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# Therapeutic solutions for anterior restorations in disabled patients: Systematic review and case report

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## Abstract

**Introduction:** Treating anterior restorations is a real challenge for a dentist and conventional protocols are not always applicable. The aim of this study is to determine different therapeutic to conducting anterior restorations in disabled people.

**Case report:** We begin by presenting the case of a 23-year-old, handicapped man, who was brought in consultation to compensate for the loss of the left upper central incisor (#21).

**Materials and methods:** We then performed a systematic literature review in December 2022, in accordance with the PRISMA guidelines. The publications, on three databases, dealing with dental treatments on disabled people were selected whether they were clinical studies or case reports.

**Results:** In the end, 14 publications were included. Most of the treatments described in the studies ( $n = 10$ ; 71.43%) concern people aged under 19. The patients present different types of handicaps with various degrees of severity and the oral diseases described are as heterogeneous as the handicaps retrieved.

**Discussion:** It is therefore difficult to make common treatment recommendations for all these variable profiles and situations. Most of patients in this study are very young, so there is a need for preventive and therapeutic care as earlier as possible, to preserve the vitality of their teeth and dental occlusion.

## KEYWORDS

case report, handicap, incisor, special care, systematic review, tooth restoration

## 1 | INTRODUCTION

Treating anterior restorations is a real challenge for dentists as it implies a double consideration: aesthetic and functional. The design of a wax-up and then of a clinical mock-up may be very helpful,<sup>1</sup> especially at the era of numeric tools.<sup>2</sup> It is, for example, difficult to imagine the design of a perfectly resistant crown on an upper central

incisor if it is not aesthetic. However, certain compromises must be made in some patients including disabled people. According to the World Health Organization (WHO) in 2011, “disability is the umbrella term for impairments, activity limitations and participation restrictions, referring to the negative aspects of the interaction between an individual (with a health condition) and that individual’s contextual factors (environmental and personal factors).”<sup>3</sup>

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This very broad definition reflects the complexity of defining disability and the multitude of patients it affects.

Performing treatments on persons with special needs is a great challenge for every practitioner, just as the access to dental care is a challenge for disabled people.<sup>4</sup> Conventional protocols are not always applicable: because of the patients' lack of cooperation or communication, dentists must manage both their technical protocols and their patients' behavior.<sup>5</sup> Moreover, disabled people often present complex oral diseases because of a late consultation due to their inability to express their pain and thus the inability of those around them to perceive their discomfort.<sup>6</sup>

The anterior sector represents the first area exposed when smiling so it has a great social and aesthetic role in the life whatever the medical status of the person is.

According to P. Magne and W.H. Douglas, showing an aesthetic smile enhances the personality of the patient.<sup>7</sup> In addition, it is sometimes necessary to answer requests from families or carers who have difficulties seeing the toothless smile of the disabled patient concerned. The emotional effects of tooth loss are well recognized and require sensitive handling in all patients' groups, including special care patients.<sup>8</sup>

However, the boundary between functional and aesthetic is often difficult to determine in disabled patients, where the issues involved in managing a case of anterior rehabilitation are numerous. Rubber dam placement may not be possible<sup>9,10</sup> and prolonged or invasive procedures should be avoided as much as possible by shorter or preventive treatments.<sup>11</sup> The literature does not really provide answers to these problems, because the clinical studies conducted on the survival of anterior restorations are often carried out on able-bodied patients and in compliance with very strict clinical protocols.<sup>12</sup> Most of the reports concerning handicapped patients also concern a low number of subjects, limiting the applicability of care recommendations.<sup>11</sup> The only way to increase the global level of evidence of these case reports or case series is to perform systematic reviews specifically dedicated to case reports.<sup>13</sup> Thus, knowing the variability in the care of handicapped patients, the aim of this study is, first, to report a clinical case of dental restoration in a patient with special needs and then to determine, through a systematic review, different therapeutic solutions that can be launched for anterior restorations in disabled people.

## 2 | CASE REPORT

The case presented here concerns a handicapped man, aged 23, who was brought in consultation in Toulouse University Hospital (Service d'Odontologie des Hôpi-

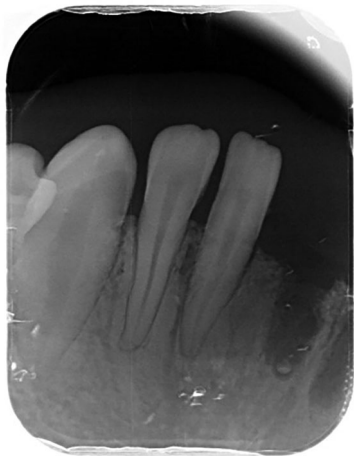


**FIGURE 1** Intraoral radiograph showing the absence of the bridge and residuals of bonding material on tooth #11.

aux de Toulouse, Toulouse, France) to compensate the loss of the left upper central incisor (#21). Indeed, the anamnesis conducted with the accompanying persons revealed that the patient had suffered from an injury with expulsion of the teeth #21 and #31 following a facial injury sustained several weeks previously. The left lateral upper and lower incisors (#22 and 32) were also luxated. In contrast to tooth #21, #31 had been conserved in a saline solution for 6 h and had been reimplanted.

The general health status of the man revealed a severe mental retardation with a history of stroke. The patient did not communicate much and was very uncooperative. Clinical examination was difficult because of the man's repeated and unpredictable movements. This examination did, however, enable us to confirm the absence of tooth #21 and the mobility of tooth #31. The patient presented with a class III malocclusion and an anterior inverted bite. Two possibilities were thus discussed to replace the missing upper central incisor: a bonded wing bridge or an implant.

After few months without any news, the young man was once again brought to the hospital. The upper left lateral incisor #22 presented a slight migration towards the edentulous crest, complicating the central incisor replacement. The patient's poor cooperation contraindicated orthodontic treatment. A full ultrasonic scaling was performed under sedation with nitrous oxide. Then a full-ceramic wing bridge was designed and bonded on the right upper central incisor. Six months later, the bridge had debonded (Figure 1) and needed to be designed again. However, a new self-injury in the next weeks complicated the treatment with avulsions of teeth #31 and #32 (Figures 2 and 3). The people accompanying the patient explained that the young man was hitting himself during periods of crisis, especially on the face.



**FIGURE 2** Intraoral radiograph confirming the complete avulsion of tooth #31.



**FIGURE 3** Intraoral radiograph confirming the complete avulsion of tooth #32.

In view of the difficulties to involved in obtaining cooperation compatible with oral cares, it was decided to plan a general anaesthesia (GA) during which a complete rehabilitation of anterior sectors on the upper and lower jaw would be carried out. Prior to this GA, a numeric registration (PrimeScan, Dentsply Sirona) was performed in order to create 3D-printed models (Figures 4–7) and numerical (Figures 8 and 9) and hand-made wax-ups (Figures 10 and 11).

On the day of the general anaesthesia, the clinical situation was complicated by the absence of three teeth (#21, #31, #32) and the migration of another one (#22) (Figure 12). The main objective of the GA was to create two temporary bridges that brought together teeth #11-(21)–22 and #33-(32)-(31)–41-42-43. The endodontic equipment was available in the operating room if these treatments became necessary during teeth preparations.



**FIGURE 4** Numerical registration of the patient's upper jaw.



**FIGURE 5** Numerical registration of the patient's lower jaw.



**FIGURE 6** numerical reproduction of the patient's occlusion.



FIGURE 7 3D-printed model of the upper jaw.

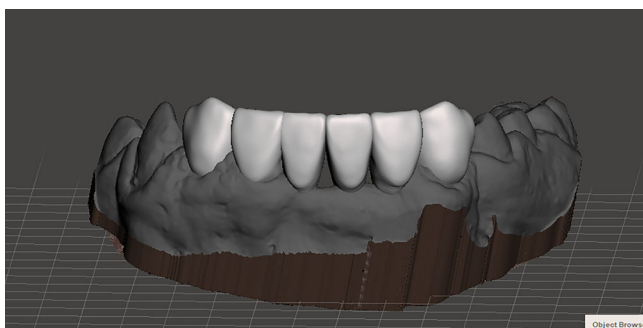


FIGURE 8 Numeric wax-up of the lower incisors.

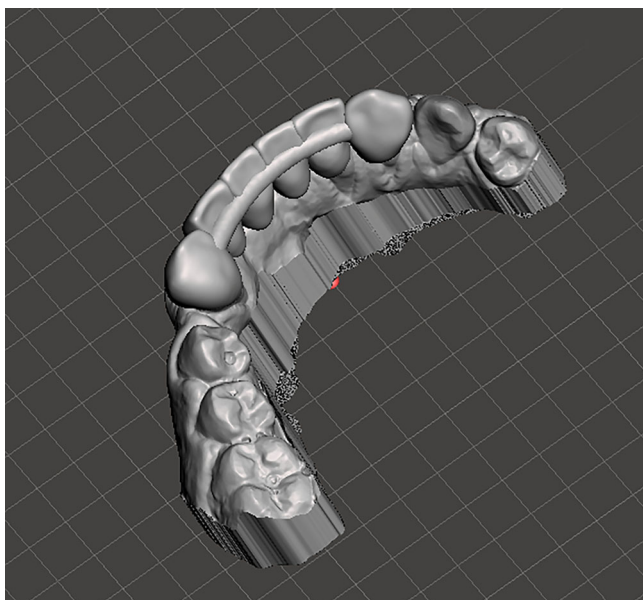


FIGURE 9 Lingual view of the numeric wax-up showing the reinforcement of the teeth.

The mandibular wax-up made it possible to create three incisors to replace the two missing teeth because the patient presented significant diastemas.

Under general anesthesia, two impressions of the upper and lower anterior sectors were performed in order to



FIGURE 10 Wax-up designed manually on the printed model.



FIGURE 11 Occlusion controlling with the lower hand-made wax-up.

have silicone keys of the initial situation if those from the 3D-printed models were not usable. A complete scaling was also performed and an occlusal treatment on tooth #37 prior to the prosthodontic steps. The preparations were performed on the upper jaw and then on the lower (Figures 13 and 14). Injections of Naropein (2 mg/mL) were used to anaesthetize the teeth locally as this molecule presents a long half-life and thus reduces the risk of

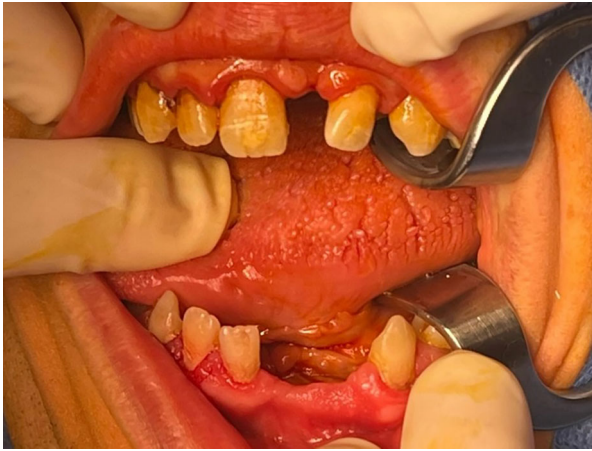


FIGURE 12 Preoperative clinical view of the patient's mouth.



FIGURE 13 Teeth preparation on the upper jaw under general anesthesia.



FIGURE 14 Teeth preparation on the lower jaw under general anesthesia.

post-operative sensitivities. The preparation of abutment teeth #11, #23, #41, and #42 had led to pulpal proximities, so four pulpotomies had been performed on these teeth following a protocol of pulp capping with Biodentine (Septodont, France) and filling with a glass-ionomer cement (Fuji IX, GC Dental). In the absence of rubber dam,



FIGURE 15 Postoperative clinical view of the two temporary bridges.



FIGURE 16 Patient smiling with his permanent bridges.

four-handed work was performed to ensure the best possible isolation. Four abutments were used on the lower jaw in order to obtain a contention effect and thus to limit the risk of failure in case of a new trauma.

After the preparations, double-mixed silicon impressions of each arch were taken to make the custom bridges. The temporary bridges were then made (Structur II, VOCO) thanks to a silicon key copying the wax-up. On the upper jaw, the result obtained with the resin was not optimal as very thin zones were visible. Rebasing was not possible with this material, so it was decided to make this bridge again with an acrylic resin (Uni-fast Trad, GC Dental). Finally, the two bridges have been cemented with a self-curing temporary luting cement (TempBond, Kerr Dental). The replacement of teeth #21, #32, and #31 resulted in significant functional and esthetic improvements (Figures 15 and 16).

For further treatment, several types of final bridge were proposed: metal-ceramic, zirconia, monolithic. The decision must be made considering all elements, that is, aesthetics and potential resistance to future trauma.

This case thus brings to light a new clinical features in the management of anterior restorations in a disabled patient. In view of the global lack of data that may complicate the process of decision making in clinics, the compilation of information described in several case reports can constitute an interesting solution. Here, we propose to perform a systematic review that will allow for in-depth discussion.

### 3 | MATERIALS AND METHODS

A systematic review was performed in December 2022, in accordance with the PRISMA guidelines.<sup>14,15</sup>

#### 3.1 | Eligibility criteria

The publications, written in English or French, were eligible for inclusion in this review if they respected the following PICO logic: they had to concern patients with a handicap and decay treatment and/or restoration onto anterior teeth as intervention. No specific treatment was decided as comparison nor specific outcomes.

#### 3.2 | Information sources

Internet searches were undertaken on three different databases following recommendations on December 12, 2022<sup>16</sup>: PubMed, Science Direct, and Google Scholar.

#### 3.3 | Search

The databases' advanced search systems and keywords were used to identify relevant articles. Given that each website uses a different research engine, the requests were adapted depending on the database on which they were initiated. All the strategies are available in Supplementary File 1.

#### 3.4 | Study selection

At first, the publications dealing with dental treatments on disabled people were selected whether they were clinical studies or case reports. Two evaluators (SA and TC) then performed a two-step screening process based on titles

and abstracts at first, and then on the whole text, to conserve only those publications that clearly presented teeth restorations in the anterior sector.

#### 3.5 | Data collection process

A specific data sheet was created on Microsoft Excel software (Microsoft Excel 2016, Microsoft, USA) to facilitate the extraction of data from the articles. One evaluator (SA) was in charge of reading the articles and filling the data sheet, then a second one (TC) had to perform a second reading to confirm the data. Every modification was discussed between the two evaluators.

#### 3.6 | Data items

Data collected from included publications concerned their authors, their countries, the year of publication, the type of study, the patients' general health (age, type of pathology/handicap), and the forms of oral care described: sedation and therapies applied.

#### 3.7 | Risk of bias

Given that all the included articles are case reports, their scientific relevance, when compared with one another, was already too low to necessitate a bias assessment.

#### 3.8 | Summary measures, synthesis of results, and statistical analyses

No measures were available in the publications so the full results will be presented as a table synthesizing the data retrieved in the articles. The types of publications that have been included did not allow to perform a meta-analysis.

### 4 | RESULTS

#### 4.1 | Study selection and characteristics

Among the 373 results obtained on PubMed, 223 on Science Direct and 469 on Google Scholar, 14 publications were finally included (Figure 17). All are case reports, each one presenting the case of a unique patient except one that presents three cases<sup>17</sup> (only one of the three was retained in accordance with the selection criteria). This type of review that includes only case reports and case series has already been described in the literature as being

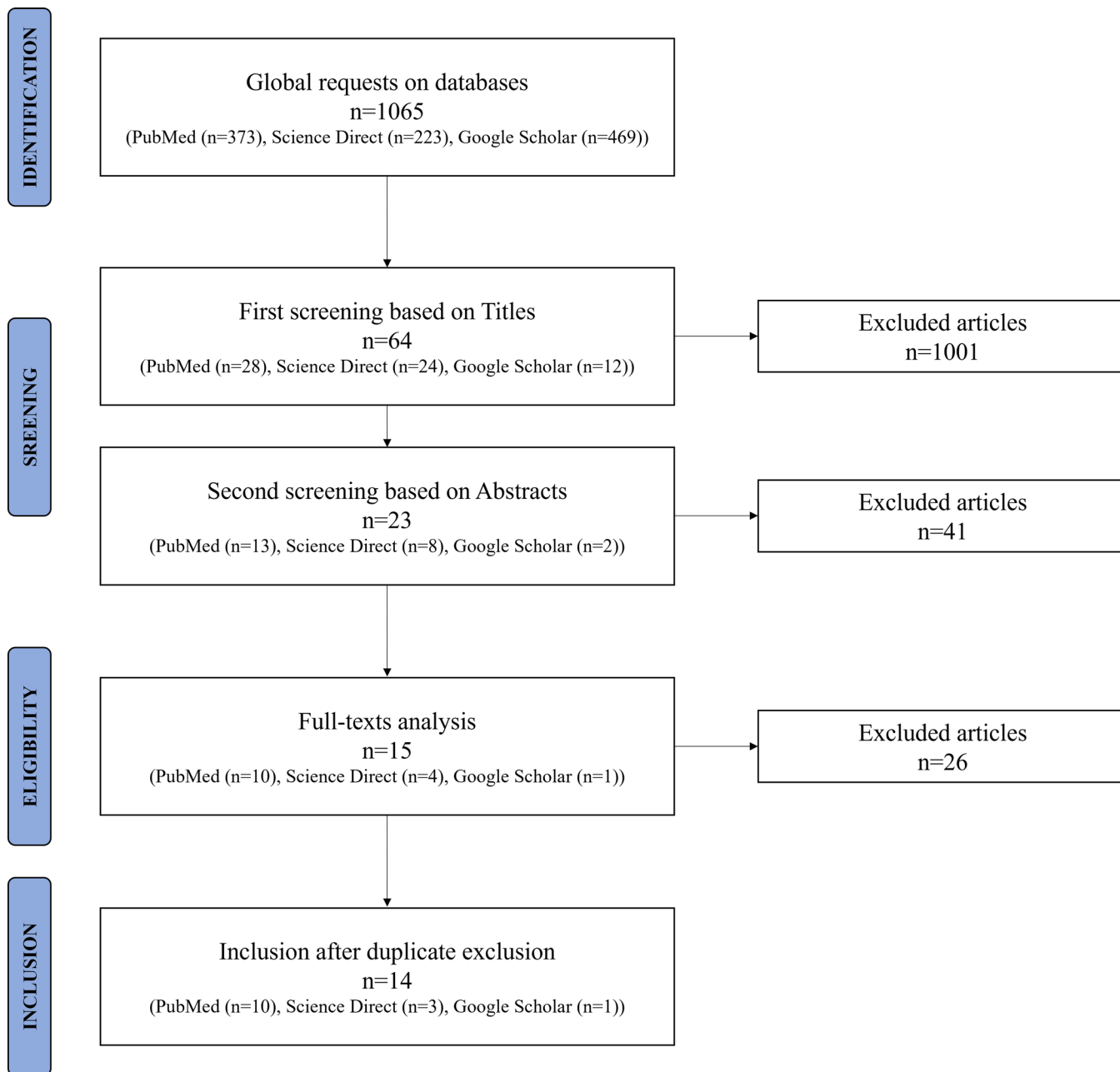


FIGURE 17 Flow chart of the systematic review.

particularly adapted to the description of low prevalence diseases.<sup>13,18</sup>

## 4.2 | Study characteristics

Among the 14 articles included, nine (64.29%) were published in the last 10 years. The oldest dates from 2001.<sup>19</sup> Less than the half of the publications describe patients treated in America ( $n = 6$ ; 42.86%) or in Europe ( $n = 5$ ; 35.71%). The authors are different for all the articles selected.

## 4.3 | Results of individual studies

Most of the treatments described in the studies ( $n = 10$ ; 71.43%) concern young people aged under 19 (mean  $21 \pm 18.15$  years-old). The patients present different types of handicaps with various degrees of severity. Rare syndromes are retrieved in seven cases: Tatton-Brown-Raham syndrome,<sup>20</sup> Pallister-Killian syndrome,<sup>21</sup> Opitz G/BBB syndrome,<sup>22</sup> Nance-Horran syndrome,<sup>23</sup> Sjögren syndrome,<sup>24</sup> fibrodysplasia ossificans progressiva,<sup>25</sup> and Usher syndrome.<sup>26</sup> Regarding the other patients, three suffer from mental retardation,<sup>17,19,27</sup> two from psychomotor



TABLE 1 Main data extracted from the included articles.

Date	Authors	Country	Article type	Handicap	Age	Place of treatment	Oral diseases	Treatments and follow-up	Sedation	Final aesthetics	Cooperation
2021	Burlea et al. <sup>31</sup>	Romania	Case report	Bipolar disorder	59	Hospital	Bridge fracture and pain	Metal ceramic bridge #21-25	No sedation Local anaesthesia		Uncooperative
2020	Paz-Alegria et al. <sup>20</sup>	Colombia	Case report	Tatton-Brown-Rahman syndrome and autistic disorder	7	Hospital	Anterior cavities of both arches, agenesis #22, 32, ectopic eruption #12	Direct composite restoration with "tell-show-do" technique. Patient never returned for follow-up.	No sedation		No verbal communication and aggressive
2018	Noirrit et al. <sup>28</sup>	France	Case report	Encephalopathy, psychomotor retardation, and epilepsy	15	Hospital	Crown fracture #11 without pulp exposition (traumatism)	Indirect restoration: ceramic veneer CAD/CAM-made	nitrous oxide	Good	Insufficient for direct restoration
2018	Young et al. <sup>24</sup>	USA	Case report	Sjögren syndrome	18	Hospital	Cavities	Direct glass ionomer cement restoration. Follow-up: no restorative failures, no chips nor fractures of any kind over 24 months.	No sedation nor anaesthesia	Improved	
2017	Giovani et al. <sup>22</sup>	Brazil	Case report	Opitz G/BBB syndrome	19	Hospital	Cavities on #11, 13, 21, 22, 23 (after orthodontic treatment)	Direct composite restoration			
2016	Didinen et al. <sup>21</sup>	Turkey	Case report	Pallister-Killian syndrome (PKS)	6	Hospital	Cavities on #51, 52, 61, 62	Extraction #51, 52, 61, 62	Moderate conscious sedation		Lack of cooperation
2015	Merigo et al. <sup>17</sup>	Italy	Case report	Mental retardation	7	Hospital	Crown fracture #11 (traumatism)	Direct restoration: collage of the fragment with Er:YAG laser	No sedation nor anaesthesia		
2014	Oliveira et al. <sup>25</sup>	Brazil	Case report	Fibrodysplasia ossificans progressiva (FOP)	26	Hospital	Cavities on #11 and 12	Direct restoration with rubber dam placement without clamping	No sedation nor anaesthesia		Good

(Continues)

TABLE 1 (Continued)

Date	Authors	Country	Article type	Handicap	Age	Place of treatment	Oral diseases	Treatments and follow-up	Sedation	Final aesthetics	Cooperation
2014	Rada <sup>29</sup>	USA	Case report	Psychomotor retardation and gastro-oesophageal reflux disease	64		Dental erosion and sensitive teeth	Indirect restoration: laboratory-fabricated bonded resin ceramic restoration from 14 to 24			Good
2011	Chang et Seo <sup>27</sup>	South Korea	Case report	Mental retardation and epilepsy	22	Hospital	Cavities and crown fracture of maxillary anterior teeth	Direct composite restoration on #13, 12, 11, 21, 22, 23, 32, 33 Indirect restoration #23 (composite veneer)	General anaesthesia	Good	Lack of cooperation
2011	Alonso de la Peña et Valea <sup>26</sup>	Spain	Case report	Usher syndrome	16	Dental office	Maxillary and mandibular anterior teeth enamel hypoplasia	Composite crown in direct technique with strip-crown use	No sedation or local anaesthesia	Expectations fulfilled	Minor communication problems
2006	Ribeiro et al. <sup>30</sup>	Brazil	Case report	18-Trisomy	13	Hospital	Moderate to severe cavities	Direct glass ionomer cement, composite or amalgam restorations with rubber dam placement	No sedation Local anaesthesia		Inability to communicate
2005	Hibbert <sup>23</sup>	Australia	Case report	Nance-Horran syndrome	9	Hospital	Supernumerary anterior teeth in the maxilla and chronic apical periodontitis of the maxillary incisors without known etiology	Extraction of supernumerary teeth Composite veneers on #11 and 21	General anaesthesia form extractions	Good	
2001	Tsai <sup>19</sup>	Taiwan	Case report	Severe mental retardation, cerebral palsy and epilepsy	13	Hospital	Repeated crown and alveolar fracture of the tooth #11	Direct then indirect restoration of #11, 12, 21, 22 then extraction and removable prosthesis	General anaesthesia	Improved	Limited cooperation and under-standing

**TABLE 2** Standard Frankl behavior scale.

<b>Rating 1</b>	DEFINITELY NEGATIVE: refusal of treatment, crying forcefully, fearful, or any other overt evidence of extreme negativism
<b>Rating 2</b>	NEGATIVE: reluctant to accept treatment, uncooperative, some evidence of negative attitude but not pronounced, that is, sullen, withdrawn.
<b>Rating 3</b>	POSITIVE: acceptance of treatment; at times caution. Willingness to comply with dentist, at time with reservation but patient follows the dentist's direction cooperatively.
<b>Rating 4</b>	DEFINITELY POSITIVE: good rapport with the dentist, interested in the dental procedure, laughing, and enjoying the situation.

retardation,<sup>28,29</sup> one has an 18-trisomy,<sup>30</sup> and one presents bipolar disorder.<sup>31</sup>

The oral diseases described in the reports are as heterogeneous as the handicaps of each patient: moderate to severe cavities ( $n = 6$ ; 42.86%), crown fracture of anterior teeth following an injury ( $n = 3$ ; 21.43%), dental erosion, periapical infections, enamel hypoplasia, and even prosthesis fracture.

Various treatments were therefore carried out, mainly direct restorations ( $n = 7$ ; 50%), indirect restorations ( $n = 3$ ; 21.43%), a mix between direct and indirect restorations ( $n = 3$ ; 21.43%), and dental extractions when rehabilitation was not possible.

Three of the selected cases required general anaesthesia to perform the dental treatment required: for extractions or for large indirect and direct restorations. Even if some others have described the use of conscious sedative methods (nitrous oxide, e.g., to bond anterior veneer<sup>28</sup>), half of the patients were treated without sedation (7 out of 14). The degree of cooperation was often noted [only four articles (28.57%) do not bring the precision]. Eight patients are described as exhibiting poor cooperation (57.14%), even going as far as aggression in the case of the patient with Tatton-Brown-Rahman syndrome.<sup>20</sup> Two publications also report an absence of verbal communication.<sup>20,30</sup>

Finally, the reason why no statistical analysis could be carried out in this review is that there is a significant lack of postoperative evaluation. The aesthetics of the restoration is only mentioned in six publications (42.86%) and mainly qualified as improved or satisfactory without further details.

All the treatments performed are presented in Table 1.

## 5 | DISCUSSION

There is a great heterogeneity in the literature review, which is consistent with the great variability of profiles among disabled patients, with different medical and psychosocial profiles and unique needs. It is therefore difficult to make common care recommendations for all these variable profiles and situations.

Dentists need to have a multidisciplinary and adapted approach to each patient in order to understand the particular pathology and its oral, but also general, ramifications. Most patients in this study are very young, so there is a need for preventive and therapeutic care as early as possible, in order to preserve the vitality of teeth and dental occlusion. Regarding treatments, it is difficult to perform indirect restorative care, because of the length and the technicality of the treatment and the invasive nature of the techniques. Authors also favour treatments carried out in a single, relatively short session.<sup>20</sup> The use of general anaesthesia is increased for patients with disabilities, compared to the general population,<sup>32</sup> despite the invasive nature of the intervention. It allows treatment to be carried out in a single session, but it often implies performing tooth extractions more frequently than conservative treatment.<sup>33</sup> Several sessions may be necessary as in the study of Chang and Seo.<sup>27</sup> However, it must be considered that this technique is invasive, has drawbacks and carries inherent medical risks. Moreover, the practitioner must make compromises and usually work in poor conditions.<sup>28</sup>

Cooperation appears to be a major issue in the treatment plan of disabled patients. It can be evaluated with different scales such as the Frankl scale<sup>34</sup> (Table 2), developed by Frankl et al. in 1962.<sup>35</sup> This scale is highly used in pediatric dentistry.<sup>20,36</sup>

Another scale developed by Venham in 1980, is also frequently used and provides more details on children's behavior.<sup>37</sup> The "tell-show-do" technique introduced by Addeleston in 1959<sup>38</sup> is also used to improve patient cooperation. This technique, based on learning theories, is certainly of interest in the care of patients with disabilities. It consists of involving the patient in the treatment by presenting the instruments and the different stages of the protocols, to familiarize patients with the treatment and therefore reduce their anxiety. In our review, two articles used this technique<sup>17,20</sup> and the authors indicated that it allowed them to reduce the anxiety of the patients. A recent study however expressed reservations about its benefits.<sup>39</sup>

New technologies are valuable tools for the care of patients with specific needs: they facilitate care, while reducing chair time and improving patient comfort.<sup>40</sup> This

review has, for example, highlighted the use of CAD/CAM technology<sup>28</sup> to design a ceramic veneer after a crown fracture of a maxillary incisor. This technique is more efficient and less invasive. Er-YAG laser has also been proposed to reattach the fragment in the disabled patient following an upper central incisor crown fracture.<sup>17</sup> This tool makes the treatment shorter and more comfortable for both the practitioner and the patient. From a biological point of view, Er-YAG laser seems to have a significant antiseptic action<sup>41</sup> and reduces the intra-pulpal temperature increase, compared to a traditional wheel.<sup>42</sup> These digital tools fit into a modern and minimally invasive approach in dentistry. They allow precise, functional, and esthetic restorations to be designed while satisfying patients.<sup>43</sup>

Finally, numerical flow can also help in the management of patients's occlusal disorders. In disabled people, multiple tooth extractions can lead to severe occlusal disharmonies that are even more complicated to treat: removable partial dentures may be poorly accepted and implants require invasive surgical procedures. An entire systematic review could be conducted in the future that focuses on precisely this question.

## 6 | CONCLUSION

The rehabilitation of anterior teeth in disabled patients can be a challenge in dental practice. This literature review highlights that conservative procedures are mostly performed directly, with composite resins or glass-ionomer cements, and that the indirect methods benefit from the development of digital tools. As the key factor for successful treatment is the cooperation of the patient, which is itself very dependent on the type of disability, it seems unlikely that we will ever be able to define a common treatment recommendation to rehabilitate the anterior sector for all people with special needs.

## CONFLICT OF INTEREST STATEMENT

The authors declare no conflicts of interest.

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## SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.

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