more likely to result in pneumonia. Moreover, periodontal pathogenic bacteria can enter the lung through aspiration in high-risk patients, resulting in pneumonia. Several observational studies found a link between poor periodontal health and an increased risk of nosocomial pneumonia and respiratory disease.[48,49] Terpenning et al found evidence that the presence of periodontal bacteria is an important risk factor for aspiration pneumonia.[50] Also, studies have proven that an increased number of teeth with active periodontal infections increases the risk of complications from aspiration pneumonia as well as being an independent predictor of mortality due to pneumonia.[51] The risk of aspiration pneumonia is increased when periodontal disease, dental caries, and poor oral hygiene are compounded by swallowing disease, feeding problems, and poor functional status, mostly in geriatric patients.[52]

The oral cavities of patients who contract aspiration pneumonia have characteristics such as mucous membranes, soft tissue, teeth, and oral function, which involves retaining moisture in the oral cavity and cleaning the lingual surfaces and palate.[53] By mechanically cleaning the oral cavity, aspiration pneumonia risk can be diminished.[53] The possibility of aspirating orthodontic dental material during treatment is rare, as this research has discussed, and a delayed diagnosis can result in recurring pneumonia and other severe complications. The general public, especially the elderly, may be at risk for micro aspiration pneumonia as a result of conventional orthodontic treatment and concomitantly poor oral hygiene.

CONCLUSION

The association between the aspiration of orthodontic material and aspiration pneumonia is not well established. Aspiration pneumonia is a secondary symptom of misdiagnosis or delayed diagnosis of dental material aspiration. It may increase the risk of recurrent pneumonia. Hence, general dentists and orthodontists must provide precautionary measures to prevent foreign body aspiration to avoid complications. Additionally, poor oral hygiene can also increase the risk of aspiration pneumonia in elderly patients since poor oral hygiene during orthodontic treatment leads to plaque retention, which can lead to increased development of hyperplastic gingivitis and periodontal breakdown, an established risk factor for aspiration pneumonia.

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