SURGICAL MANAGEMENT OF MESIODENS BASED ON CHARACTERISTICS AND COMPLICATIONS OF THE CONDITION: A SYSTEMATIC REVIEW

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ABSTRACT

Disturbances in dental development may result in anomalies, such as supernumerary teeth in the upper or lower jaw. Mesiodens is the most prevalent supernumerary tooth that is often found in the midline of the maxilla and can cause problems, such as malpositioned permanent teeth, diastema formation, cyst formation, and delayed eruption of maxillary anterior incisors. Surgical treatment might be an option for the management of this condition. This study aims to review the characteristics and complications, which need to be considered for the surgical management of mesiodens. A literature search for articles written in English and published within the last 10 years was conducted using the electronic database, PubMed. The keywords verified by Medical Subject Headings included mesiodens, characteristics, complications, and management. A total of 60 articles were retrieved; however, after exclusion, only 45 articles were relevant for evaluation. Subsequently, only 30 articles with full-text versions available online were included in the study. Based on this review, the majority of studies factored in the complications of mesiodens during treatment planning. Very few studies covered the relationship between the characteristics and complications of this condition and its management.

KEY WORDS: surgical management, mesiodens, supernumerary teeth, tooth abnormalities, radiographic study.

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INTRODUCTION

Mesiodens is an abnormality in the number of teeth in the upper or lower jaw, which results from disturbances in dental development [1, 2]. Although the etiology of this condition remains to be understood, several theories have been developed in the past. Among them, the theory of dental lamina hyperactivity is still considered as the main reason for the development of mesiodens [1, 3, 4]. Several cases were shown to be associated with various craniofacial deformities, including cleft lip and palate, Down’s syndrome, and cleidocranial dysostosis [3]. The mesiodens is commonly located at the midline of maxilla as a single, unerupted, and inverted entity. Few studies have shown that mesiodens can be found in the mandible, being bilaterally multiple, already erupting, and growing vertically [2-4]. It occurs more frequently in men than in women, with a ratio of 2 : 1 [1-5]. The prevalence of mesiodens in general population is 0.15-13.9% [3].

Mesiodens can be diagnosed by clinical and radiographic examinations. Clinical examination can reveal the presence of supernumerary tooth or teeth in the midline of maxilla, usually followed by a complication of the condition, including diastema [2, 3]. Radiographic investigations are also performed to evaluate the posi-
tion of mesiodens and the condition of adjacent tooth. Periapical, panoramic, and occlusal radiographs can provide clear information regarding mesiodens [2-4]. In some cases, computed tomography (CT) and cone-beam CT can also be used for diagnoses [2].

Various complications related to mesiodens include delayed eruption of permanent tooth, central diastema formation, and rotation of maxillary anterior teeth. Additionally, root resorption and cyst formation are the less commonly associated complications of mesiodens [1, 2]. The main complaints of patient are based on these complications. The time of diagnosis is an important factor to be considered while managing a mesiodens. In some cases, a patient is diagnosed at the age of 6-10 years based on complaints. Furthermore, the appropriate time for the removal of a mesiodens remains controversial [3].

The characteristics of mesiodens must also be considered for the management of this condition [1, 3]. Some types of mesiodens can be treated by a simple tooth extraction, whereas in some cases, the mesiodens must be removed using complicated methods, including surgical extraction. Surgical procedure can be followed by additional procedures for other complex complications, including orthodontic treatment [1, 4, 5].

It is important to evaluate the optimal management of mesiodens based on the characteristics and complications of this condition. This study aims to review these factors and evaluate their association with the treatment methods used in previous studies.

MATERIAL AND METHODS

A literature search was performed by one author and included electronic database PubMed search for eligible studies published between January 2008 and December 2017. The question “How to determine the management of mesiodens considering the characteristics and complications of the condition?” guided the search strategy. Keywords, such as mesiodens, characteristics, complications, and management were applied to obtain an appropriate result. The final string used was mesiodens *AND characteristics *AND complications *AND surgical management. Additional criteria, such as language and the time of publication, were included. The studies had to be published in English. PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analysis) flowchart was also used. Those with review formats and topics that were unrelated to mesiodens were excluded (Table 1).

RESULTS

During the initial search, 330 articles were shown as results using the keyword “mesiodens”, among which, 155 articles were published within the last 10 years. However, 60 out of 155 articles were excluded because of non-compliance with the aim of this study.

Figure 1 was formulated based on the PRISMA guidelines. After using the terms “mesiodens” AND “characteristics”, we found 14 articles that were published within the last 10 years. Further detailed search using the keywords “mesiodens” AND “complication”, and “mesiodens” AND “management” resulted in 18 and 28 articles, respectively, which were published within the last 10 years. Among a total of 60 articles, 45 articles relevant to our inclusion criteria were identified; however, only 30 full-text articles were available online for downloading (Table 2).

A majority of the studies (25 articles) were single or serial case reports, while the remaining 5 were retrospective studies (Tables 3 and 4). A review of case reports revealed 41 cases of mesiodens in 30 patients (Tables 4 and 5). They were determined based on the characteristics, chief complaints, complications, and management of the condition. Additionally, the characteristics and complications that needed to be considered for the management of mesiodens were determined in the five retrospective studies included in the present study (Table 3).

Most of the retrospective studies showed a prevalence rate of less than 1%, except for the Patil study, which reported a prevalence of > 1% (Table 3). Although the majority of the studies reported a predilection for males, a female tendency was reported in the study by Colak et al. Likewise, the majority of these studies reported that the mesiodens occurs more frequently in young individuals (maximum age, 16 years). The most common characteri-

| Criteria | Inclusion | Exclusion |
|----------|-----------|-----------|
| Period time | January 2008 to December 2017 | Any study outside the period |
| Language | English | Non-English |
| Type of article | Case report, original articles | Review |
| Study focus | Mesiodens, complication, management | Unrelated to mesiodens, complication, and management |
| Geographical area of interest | International studies | None |
| Sample | Human, medical record | None |
| Type of study | Clinical report Retrospective study | Review article |
The characteristics of mesiodens based on the studies were the number (single) and position (vertical) of the supernumerary tooth. However, differences in the eruption status and the shape of the crown were observed among the studies. Furthermore, only one study reported that most patients with mesiodens had no complications (Table 5).

DISCUSSION

As an abnormal additional tooth commonly located at the midline of maxilla, the mesiodens may occur as single or multiple entities. Variations in the eruption status, shape of the crown, and position have been observed. However, the etiology of this condition has not been clearly documented so far. Among the various theories proposed, dental lamina hyperactivity is considered as the most relevant [1-4].

All of the five retrospective studies reviewed in the current study indicated a prevalence of approximately 0.3-1.5%, and a male to female ratio of 1.5 : 2.1 [1-5]. Only one out of these five retrospective studies stated that the mesiodens occurs more frequently in women than in men [4]. The mesiodens were usually found at the midline of maxilla. However, two case studies reported the anterior midline of mandible as the site of mesiodens, which are very rare occurrences [6, 7]. The reason for this predilection for the maxilla remains unknown.

The mesiodens is usually found at a young age, especially in 6-9 years old individuals. However, few case reports have detected this anomaly in older patients (third to fifth decade) [8-11]. The chief complaints of young patients with mesiodens were delayed eruption, central diastema in the maxilla, and axial rotation of the permanent central incisors causing functional and esthetic issues. Older patients may not have been aware of the problem until accompanied by pain or swelling that may be related to the development of dentigerous cyst. Therefore, the timing of chief complaint may affect the timing of diagnosis of mesiodens.

The characteristics of mesiodens can be ascertained from the number, eruption status, shape of the crown, and the position in relation to the adjacent teeth. In a number of instances, the mesiodens occurs more fre-
| No. | Authors                                      | Year | Title                                                                 | Journals                                      | Aim                                                                 | Sample | n  | Type of Study | Time of Experience |
|-----|---------------------------------------------|------|----------------------------------------------------------------------|-----------------------------------------------|----------------------------------------------------------------------|--------|----|--------------|-------------------|
| 1   | Cogulu D, Yetkiner E, Akay C, Seckin O, Alpoz R | 2008 | Multidisciplinary management and long-term follow-up of mesiodens: a case report | The Journal of Clinical Pediatric Dentistry | To present multidisciplinary management of bilateral mesiodens         | Human  | 1  | Case report  | 1 day             |
| 2   | Gunduz K, Celenk P, Zengin Z, Suner P        | 2008 | Mesiodens: a radiographic study in children                           | Journal of Oral Science                       | To describe mesiodens in Turkish children                            | Radiograph | 69 | Retrospective study | 3 years (2003-2005) |
| 3   | Canoglu E, Er N, Cehrel iZC                  | 2009 | Double inverted mesiodens: report of an unusual case                  | European Journal of Dentistry                | To present radiographic features of a unique occurrence of two impacted, inverted mesiodens in a child patient | Human  | 1  | Case report  | 1 day             |
| 4   | Nagaveni NB, Umashankara KV, Sreedevi, Radhika NB, Sathisha TS | 2010 | Multilobed mesiodens with palatal talon cusp: a rare case report      | Brazilian Dental Journal                     | To present a multilobed mesiodens                                   | Human  | 1  | Case report  | 1 day             |
| 5   | Neeraja R, Kayalvizhi G, Baig M              | 2010 | Mandibular mesiodens and maxillary mid-palatal mesiodens: rare occurrences | Pediatric Dental Journal                     | To report two mesiodens in mandibular and mid palatal               | Human  | 1  | Case report  | 1 day             |
| 6   | Hosseini SV, Moradzadeh M, Lotfi M, Aghbali A, Fattahi S | 2011 | Dentigerous cyst associated with a mesiodens: a case report          | Journal of Dental Research, Dental Clinics, Dental Prospects | To present mesiodens with a dentigerous cyst in an 18-year-old woman | Human  | 1  | Case report  | 1 day             |
| 7   | Kazanci F, Celikoglu M, Miloglu O, Yildirim H, Ceylan I | 2011 | The frequency and characteristics of mesiodens in a Turkish population | European Journal of Dentistry                | To know the types and frequency of mesiodens among a group of patients in Turkey | Radiograph | 10 | Retrospective study | 5 years (June 2003-July 2008) |
| 8   | Aysever H, Gunduz K, Orhan K, Aksoy S        | 2012 | An inverted eruption of mesiodens: report of a rare case              | MUSBED                                        | To present an inverted erupted mesiodens in mid-palatal              | Human  | 1  | Case report  | 1 day             |
| 9   | Jindal R, Sharma S, Gupta K                  | 2012 | Clinical and surgical considerations for impacted mesiodens in young children | Indian Journal of Oral Sciences              | To report clinical problems associated with mesiodens management     | Human  | 3  | Case report  | 1 day             |
| 10  | Khambete N, Kumar R, Risbud M, Kale L, Sohdh S | 2012 | Dentigerous cyst associated with an impacted mesiodens: report of two cases | Imaging Science in Dentistry                | To present two rare cases of dentigerous cyst related to mesiodens   | Human  | 2  | Case report  | 1 day             |
| 11  | Sulabha AN, Sameer C                         | 2012 | Association of mesiodens and dens invaginatus in a child: a rare entity | Case Reports in Dentistry                    | To describe dens invaginatus associated with two mesiodens in a child | Human  | 1  | Case report  | 1 day             |
| 12  | Sulabha AN, Sameer C, Umesh K, Ward N       | 2012 | Mesiodens: a radiographic study among the children of Bijapur, India | Journal of Advanced Oral Research            | To know the frequency and the types of mesiodens among children in Bijapur, India | Radiograph | 18 | Retrospective study | 24 months (March 2009-March 2011) |
| No. | Authors | Year | Title | Journals | Aim | Sample | n | Type of Study | Time of Experience |
|-----|---------|------|-------|----------|-----|--------|---|---------------|------------------|
| 13  | Colak H, Uzgur R, Tan E, Hamidi MM, Turkal M, Colak T | 2013 | Investigation of prevalence and characteristics of mesiodens in non-syndromic dental outpatients | European Review for Medical and Pharmacological Science | To know the frequency of mesiodens in a group of Turkish population | Human | 1 | Case report | 1 day |
| 14  | Dave B, Patel J, Swadas M, Mallikarjuna R | 2013 | Multilobed mesiodens: a supernumerary tooth with unusual morphology | BMJ Case Report | To present a multilobed mesiodens in monolocular twins | Human | 1 | Case report | 1 day |
| 15  | Gurgel CV, Cota AL, Kobayashi TY, Silva SM, Machado MAA, Rios D, Garca GS, Oliveira JF | 2013 | Bilateral mesiodens in primary dentition | BMJ Case Report | To present a case of two mesiodens in monolocular twins | Human | 1 | Case report | 1 day |
| 16  | M. Shiwara HS, Bherumugapura FB | 2013 | Molaiiform mesiodens in primary dentition | Case Reports in Dentistry | To report a case of molaiiform mesiodens | Human | 1 | Case report | 1 day |
| 17  | Patel K, Patel N, Venkataraghavan | 2013 | Paired erupted and unerupted mesiodens: a case report | Journal of Clinical and Experimental Dentistry | To present an unusual case of paired erupted and unerupted mesiodens | Human | 1 | Case report | 1 day |
| 18  | Patel S, Prasad T, Srivastava S, Khurana L, Khandelwal S, Khandelwal S | 2013 | Paired erupted and unerupted mesiodens: a case report | Journal of Clinical and Experimental Dentistry | To report an unusual case of paired erupted and unerupted mesiodens | Human | 1 | Case report | 1 day |
| 19  | Vinod K, Venkataraghavan | 2013 | A labially positioned mesiodens and its repositioning as a missing central incisor | International Journal of Case Report and Images | To present a labially positioned mesiodens and its repositioning as a missing central incisor | Human | 1 | Case report | 1 day |
| 20  | Ephrath S, Dina NC, Shabah S, Shabah M | 2014 | A labially positioned mesiodens and its repositioning as a missing central incisor | International Journal of Case Report and Images | To present a labially positioned mesiodens and its repositioning as a missing central incisor | Human | 1 | Case report | 1 day |
| 21  | Sharma M, Parashar K, Kashyap N, Kappadi D | 2014 | A mesiodens in an 8-year-old girl: a case report | American Journal of Advanced Health Sciences | To present a labially positioned mesiodens in an 8-year-old girl: a case report | Human | 1 | Case report | 1 day |
| 22  | Asha MB, Lahoti G, Rajagopalan BL, Raghupathy D | 2014 | A mesiodens in an 8-year-old girl: a case report | American Journal of Advanced Health Sciences | To present a labially positioned mesiodens in an 8-year-old girl: a case report | Human | 1 | Case report | 1 day |
| 23  | Dabade M, Lose J | 2015 | Mesiodens surgery in the deciduous and permanent dentition | RSBO (Revista Sul-Brasileira de Odontologia) | To describe management of two mesiodens | Human | 1 | Case report | 1 day |
| 24  | Dabade M, Lose J | 2015 | Mesiodens surgery in the deciduous and permanent dentition | RSBO (Revista Sul-Brasileira de Odontologia) | To describe management of two mesiodens | Human | 1 | Case report | 1 day |
## TABLE 3. Overview of retrospective studies included in the present review

| No. | Authors                  | Year | Title                                                                 | Journals                      | Aim                                                                 | Sample | n   | Type of Study | Time of Experience |
|-----|--------------------------|------|----------------------------------------------------------------------|-------------------------------|----------------------------------------------------------------------|--------|-----|---------------|-------------------|
| 1   | Gunduz et al. (2008)     | 2008 | Surgical management of palatally placed impacted mesiodens: a case report | USS Case Reports & Reviews    | To present the management of palatally placed mesiodens              | Human  | 1   | Case report   | 1 day             |
| 2   | Kazanci et al. (2011)    | 2011 | Bilateral impacted inverted mesiodens in the palatal vault: a case report | Pediatric Dental Journal      | To report bilateral impacted and inverted mesiodens in the palate    | Human  | 1   | Case report   | 1 day             |
| 3   | Vyas SM, Shah NR, Dave BH| 2014 | Unusual morphology of mesiodens: a case report                        | RRJDS                         | To describe management of an unusual mesiodens                       | Human  | 1   | Case report   | 1 day             |
| 4   | Aoun G, Nasseh I         | 2016 | Mesiodens within nasopalatine canal; an exceptional entity            | Clinic and Practice           | To describe a mesiodens in the nasopalatine canal                    | Human  | 1   | Case report   | 1 day             |
| 5   | Karthik A, Yamin V       | 2016 | Labially positioned conical mesiodens: a rare case report             | International Journal of Life and Biosciences | To report a labially placed mesiodens in a 14-year-old boy           | Human  | 1   | Case report   | 1 day             |
| 6   | Palanisamy V, Rao A, Ongole R, Chacko V | 2017 | Mandibular mesiodens: a rare case report                              | Journal of Oral and Maxillofacial Surgery, Medicine, and Pathology     | To present a mandibular mesiodens                                   | Human  | 1   | Case report   | 1 day             |

## TABLE 2. Cont.

| No. | Authors                  | Year | Title                                                                 | Journals                      | Aim                                                                 | Sample | n   | Type of Study | Time of Experience |
|-----|--------------------------|------|----------------------------------------------------------------------|-------------------------------|----------------------------------------------------------------------|--------|-----|---------------|-------------------|
| 22  | Jain S, Jain P           | 2015 | Surgical management of palatally placed impacted mesiodens: a case report | USS Case Reports & Reviews    | To present the management of palatally placed mesiodens              | Human  | 1   | Case report   | 1 day             |
| 23  | Viswanathan R, Pai S     | 2014 | Bilateral impacted inverted mesiodens in the palatal vault: a case report | Pediatric Dental Journal      | To report bilateral impacted and inverted mesiodens in the palate    | Human  | 1   | Case report   | 1 day             |
| 24  | Kazanci et al. (2011)    | 2011 | Bilateral inverted impacted mesiodens in the palatal vault: a case report | Pediatric Dental Journal      | To report bilateral inverted mesiodens in the palate                | Human  | 1   | Case report   | 1 day             |
| 25  | Vyas SM, Shah NR, Dave BH| 2014 | Unusual morphology of mesiodens: a case report                        | RRJDS                         | To describe management of an unusual mesiodens                       | Human  | 1   | Case report   | 1 day             |
| 26  | Aoun G, Nasseh I         | 2016 | Mesiodens within nasopalatine canal; an exceptional entity            | Clinic and Practice           | To describe a mesiodens in the nasopalatine canal                    | Human  | 1   | Case report   | 1 day             |
| 27  | Karthik A, Yamin V       | 2016 | Labially positioned conical mesiodens: a rare case report             | International Journal of Life and Biosciences | To report a labially placed mesiodens in a 14-year-old boy           | Human  | 1   | Case report   | 1 day             |
| 28  | Palanisamy V, Rao A, Ongole R, Chacko V | 2017 | Mandibular mesiodens: a rare case report                              | Journal of Oral and Maxillofacial Surgery, Medicine, and Pathology     | To present a mandibular mesiodens                                   | Human  | 1   | Case report   | 1 day             |
### TABLE 4. Overview of case reports included in this study

| No. | Authors | Gender | Age (years) | Number | Eruption status | Shape of crown | Position | Chief complaints | Complications | Management |
|-----|---------|--------|-------------|--------|-----------------|----------------|----------|-----------------|--------------|------------|
| 1   | Cogulu et al. (2008) | Female | 8           | Double | Impacted Impacted | Conical Conical | Vertical | Retention of the maxillary primary incisors | Malposition | The extraction of primary central incisors, followed by the surgical extraction of mesiodens and the exposure of the impacted permanent incisors |
| 2   | Canoglu et al. (2009) | Male   | 8           | Double | Impacted Impacted | Conical Inverted | Inverted | Crowding of maxillary anterior | Malposition | Surgical removal of mesiodens under general anaesthesia |
| 3   | Nagaveni et al. (2010) | Male   | 11          | Single | Erupted Multilobed | Vertical | An extra tooth was noticed in the maxilla | Displacement | Extraction Orthodontic treatment |
| 4   | Neeraja (2010) | Case 1 Male | 7           | Single | Erupted Conical | Vertical | No complaint (routine dental check-up) | Space deficiency for the eruption | Extraction of mesiodens Observation |
|     |         | Case 2 Female | 7           | Double | Erupted Conical | Conical Horizontal | The eruption of the tooth in the mid-palate | Delayed eruption | Extraction of erupted mesiodens and surgical removal of the partially erupted one |
| 5   | Hosseni et al. (2011) | Female | 18          | Single | Impacted Conical | Not described | Painless swelling in the upper jaw | Dentigerous cyst | Surgical removal of mesiodens and enucleation in the same visit |
| 6   | Avsever (2012) | Male   | 18          | Single | Erupted Conical | Inverted | Tooth eruption in the mid-palate | No complications | Extraction of mesiodens under local anaesthesia |
| 7   | Jindal et al. (2012) | Case 1 Male | 9           | Double | Erupted Impacted | Conical Inverted | The extra tooth in the upper front region | Displacing 11 labially | The extraction of erupted mesiodens, followed by surgical removal of the unerupted one |
|     |         | Case 2 Male | 10          | Single | Impacted Conical | Inverted | Prodrued incisor | Displacing 11 | Surgical extraction of mesiodens |
|     |         | Case 3 | 9           | Double | Impacted Impacted | Not described Not described | ? ? | Missing permanent left central incisor | Delayed eruption | Surgical removal |

*J Stoma 2020, 73, 5*
TABLE 5. Overview of mesiodens cases among the 25 case reports reviewed in this study

| Aspect                | Criteria                      | n  |
|-----------------------|-------------------------------|----|
| Age                   | ≤ 16 years                    | 23 |
|                       | > 16 years                    | 7  |
| Gender                | Male                          | 20 |
|                       | Female                        | 7  |
|                       | Not described                 | 3  |
| Location              | Maxilla                       | 39 |
|                       | Mandibula                     | 2  |
| Number                | Single                        | 19 |
|                       | Double/Multiple               | 11 |
| Eruption status       | Erupted                       | 15 |
|                       | Impacted                      | 26 |
| Shape of crown        | Conical                       | 26 |
|                       | Uncommon shaped               | 5  |
|                       | Not described                 | 10 |
| Position              | Vertical                      | 19 |
|                       | Horizontal                    | 3  |
|                       | Inverted                      | 14 |
|                       | Not described                 | 5  |

Bayu Rahadian, Vera Julia, Lilies D. Sulistyani

However, Colak et al. reported that the presence of complications, such as dentigerous cysts and root resorption, were reported in some of the case reports reviewed in this study. These types of complications generally occur in long-standing cases (during or after the second decade of life). If associated with a major complaint, the presence of a dentigerous cyst is usually characterized by the major complaints of pain and swelling.

The management of mesiodens can be viewed in terms of the timing (immediate or delayed) and technique (simple or surgical) of removal. Immediate treatment is usually considered for cases that are associated with complications, whereas delayed treatment usually occurs due to the age of patient, the absence of complaints, or when the roots of adjacent permanent teeth have not been fully formed. The age of 8-9 years is considered as appropriate for the procedure using simple techniques or surgery with local anesthesia. In addition, the characteristics of mesiodens, such as the eruption status, must also be considered while performing simple procedures. An impacted mesiodens clearly requires surgery, although local anesthesia might be sufficient for the procedure. However, sometimes a vertically erupted mesiodens might require surgical extraction as long as there is no risk of damage to the adjacent fully erupted teeth [3].

Among the 25 case reports, 41 mesiodens in 30 patients were identified in this study. Immediate removal was carried out in 32 cases, whereas delayed removal was performed in the remaining 4 cases. This is understandable because almost all of these cases presented with complications or the risk of future complications, which could impact the complexity of treatment. The characteristics of mesiodens in relation to their management have not been well documented so far. However, in various cases when mesiodens has fully erupted, it can be removed by simple extraction, but an inverted mesiodens may require surgical removal to avoid damage to adjacent permanent teeth. The number of mesiodens (single or multiple) or form of the crown is generally not considered while determining the treatment method in these cases. On the other hand, the presence of complications, such as dentigerous cyst, can influence treatment planning.

Nevertheless, this review has to be interpreted with caution due to limitation of this study that has used only the PubMed as database information. Further review may use other databases.

CONCLUSIONS

In this study, we reviewed the management of 41 cases of mesiodens based on their characteristics and associat-
ed complications. The chief complaints of patients were dependent on the complications associated with mesiodens. The mesiodens was generally treated when the patient presented to the dentist with a chief complaint. Furthermore, the characteristics of mesiodens (especially, the eruption status and position) were likely to be considered during the management of this condition. Unfortunately, it was not possible to determine the significance of the characteristics and complications on the timing and surgical management of the mesiodens from the 30 articles that were reviewed in this study.

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CONFLICT OF INTEREST

The authors declare no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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