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Case Report

Global Developmental Delay and Its Considerations in Paediatric Dental Care—A Case Report

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Abstract: Global developmental delay (GDD) is an inability to attain developmental milestones within the anticipated age range. It comprises a delay in two or more of the developmental domains: gross and fine motor; speech and language; cognition; personal and social development; and activities of daily living. With a wide aetiology, GDD can have a major impact on growth and development; it may manifest itself in many diverse medical and dental complications, which necessitate the care from several multidisciplinary healthcare professionals. Of relevance to the paediatric dentistry, special needs dentistry, and orthodontics disciplines, this case report provides an example of a paediatric dental patient with GDD that was both severe and significant. The author outlines the findings, clinical and behavioural management, and future considerations.

Keywords: global developmental delay; medical and dental complications; dental care; oral health; behavioural management; growth and development; multidisciplinary healthcare; paediatric dentistry; special needs dentistry; orthodontic considerations

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1. Introduction

Global developmental delay (GDD) is an incapability to reach developmental milestones within the expected age range. It involves a delay in two or more of the following developmental domains: gross and fine motor; speech and language; cognition; personal and social development; and activities of daily living. GDD is classed as: mild (functional age is 33% below the chronological age); moderate (functional age is 34–66% of the chronological age), or severe (functional age is 66% below the chronological age) [1]. GDD is classified as 'significant,' if there is an underperformance of at least two standard deviations below the age appropriate mean on standardised norm-referenced testing [2]. It is estimated that GDD affects 1–3% of children aged five-years or younger [1].

The causes of GDD can include:

- Genetic (e.g., mucopolysaccharidoses, Duchenne muscular dystrophy, tuberous sclerosis, neurofibromatosis type 1, and subtelomeric deletions);
- Syndromic (e.g., Down syndrome, fragile X syndrome, velo-cardio-facial syndrome, Angelman syndrome, Sotos syndrome, Rett syndrome, and maternal phenylketonuria syndrome);
- Metabolic disorders (e.g., phenylketonuria and medium-chain acyl-coA dehydrogenase deficiency);
- Endocrinal (e.g., congenital hypothyroidism);
- Environmental (e.g., neglectful, fearful, or under stimulated environments);
- Traumatic (e.g., prematurity; acquired brain injury);
- Structural brain abnormalities (e.g., cerebral malformations: neuronal migration disorders; cerebral palsy and dyspraxia);
- Infections (e.g., perinatal: rubella, cytomegalovirus, and human immunodeficiency virus; neonatal meningitis);
- Toxins (e.g., foetal: maternal alcohol or drugs in pregnancy; childhood: lead toxicity) [3].

With a wide aetiology, GDD exhibits a heterogenous clinical presentation. Clinical features are varied and might include: short stature, macrocephaly, flat facial profile, facial asymmetry, midface hypoplasia, generalised hair growth anomalies, and epilepsy [4]. Diagnosing GDD requires detailed prenatal, natal, postnatal, and family histories; thorough clinical tests and examinations of the neuromuscular system; neuroimaging, and advanced metabolic and genetic investigations. To ensure the best outcomes, early and accurate diagnoses need to be established. The responsible physicians can then explore suitable treatment options, perform surveillance for potential complications, provide prognoses, and offer condition-specific family support [5].

2. Case Presentation

2.1. First Appointment

In 2015, a three-year-old, Caucasian boy was referred to the community dental service by a health visitor. In June 2018, the author first saw this patient, then aged seven-years-old, for an assessment appointment, in attendance with his father. The clinical information was as follows:

(i) Medical history (MH)—Conditions:

- GDD;
- Learning disability;
- Blindness;
- Nonverbal communication disorder;
- Sensory processing disorder;
- Neuromuscular disorder;
- Wheelchair dependence for mobility;
- Nutrient and fluid intake via a percutaneous endoscopic gastrostomy (PEG) feeding tube.

Medications:

- Growth hormone injections;
- Melatonin to promote sleep.

Under the regular care of:

- Paediatrics;
- Ophthalmology;
- Endocrinology;
- Neuro-disability;
- Dietetics;
- Speech and language therapy;
- Physiotherapy.

(ii) Social history (SH):

- Lived with parents: mother and father;
- Received additional support from a caregiver;
- Attended a specialist school for blind and partially sighted children with significant learning difficulties and disabilities.

(iii) Dental history (DH):

- No pain;
- Constant bad breath;
- Started to lick certain foods;
- Began to sip tea and soft drinks;
- Parents could not clean the child's teeth with a toothbrush when he was awake;
- Unflavoured toothpaste had not helped;
- A flannel was used to clean the child's teeth when he was asleep;

- Father requested a referral to a dental hospital, for the child to have his teeth cleaned under general anaesthesia (GA).

(iv) Clinical examination (CE)—extra-oral observations:

- Long face;
- High, prominent forehead;
- Bilateral corneal opacities;
- Facial asymmetry.

Behavioural observations:

- Fearful and distressed upon being lifted out of the wheelchair by his father;
- Preferred to sit in his father's lap;
- Opened the mouth slightly;
- Minimal cooperation;
- A limited examination was possible.

Intra-oral observations:

- A severe gag reflex, even when the dental mirror gently touched the intra-oral soft tissues;
- A very uncontrollable tongue;
- All 20 deciduous teeth were present;
- No signs of caries;
- Some plaque on the lower teeth;
- No signs of gingivitis or any other problems.

(v) Outcomes:

- Oral hygiene instruction (OHI), preventive, and dietary advice was given;
- Recommended that the father use his finger wrapped in gauze, a fingertip toothbrush, or a small electric toothbrush to clean the child's teeth;
- Suggested that the father plays the child's favourite music or sounds when attempting to clean the teeth as a distraction;
- Advised the father to try and clean the child's tongue with a flannel or toothbrush;
- Suggested the use of a non-foaming fluoride toothpaste;
- Recommended the father to regularly simulate a dental examination on the child at home for familiarisation—a plastic dental mirror was provided;
- Advised three-month interval examinations to facilitate acclimatisation and systematic desensitisation, and to monitor the child's oral health;
- Referred the child to a dental hospital, as per the father's request but warned that teeth cleaning under GA may not be deemed clinically necessary;
- During August 2018, the child and his parents were seen by a hospital-based consultant in paediatric dentistry—the child's teeth were considered to be caries free with some plaque present; OHI and dietary advice was given, teeth cleaning was not performed, and a six-month review was scheduled.

2.2. Second Appointment

In October 2018, the author saw the patient, then aged eight-years-old, for a second assessment appointment, with his father and caregiver in attendance. The clinical information was as follows:

(i) MH:

- Vomited each morning for the past two weeks due to swallowing problems—this was under medical investigation;
- No other changes.

(ii) SH:

- No changes.

(iii) DH:

- No pain;
- Tolerated a strawberry flavoured toothpaste;
- Parents still used a flannel to clean the child's teeth at night, as other teeth cleaning methods were not accepted;
- No other issues.

(iv) CE:

Behavioural observations:

- Tolerated being placed onto the dental chair by the father;
- Distressed when the dental chair was reclined; therefore, it remained upright;
- Opened the mouth slightly;
- Some cooperation;
- A limited examination was possible.

Intra-oral observations:

- A pronounced gag reflex;
- An uncontrollable tongue;
- All 20 deciduous teeth were present;
- No signs of caries;
- Plaque on the lower teeth;
- Both lower deciduous central incisors were slightly mobile;
- No signs of gingivitis or any other problems.

(v) Outcomes:

- Reinforced OHI, preventive, and dietary advice;
- Advised avoiding acidic foods and drinks—anything that could potentially cause gastroesophageal reflux;
- Suggested that the father or caregiver smear toothpaste on the child's teeth with their finger wrapped in gauze or with a flannel;
- Advised that the lower deciduous central incisors may soon exfoliate and that this should be monitored;
- Cooperation had improved but reminded that regular simulations of the dental examination should still continue at home to further increase cooperation.

2.3. Third Appointment

In January 2019, the author saw the patient, still aged eight-years-old, for a third assessment appointment, with his father in attendance. The clinical information was as follows:

(i) MH:

- Recently hospitalised for a constipation issue, which had since settled;
- The vomiting had been resolved and was attributed as a symptom of the neuromuscular disorder;
- Under investigation for swallowing problems;
- No other changes.

(ii) SH:

- No changes.

(iii) DH:

- No pain;
- A lower anterior deciduous tooth had been lost, likely to have been swallowed, but with no known problems;
- A permanent tooth was erupting in its place;
- Still tolerated having the teeth cleaned with a strawberry flavoured toothpaste and a flannel.

(iv) CE:

Behavioural observations:

- Tolerated being placed onto the dental chair by his father;
- Allowed the dental chair to recline but required encouragement from the father, author (dentist), and dental nurse;
- Music from the father's mobile phone provided comfort as the dental chair was reclined;
- Opened the mouth slightly;
- A limited examination was possible but was much improved.

Intra-oral observations:

- A prominent gag reflex;
- An uncontrollable tongue;
- The lower left deciduous central incisor was absent, and the partially erupted successor was present;
- No signs of caries;
- Some plaque deposits were apparent on the lower teeth;
- No signs of gingivitis or any other problems.

(v) Outcomes:

- Reinforced OHI, preventive, and dietary advice;
- The child showed improved cooperation.

(vi) Future plans:

- Attempt dental examinations in the dental chair to maintain the child's confidence;
- Parents and caregiver were to continue simulating regular dental examinations at home;
- Maintain three-month examinations for further confidence building;
- Monitor for signs and symptoms of the eruption of the first permanent molars;
- Introduce topical fluoride placement on the teeth;
- Provide appropriate dietary advice as oral intake of foods and drinks increases.

3. Case Discussion

This case report provides an example of a child with GDD that was both severe and significant. The child had a number of comorbidities: learning disability, blindness, nonverbal communication, sensory processing, and neuromuscular disorders; he required care from several healthcare professionals. He was likely to score grade 4 (patient has incapacitating disease that is a constant threat to life) on the American Society of Anaesthesiologists (ASA) grading system [6].

Had the child experienced active, painful dental disease, then treatment under GA in an appropriate hospital setting would have been more realistic. However, this may pose great risk to life, as the risk of death may increase with higher ASA scores [6]. The GA experience is also thought to be troublesome for both parents and children [7]; this may be heightened for such a medically compromised child and his parents. Additionally, the child had a neuromuscular disorder, which can typically present with muscle weakness and hypotonia. Airway and breathing problems can result, which might lead to obstructive sleep apnoea and sleep disordered breathing [8]. This poses a further risk for treatment under GA.

Muscle weakness and hypotonia can affect the orofacial musculature to include: the facial muscles, muscles of mastication, lips, and tongue [9]. Relatedly, the child had difficulties in eating, drinking, swallowing, and speech. Excessive drooling and mouth breathing can be additional problems [9]. Muscle weakness disorders can also adversely affect facial growth and cause malocclusion via modifying bone formation at the point of muscle insertion, yielding a narrow, underdeveloped mandible, as well as a generalised underdevelopment of the jaws or disruption of the soft tissue matrix that carries the jaws

downwards and forwards, where the low tongue and mandibular position cannot offset the forces developed by the stretched facial musculature [8]. Consequently, orofacial manifestations can include: an increased facial height, dental crowding, a weaker bite, an anterior open bite, and delayed eruption [10]. Notably, at the age of eight-years, the child had yet to receive his first permanent molars.

GDD can have a significant effect on the central nervous system (CNS) [11]. The child had profound blindness, sensory and nonverbal communication disorders, and a learning disability. The traditional 'tell-show-do' behavioural management approach was adapted into a multisensory 'tell-feel-do' approach. Although the child displayed an absence of cognitive skills and could not comprehend verbal information, instructions, or commands, verbal communication was still important in facilitating voice recognition. Tactile sensation was also important. For instance, when gently pressing the dental mirror against the child's lips, it appeared that he would open his mouth. Furthermore, the child was given ample time to explore his surroundings through touch and sound, to encourage familiarity.

Damage to, or underdevelopment of the CNS, secondary to GDD, can lead to a dysfunction of organ systems, including the gastrointestinal tract. Consequently, oral-motor dysfunction, gastroesophageal reflux, delayed gastric emptying, and constipation can occur. Such comorbidities may cause respiratory distress and aspiration pneumonia (AsP), as well as an inability to feed orally [12]. Particularly, the child was receiving nutrition through a PEG feeding tube; this would have involved an external tube being surgically placed into his stomach. Such a device is indicated for children with dysphagia, feeding disorders, a failure to thrive, a deficient calorific intake, a poor nutritional status, severe disabilities, and/or a gastrointestinal tract obstruction [13].

The child displayed signs of oral aversion; this may be attributable to the sensory processing disorder, an oral-motor dysfunction, and/or a prolonged PEG feeding dependency [14]. Resultantly, toothbrushing or cleaning was intolerable, and only certain tastes or textures were accepted. PEG feeding may result in a low caries risk, as rarely any cariogenic substrate enters the mouth. However, a decreased salivary flow transpires, which might facilitate an overgrowth of oral pathogens. If such microorganisms are aspirated, then AsP may occur [13]. Therefore, prevention was fundamental in this case.

4. Future Considerations

The child was extremely vulnerable and completely dependent on his parents and caregiver, which is likely to continue. These people appeared to be loving and caring towards the child; they were also attentive and receptive to the advice that was given regarding the child's oral health. As with any paediatric patient, it shall always be essential to be watchful for any safeguarding issues such as signs of abuse and/or neglect. Since the father and caregiver communicated wholly on the patient's behalf, it was imperative to build a good rapport with them so that they felt comfortable in providing honest information about the child and his health; such rapport must be maintained. Additionally, dental practices must be equipped to offer parents and caregivers with information on condition-specific family support services that are available within the community.

The child had complex special needs. Thus, it was useful to involve the care of a hospital-based consultant in paediatric dentistry. Such interprofessional input allowed for further monitoring, specialist support, and any necessitating treatment, as well as perhaps further helping to increase the child's familiarity and cooperation. Should the child require an orthodontic opinion, investigation, or intervention, then this hospital-based setting may be able to facilitate the necessary multidisciplinary work with its integrated orthodontics department.

If the child experiences reoccurring vomiting or gastroesophageal reflux problems, dental erosion with potential dentine hypersensitivity could result. Contact may need to be made with the general medical practitioner so that the child can receive the appropriate medical care. As the child increases his oral intake, his diet will need to be assessed. Sensible and practicable food and drink alternatives may need to be recommended. This

could require collaborations with the child's dietician to propose a nourishing diet with a low cariogenic and erosive risk.

It will be important to provide the parents and caregiver with appropriate evidence-based guidance on prevention (e.g., *Delivering better oral health: an evidence-based toolkit for prevention* [15])). However, owing to the child's complex special needs, alternative evidence-based guidance more relevant to his needs (e.g., *Mini Mouth Care Matters—A guide for hospital healthcare professionals* [16]), may be required. For instance, the child's swallowing difficulties or dysphagia must be considered, and thus, the following evidence-based recommendations might be applicable:

- During toothbrushing, the child should be seated in an upright position with his head tilted forward to prevent aspiration;
- Use of an aspirating or suction toothbrush to help remove excess saliva from the mouth;
- Use of a 'curved' toothbrush containing three rows to clean the buccal, occlusal, and lingual/palatal teeth surfaces concurrently;
- Use of oral sponge swabs and gauze to gently massage around the mouth and cheeks to encourage desensitisation;
- Use of oral sponge swabs and gauze to help remove food debris, sticky secretions, and thickened saliva;
- Avoidance of the use of mouthwash, as this may exacerbate the dysphagia and pose a risk to AsP;
- Avoidance of toothpastes containing sodium lauryl sulphate to prevent foaming and hypersensitivity [16].

As the child ages and progresses through the mixed dentition phase, further attention will need to be given to the developing occlusion. Particularly, any future dental crowding might create further difficulties for the parents and caregiver in cleaning the child's teeth. Unremoved plaque will consequently become calculus; this can cause gingivitis and periodontitis, increasing the risk for AsP. It is unlikely that the child will tolerate calculus removal via conventional means, and ultrasonic scaling of the teeth under GA may pose a risk for AsP. Thus, prevention will remain fundamental.

Dental radiographs were not mandatorily indicated in this case. Had they been required, then it would have been likely that radiograph taking approaches would have been intolerable for the child. Such an attempt may have well been traumatic and off-putting for him. Nonetheless, in the future, dental radiography could become necessary. The success of this procedure shall depend on the patient's level of cooperation and the methods used. The technique of oblique lateral extra-oral radiography with vacuum pillows to stabilise the head and neck, might be one helpful approach [17].

Owing to the child's difficulties in eating, drinking, swallowing, and speech, which were secondary to the GDD, he was likely to have had an orofacial myofunctional disorder (OMD). This is a 'dysfunction of the lips, jaw, tongue and/or oropharynx that interferes with normal growth, development or function of other oral structures, the consequence of a sequence of events or lack of intervention at critical periods, that result in malocclusion and suboptimal facial development' [18].

To help improve the child's facial proprioception, orofacial mobility, appearance of tone, nasal breathing, feeding, swallowing, and oral habits; and to prevent further medical and structural complications, facial rehabilitation therapy administered by physiotherapists and/or speech and language therapists may need to be facilitated. However, the child might require specialised orofacial myofunctional therapy (OMT) from suitably trained orofacial myofunctional therapists. Similar to facial rehabilitation therapy, OMT involves exercising the facial and cervical muscles to improve proprioception, tone, and mobility. It aims to treat disorders of the stomatognathic system, including orofacial abnormalities, mouth breathing patterns, lip incompetence, tongue thrust habits, mandibular deviation, and improper joint patterns during speech; chewing and swallowing problems; and para-functional habits including digit or thumb sucking, and bruxism [19,20].

The management of OMD will be multi-professional and complex. The child may need to receive additional care from appropriately trained allergists, osteopaths, chiropractors, massage therapists, occupational therapists, craniosacral therapists, dentists, dental hygienists, educational professionals, nutritionists, oral-maxillofacial surgeons, osteopathic medical physicians, orthodontists, otolaryngologists, paediatric dentists, paediatricians, psychologists, neuropsychologists, and respiratory therapists [20].

It must be remembered that every dental patient with GDD will be different. In addition to this case, one study reports on a case where a seven-year-old boy with severe GDD had developmental delays in speech, language, and cognition. The child required a dental examination and treatment under general anaesthesia. The same study reports on another case where a six-year-old boy with mild GDD initially had a delay in reaching milestones such as walking and speech. However, the child was gradually able to communicate satisfactorily due to rehabilitative treatment. He was able to receive dental treatment with the use of behavioural management, physical restraining, and oral sedation [4].

5. Conclusions

The dental care of children with GDD will not be the same for each child. Henceforth, a universal protocol is not valid. Nevertheless, taking thorough medical, social, and dental histories; adapting to the child's unique persona and needs; building a good, sustainable rapport with the child, parents, and/or caregivers; employing acclimatisation and behavioural management approaches; being empathetic, compassionate and understanding; deciphering systemic health-dental health associations; referring the child to necessary professionals and managing his/her care holistically, taking account of physical, social, and psychological needs; suggesting realistic and practicable alternatives to aid the child's oral care; and engaging in interprofessional and multidisciplinary collaborations to help improve the child's general health, are likely to be invaluable practices.

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Informed Consent Statement: The child's parent consented to the examining of the child at each dental appointment. Written informed consent was obtained from the child's parent with regard to the prospect of a case report being written. However, the parent declined clinical photographs of the child, and this was duly respected.

Data Availability Statement: No new data were created or analysed in this case report. Data sharing is not applicable to this case report.

Conflicts of Interest: The author declares no conflict of interest.

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Short Biography of Author

Dr. Bhaven Modha: After qualifying as a dentist in 2012 from the Universities of Exeter and Plymouth's Peninsula College of Medicine and Dentistry, Dr. Bhaven Modha has had both a varied and unique mix of experience in dentistry, to include dentist positions in general dental practices, secure units including prisons and immigration detention centres; adult and paediatric special needs community dental clinics, university and educational establishments, and as a senior dentist overseas.