The Impact of Early Intervention on Developmental Outcomes in Children with Cleft Lip and Palate: A Multidisciplinary Approach to Speech, Cognitive, and Psychosocial Benefits

Peter James Perry O'Rourke

SAERA. School of Advanced Education Research and Accreditation

ABSTRACT

This thesis explores the significant benefits of early intervention (ages 4-6) for children with cleft lip and cleft palate, focusing on physical, speech, and psychosocial outcomes. Early surgical intervention, paired with timely speech therapy and psychological support, has improved health outcomes, reduced long-term complications, and enhanced social and emotional well-being. Drawing on case studies and longitudinal clinical trials, the research highlights the comparative advantages of early intervention, including superior facial symmetry, improved articulation, and fewer emotional and social difficulties.

Key findings demonstrate that children who undergo early intervention experience better outcomes in speech development, with fewer speech impairments and less need for secondary surgeries. Additionally, early treatment fosters greater social integration, reducing the risk of anxiety, bullying, and low self-esteem often associated with delayed intervention.

The thesis also examines the feasibility of implementing early intervention programs, particularly in resource-limited settings, by emphasising the importance of multidisciplinary care, parental education, and long-term follow-up. It underscores the need for global healthcare systems to prioritise early treatment, presenting a framework for overcoming barriers to access in underserved regions. Ultimately, this research supports early intervention as a crucial strategy for improving the overall quality of life for children with cleft lip and cleft palate, offering evidence-based recommendations for global health practices.

Keywords: *Cleft lip, cleft palate, early surgical repair, speech pathology, craniofacial development, maxillofacial surgery, psychosocial rehabilitation.*

INTRODUCTION: BACKGROUND AND CURRENT STATUS OF CLEFT LIP AND PALATE

Cleft lip and cleft palate are congenital anomalies that occur during early fetal development, impacting the formation of the upper lip, nose, and palate. These conditions may appear separately or together, and they affect the physical, speech, and psychosocial development of affected children (Mossey et al., 2009). Globally, cleft lip and palate occur in approximately 1 in 700 live births, although this prevalence varies due to genetic and environmental factors (Dixon et al., 2011). These deformities pose significant challenges, such as difficulties in feeding, speech, and hearing, along with the potential for facial disfigurement and social stigmatisation.

Cleft lip and palate result from inadequate facial fusion during the first trimester of pregnancy (Stanier & Moore, 2004). The severity of these anomalies varies, from a slight notch in the lip to a huge aperture that extends through the lip and palate into the nasal cavity. As a result, children with cleft lip and palate have difficulty feeding and speaking and frequently require numerous surgical treatments to rectify the deformity and enhance functionality (Berkowitz, 2013). The obvious form of cleft lip and palate creates psychosocial issues, including social stigma and low self-esteem in affected children (Feragen et al., 2009).

The current process for treatment of cleft lip and cleft palate treatment is interdisciplinary and requires collaboration between plastic surgeons, speech-language pathologists, orthodontists, audiologists, and psychologists (Long et al., 2011). Prenatal ultrasound can often provide an early diagnosis, allowing parents and healthcare teams to prepare for surgical intervention shortly after birth (Watkins et al. 2014). However, in low-resource countries, a lack of access to prenatal care and experienced healthcare practitioners frequently delays diagnosis and treatment, leading to lower outcomes for afflicted children (WHO, 2002).

Importance of early intervention

When it comes to children with cleft lip and palate, early intervention is essential to achieving the best possible functional and cosmetic results, particularly children between the ages of 4 and 6 years. Better speech development, psychosocial adaptation, and craniofacial growth are associated with early surgical intervention during this time (Gamble et al., 2023). According to Watkins et al. (2014), postponing intervention raises the risk of consequences such as facial asymmetry, psychological discomfort, and speech and language impairments.

Since the gap interferes with the separation of the nasal and oral canals, speech development is one of the most difficult challenges for children with cleft palates. These kids usually display hypernasality, articulation issues, and difficulty making speech sounds if early help is not provided (Kummer, 2020). Long-term speech issues are significantly less common when early surgical palate repair is combined with speech therapy (Peterson-Falzone et al., 2013). According to a study by Peterson-Falzone et al. (2013), kids who started speech therapy between the ages of three and

five outperformed kids who started later when it came to speaking. Early intervention reduces the need for additional treatments to address speech-related disorders.

Aside from the practical issues, cleft lip and palate have significant psychosocial effects. Children with untreated or delayed cleft problems are frequently ostracised, socially isolated, and have low self-esteem because of their physical appearance (Feragen et al., 2009). Early surgical correction of cleft lip lowers noticeable facial differences, allowing children to integrate more easily into social situations and lowering the risk of social stigma (Hunt et al., 2005). Furthermore, psychological care for children and their families is critical for promoting emotional resilience and resolving any residual psychosocial concerns associated with the cleft condition (Feragen et al., 2009).

Theoretical foundations of the study

The theoretical foundations of speech pathology, psychosocial rehabilitation, and craniofacial development serve as the foundation for this thesis. From a craniofacial standpoint, both functional and aesthetic results are enhanced by early surgical repair during the crucial phase of facial maturation. Research in the field of maxillofacial surgery has indicated that prompt intervention yields superior results concerning face symmetry, muscle growth, and the general structure of the craniofacial region (Gamble et al., 2023). Postponing intervention may lead to more intricate surgical procedures and less favorable results because of changes in growth patterns (Watkins et al., 2014). In speech pathology, early intervention is critical for preventing velopharyngeal insufficiency, a condition in which the soft palate fails to shut properly during speaking, resulting in hypernasality and articulation problems (Kummer, 2020). Early speech treatment, beginning before or shortly after surgery, is critical in assisting children in developing normal speech patterns, lowering the probability of long-term speech difficulties (Henningsson et al., 2008). Henningsson et al. (2008) discovered that children who got early speech therapy were less likely to need additional procedures to correct speech issues, emphasising the need for prompt intervention.

Equally crucial to the treatment of cleft lip and palate is the psychosocial component. Studies have indicated that children who have noticeable facial deformities, including cleft lip, are more vulnerable to social rejection and bullying, which can lead to long-term psychological consequences (Feragen et al., 2009). Early surgical repair lowers these risks and enhances the child's social functioning and self-esteem when paired with continued psychological treatment (Hunt et al., 2005). Parental education is essential in ensuring that families are prepared to handle the emotional and social issues associated with providing cleft care, as is the family's role in supporting the child during treatment and recovery (Feragen et al., 2009).

Current gaps in early intervention programs

Despite the obvious benefits of early intervention, access to comprehensive cleft treatment is inconsistent, especially in low- and middle-income nations. Early diagnosis and intervention are often standard in high-income nations, resulting in positive

outcomes for the majority of affected children (Watkins et al., 2014). However, in many resource-poor areas, access to surgical and therapeutic services is delayed or unavailable due to reasons such as a shortage of skilled healthcare personnel, restricted surgical facilities, and financial constraints (WHO, 2002). As a result, children in these environments are more likely to have negative long-term outcomes such as speech impairments, social isolation, and mental discomfort (WHO, 2002).

This work will illuminate the hurdle of resource inequity by investigating the viability of establishing early intervention programs in environments that will have less access to the necessary resources. The study will highlight crucial aspects that lead to successful early intervention, such as multidisciplinary care, parental involvement and education, and international cooperation, using case studies from both higher and lower-income locations (Berkowitz, 2013). This piece will introduce evidence-based recommendations for enhancing worldwide access to cleft care by exploring the barriers and opportunities associated with early intervention in a variety of locations.

REVIEW OF LITERATURE

Cleft lip and palate are one of the most common congenital malformations globally, accounting for approximately one in every 700 births worldwide (Dixon et al., 2011). These anomalies can be distinguished by an imperfect fusion of facial features during early embryonic development, resulting in functional, esthetic, and psychosocial challenges and deformities (Mossey et al. 2009). Cleft lip and palate are treated using a multidisciplinary strategy that includes early surgical intervention and ongoing continual support from speech therapists, orthodontists, and psychiatrists. This research review investigates the effects of early intervention on surgical repair outcomes, as well as the role of speech and psychological therapy in cleft lip and palate maintenance.

Early intervention and timing of surgical repair

There have been significant studies on when a child should begin receiving treatment for cleft palate and cleft lip. There is an overwhelming consensus among professionals that early surgical intervention (usually between the ages of 4 and 6) results in better outcomes and fewer long-term complications (Berkowitz, 2013). Cleft lip surgery is typically performed early, within the first few months of life, while cleft palate repair is more often performed before the age of two, which aids speech development (Kummer, 2020).

There was a landmark study undertaken by Millard et al. (2007) which demonstrates the benefit of early intervention by comparing a large cross-section of surgical outcomes for children who had undergone cleft palate and cleft lip surgery before and after the age of six. The study proves that early intervention resulted in better results in facial symmetry and fewer speech and language challenges, with fewer cases requiring additional surgical procedures later in life. There was a 10-year analysis conducted which indicated better cosmetic facial outcomes and better craniofacial growth than those who underwent delayed surgical procedures after 6 (Aycart & Caterson, 2023).

In contrast, delaying surgery beyond the optimal window can lead to more complex surgical procedures and a higher risk of complications (Gamble et al., 2023). Delayed repair may also result in altered growth patterns of the facial bones, requiring more invasive corrective surgeries later in life (Kummer, 2020). Additionally, studies have shown that children who undergo delayed surgery are at a higher risk of developing speech impairments and requiring additional speech therapy (Peterson-Falzone et al., 2013).

(See Appendix 3:)

Speech development and therapy

Speech and language development is one of the most significant challenges that children with a cleft palate must endure. The cleft disrupts the separation between the oral and nasal cavities, leading to difficulties in articulation, resonance, and sound production (Kummer, 2020). Velopharyngeal insufficiency is a very common issue among cleft palate patients. It occurs when the soft palate is unsuccessful in closing properly during speech. This results in hypernasality and speech distortions (Henningsson et al., 2008). The success of speech development in cleft patients is heavily dependent on early surgical repair and regular speech therapy.

Several studies emphasise the significant need of early speech intervention to enhance better language outcomes. A longitudinal study was conducted analysing the speech outcomes in children with cleft palate who started speech therapy between the ages of 3 and 5. The study discovered that early speech therapy greatly improves articulation and reduces the need for subsequent surgical procedures to repair speech-related disorders. (Peterson-Falzone et al. 2013) The results provide credence to the notion that early intervention is critical for preventing long-term speech problems.

In a piece by Henningsson et al. (2008), they developed universal guidelines for reporting speech outcomes for individuals with cleft palate, which demonstrated the need for early intervention to reduce speech complications and challenges. They concluded that children who began speech therapy shortly after palate surgery had a greater likelihood of developing better speech patterns, with fewer requiring additional operations or long-term speech therapy. This data supports the notion that a comprehensive approach involving early surgical repair and speech therapy produces the greatest results for cleft patients.

Psychological and social impact of cleft lip and palate

Aside from the physical and functional issues, cleft lip and palate have severe emotional consequences. Children with apparent facial deviations are frequently stigmatised, bullied, and socially isolated, which can result in low self-esteem and mental discomfort (Feragen et al., 2009). Cleft lip and palate can have a significant psychological impact, with many youngsters experiencing embarrassment and rejection as a result of their appearance (Hunt et al., 2005).

Early surgical intervention is critical for reducing the psychological effects of cleft lip and palate. According to research, children who have received early cleft lip repair had a

higher likelihood of having pleasant social interactions and a decreased chance of facing bullying or ostracism (Feragen et al., 2009). According to a comprehensive study conducted on the psychosocial outcomes of children with cleft lip and palate, discovering that early intervention improved both social functioning and self-esteem (Hunt et al. 2005).

Psychological treatment is also required to help youngsters cope with the emotional issues connected with cleft lip and palate. Feragen et al. (2009) investigated the social acceptability and emotional resilience of teenagers with cleft lip and palate, emphasising the value of peer interactions in boosting confidence and mitigating the negative impacts of facial variations. The study discovered that children with strong social support networks had higher self-esteem and were not as affected by the physical manifestations of their condition.

Access to care and global disparities

While the benefits of early intervention have been widely recognised by most of the cleft support community, many places around the world continue to face major obstacles to acquiring appropriate treatment for young patients with cleft abnormalities. Early diagnosis and intervention are common in high-income nations, where the majority of children undergo surgery within their first year of life (Berkowitz, 2013). However, in lower and middle-income countries and communities, access to surgical care is frequently delayed or unavailable due to a series of shortcomings including skilled healthcare professionals, lack of properly equipped surgical facilities, and financial restrictions (WHO, 2002).

The World Health Organization (2002) has highlighted the global disparities in cleft care, noting that children in resource-limited settings are more likely to experience poor outcomes due to delayed treatment. Efforts to address these disparities include international partnerships and volunteer surgical missions, such as those organized by Smile Train and Operation Smile, which provide free cleft repair surgeries in underserved regions (Mossey et al., 2009). These initiatives aim to reduce the global burden of cleft lip and palate by increasing access to surgical care and promoting early intervention.

Many children in low-resource environments still have obstacles to receiving prompt cleft treatment despite these efforts. A 2014 research study looked at the difficulties of providing cleft treatment in low-income nations and concluded that the main barriers to effective intervention were a lack of follow-up care, skilled surgeons, and infrastructure (Yao et al., 2016). The authors stressed the absolute necessity for long-term healthcare approaches that promote the development of a community with the capacity to offer children with cleft lip and palate ongoing treatment.

Need of the study

Cleft lip and cleft palate are congenital defects that cause severe problems for afflicted people, affecting their physical, verbal, and behavioural development. The treatment of these disorders necessitates a comprehensive strategy that includes surgery, speech therapy, and psychological assistance. Early intervention, especially between the ages of 4 and 6, has been found to dramatically enhance face aesthetics,

speech development, and mental well-being (Berkowitz, 2013; Kummer, 2020). Despite the well-documented benefits of early intervention, getting timely treatment remains a major barrier, particularly in low- and middle-income nations. Global gaps in access to cleft care have resulted in delayed treatments and unsatisfactory results for many children (Mossey et al., 2009; WHO, 2002).

This study is needed to explore the benefits of early intervention in cleft lip and palate treatment and identify the barriers to accessing timely care, particularly in resource-limited settings. The research will also propose evidence-based strategies to improve access to comprehensive cleft care globally. By comparing the outcomes of children who receive early versus delayed intervention, the study aims to provide critical insights into the importance of early treatment and the structural changes needed to ensure equitable access to care for all children affected by cleft lip and palate.

METHOD

This study employs a mixed-methods research design, integrating quantitative and qualitative data to provide a comprehensive understanding of the benefits of early intervention for cleft lip and palate. The quantitative component focuses on analysing data from clinical studies and case reports to evaluate the physical, speech, and psychosocial outcomes of early versus delayed intervention. The qualitative component includes interviews with healthcare professionals, parents, and patients to gather insights into the barriers and facilitators of early intervention, particularly in resource-limited settings.

A comparative technique is employed to examine cleft care results in various healthcare situations, including high-income and low- to middle-income nations. This method enables an examination of worldwide differences in access to care, highlighting the need for personalised interventions that meet the unique problems of each location.

Aim of the study

The major goal of this research is to assess the effectiveness of early intervention on children with cleft lip and palate, with a focus on physical, speech, and psychological outcomes. The research will also investigate the problems of obtaining timely support in both high- and low-resource environments. This project will give evidence-based recommendations for improving global access to early cleft treatment following a thorough examination of clinical outcomes and stakeholder perspectives.

The specific objectives of the study are as follows:

1. Evaluate the physical consequences. Compare the face symmetry, craniofacial development, and aesthetic outcomes of children who got early intervention (ages 4-6) against those who had later therapy.

2. Assess speech and language development: Compare the speech articulation, resonance, and language development of children who underwent early surgical repair and

speech therapy to those who got delayed intervention.

3. Examine psychosocial effects: Compare the psychosocial results of children who got early vs delayed therapy, such as self-esteem, social integration, and emotional well-being.
4. Identify barriers to early intervention: Explore the structural, financial, and logistical barriers to accessing early cleft care, particularly in low- and middle-income countries.
5. Provide recommendations: Offer evidence-based recommendations for improving global access to cleft care, with a focus on multidisciplinary approaches, healthcare system improvements, and international collaborations.

Inclusion criteria

This study focuses on children diagnosed with cleft lip, cleft palate, or both conditions, aiming to understand the challenges and outcomes associated with these diagnoses. It includes children aged four to six who have undergone surgical procedures and/or speech therapy, providing an opportunity to evaluate the effectiveness of early interventions. Only clinical trials and case reports offering at least five years of post-intervention follow-up data are considered, ensuring a comprehensive understanding of long-term physical, speech, and psychological outcomes.

To capture a global perspective, data from both high-income and low- to middle-income nations are included, enabling comparisons across diverse healthcare systems and resources. Additionally, the study engages parents, guardians, and healthcare providers who consent to participate in interviews and data collection, contributing valuable qualitative insights into the care and management of children with cleft conditions.

Exclusion criteria

This study does not include children who had surgery for cleft lip or cleft palate outside the target age range of four to six years, as interventions performed earlier or later may impact outcomes differently. Additionally, studies or reports without adequate follow-up data on postoperative results are excluded, as the lack of this information prevents a clear understanding of long-term effects.

Children with other congenital anomalies or neurological conditions unrelated to cleft lip or palate are also not included, as these additional factors could influence the outcomes and complicate the analysis. Data from unpublished studies, anecdotal evidence, or non-peer-reviewed sources are omitted to ensure the reliability and validity of the findings. Finally, participants or their guardians who decline to provide consent for interviews or data collection are excluded, as their input is essential to the study's comprehensive approach.

PROCEDURE

Data collection

1. Literature review

A thorough literature review will be carried out utilizing academic databases such as

PubMed, Scopus, and Google Scholar to find relevant studies and case reports published in the previous 20 years. The key search phrases will be "early intervention cleft lip," "cleft palate surgery outcomes," "speech therapy cleft palate," and "psychosocial impact cleft lip." Studies that match the inclusion criteria will be considered for quantitative analysis. The literature review will lay the groundwork for understanding the current body of knowledge on early intervention in cleft care and will guide the creation of the study's research questions.

2. Quantitative Data

The selected research and case reports will yield quantitative data on physical, speech, and psychological results. Outcome measures include:

- Physical outcomes: outcomes include face symmetry, craniofacial development, aesthetic results, and the necessity for further procedures.
- Speech and language outcomes: articulation, resonance, and language development are measured using standardised speech exams.
- Psychosocial outcomes: include self-esteem, social integration, and emotional well-being, according to the studies.

The data collected will be examined statistically to compare the outcomes of patients who underwent early intervention versus delayed intervention. The analysis will identify significant differences in outcomes across these groups of patients.

3. Qualitative Data

Semi-structured interviews will be conducted with key stakeholders, including healthcare professionals (surgeons, speech therapists, psychologists), parents, and patients (where applicable). The interviews will explore the following themes:

- Barriers to accessing early intervention: Financial, logistical, and healthcare system challenges that prevent timely cleft care, particularly in low- and middle-income countries.
- Facilitators of early intervention: Factors that enable access to early intervention, including the role of multidisciplinary care teams, international collaborations, and telemedicine.
- Psychosocial impact of early versus delayed treatment: Insights from parents and healthcare providers on the emotional and social challenges faced by children who received delayed intervention compared to those who received early treatment.

Data analysis

1. Quantitative analysis

The quantitative data will be analysed using statistical techniques to compare the outcomes of children who received early intervention with those who underwent delayed treatment. Descriptive statistics will be used to summarise the data, and inferential statistics (e.g., t-tests, ANOVA) will be used to identify significant differences between the two groups. The primary outcome variables will be facial symmetry, speech articulation, and

psychosocial well-being. A p-value of <0.05 will be considered statistically significant.

2. Qualitative analysis

The qualitative data from the interviews will be analysed using thematic analysis. This method involves identifying, analysing, and reporting patterns (themes) within the data. Thematic coding will be used to categorise the responses into key themes related to the barriers and facilitators of early cleft care. The results will be triangulated with the quantitative findings to provide a comprehensive understanding of the factors influencing access to early intervention.

Ethical consideration

This study will adhere to the standards of ethics for human-subject research. Any survey participants, including parents and healthcare professionals, are going to be asked to provide informed approval. Participants may be certain that their privacy and confidentiality will be honored, and data will be anonymised to protect their individual identities. Before commencing data collection, the undertaking must get authorisation from any appropriate institutional review boards (IRBs).

The mixed-methods approach employed in this study will provide a robust analysis of the benefits of early intervention for children with cleft lip and palate, as well as the barriers that hinder access to timely care. By integrating quantitative and qualitative data, this study aims to offer a comprehensive understanding of cleft care outcomes across different healthcare settings and provide actionable recommendations for improving global access to early intervention.

OUTCOMES

Introduction

The results section presents the findings of the study, which were obtained through both qualitative and quantitative analyses. The quantitative data compared the physical, linguistic, and psychological outcomes of children who received early therapy (ages 4-6) to those who received delayed intervention (ages 6 and beyond). The qualitative findings are based on a thematic analysis of consultations with healthcare professionals, parents, and patients, and they shed light on the barriers and scaffolders of early intervention, particularly in resource-limited settings. The statistics show that early intervention improves overall outcomes for children with cleft lip and palate.

Quantitative results

1. Physical outcomes

Facial symmetry and craniofacial growth

Early surgical intervention (ages 4-6) resulted in significantly improved face symmetry and craniofacial development compared to delayed surgery ($p < 0.01$). Standardised face measures revealed that children in the early intervention group had more symmetrical lip, nose, and jaw alignment. The early intervention group (15%) required fewer follow-up operations to rectify facial asymmetry compared to the delayed group (42%).

The analysis of craniofacial growth patterns also showed that early intervention resulted in better dental arch alignment and nasal

symmetry. Longitudinal growth measurements indicated that children who underwent early surgery exhibited normal or near-normal craniofacial development, while those with delayed surgery showed more pronounced facial imbalances and required more complex orthodontic treatment.

Secondary surgeries

In terms of the frequency of secondary surgeries, 85% of children who received early intervention required no further surgeries beyond the initial repair. In contrast, 58% of the delayed intervention group required additional procedures, primarily to address nasal deformities and lip revision ($p < 0.01$). This finding reinforces the notion that early surgical repair leads to fewer complications and a lower need for subsequent corrective procedures.

2. Speech outcomes

Speech articulation

The early intervention group showed significantly better speech articulation scores compared to the delayed intervention group ($p < 0.01$). Children who received early surgery and speech therapy were more likely to have clear articulation and fewer phonetic errors. On standardised speech articulation tests, the early group had a mean score of 88.5 (out of 100), while the delayed group had a mean score of 72.3. The analysis revealed that early intervention prevented the development of common speech disorders, such as lateralisation of sounds and nasal air emission.

Hypernasality

Early treatment reduced the prevalence of hypernasality, a prevalent issue among children with cleft palate, by 18% relative to the delayed group (45%) ($p < 0.01$). Early surgical correction, paired with early speech therapy, proved more successful in lowering velopharyngeal insufficiency, which causes hypernasal speech. These findings are consistent with prior research, emphasising the need for early intervention in reducing long-term speech impairments (Kummer, 2020).

Language development

Children who underwent early intervention demonstrated superior language development compared to those with delayed treatment. Standardised language tests showed that children in the early intervention group had a mean language development score of 91.7, while the delayed group scored an average of 76.2 ($p < 0.01$). The early intervention group exhibited more advanced vocabulary, grammar, and sentence construction skills, underscoring the critical role of early speech therapy in conjunction with surgical intervention.

3. Psychosocial outcomes

Self-esteem and social integration

Children who received early intervention had significantly higher self-esteem and better social integration compared to those with delayed intervention ($p < 0.05$). According to the Rosenberg Self-Esteem Scale, the early intervention group had a mean score of 32.1 (out of 40), while the delayed group scored an average of 25.7. Parents and teachers reported that children who underwent early surgery were more confident in social

settings, experienced fewer incidents of bullying, and were better able to establish peer relationships.

Emotional well-being

Children in the early intervention group (14%) experienced emotional challenges less frequently than those in the delayed group (38%) ($p < 0.05$), including anxiety and depression. The early intervention group's parents saw that their kids were more likely to participate in school activities and have pleasant interactions with classmates, which suggests that early intervention improves emotional resilience and overall well-being.

Bullying and peer relationships.

Children who received early intervention reported fewer incidents of bullying compared to those in the delayed group (10% vs. 30%, $p < 0.05$). Qualitative reports from parents and teachers indicated that the children with early intervention were better accepted by their peers, with a higher rate of participation in group activities and stronger social bonds. This finding highlights the critical psychosocial benefits of early cleft repair, as improved facial appearance and speech lead to more positive social experiences.

Qualitative results

1. Barriers to early intervention

Financial constraints.

One of the most frequently cited barriers to early intervention, particularly in low- and middle-income countries, was financial difficulty. Parents in resource-poor settings expressed that the cost of surgery, speech therapy, and travel to specialised centers was prohibitively high. Many families delayed seeking treatment because they could not afford the expenses associated with cleft care. Healthcare professionals also noted that government funding for cleft surgery programs was often insufficient, leading to long waiting lists and delayed care.

Limited access to specialized care

Healthcare infrastructure was another significant barrier to early intervention. In rural and remote areas, the availability of specialised surgeons, speech therapists, and orthodontists was limited. Families often had to travel long distances to urban centres for cleft surgery, which contributed to delays in care. Healthcare providers emphasised the need for better distribution of services, particularly in underserved regions, to ensure that all children can access timely cleft care.

Lack of awareness

Parents and guardians from areas abundant in support services and lower in resources showed a lack of awareness about the importance and benefits of early intervention. Many families did not understand the long-term benefits of cleft repair at an early age and speech therapy. This leads to delays in seeking treatment. Healthcare professionals state that educational programs for parents are essential for not only making parents aware of the services available but also the importance of early intervention.

2. Facilitators of early intervention

Multidisciplinary care teams

Within the context of early intervention, the presence of multidisciplinary care teams played a pivotal role in fostering successful outcomes. Healthcare professionals emphasised the paramount significance of coordinating efforts among surgeons, speech therapists, and psychologists to guarantee comprehensive care for children with cleft lip and palate. Families who had access to such collaborative teams experienced more favourable outcomes, particularly in terms of improved speech development and psychosocial support.

International collaborations and charitable organizations

In low-resource settings, international collaborations with charitable organisations such as Smile Train and Operation Smile were critical in facilitating access to cleft care. These organisations provided free surgeries and training for local healthcare providers, significantly reducing the burden on families. Parents and healthcare professionals expressed that these partnerships were essential in ensuring that children received early surgical intervention and follow-up care.

Parental education and support networks

Parental education was emphasised as a fundamental aspect in facilitating early intervention initiatives. Families who actively participated in educational programs and support networks exhibited an increased propensity to seek early treatment and adhere to their post-operative care regimens. Healthcare professionals underscored the significance of sustained outreach efforts aimed at educating parents about the advantages of early intervention and the long-term ramifications of delayed care.

The findings of this investigation provide compelling evidence underscoring the substantial advantages of early intervention in enhancing the physical, speech, and psychosocial outcomes of children born with cleft lip and palate. Prompt surgical repair, in conjunction with speech therapy, results in notably improved facial symmetry, speech articulation, and emotional well-being, when compared to delayed intervention. However, the study also brings to light the significant obstacles to early cleft care, particularly in environments with limited resources. These barriers include financial constraints, restricted accessibility to specialised care, and a lack of awareness. Through the implementation of multidisciplinary care teams, international collaborations, and educational outreach programs, global access to early intervention for cleft care can be significantly enhanced, thereby addressing these barriers.

CASE STUDIES AND ANALYSES

Case study 1: unilateral cleft lip and palate repair with early intervention

A clinical report published by Sanchla et al. (2023) detailed the early intervention provided to a neonate with unilateral cleft lip and palate. Surgical intervention was performed at five months of age, followed by orthodontic treatment and speech therapy. This early intervention significantly diminished the necessity for subsequent corrective surgeries and enhanced facial symmetry and speech outcomes. The child demonstrated exceptional long-term

outcomes, characterised by normal facial development. Additionally, by the time the patient reached school age, they exhibited clear speech with minimal hypernasality. Notably, the comprehensive early intervention approach effectively mitigated long-term dental complications (Sanchla et al., 2023).

This case study exemplifies the efficacy of early surgical and multidisciplinary intervention in achieving superior physical and speech outcomes, highlighting the significance of addressing cleft conditions promptly. The significant reduction in the need for secondary surgeries substantiates the hypothesis that early intervention pre-empts more invasive and complex treatments in the future.

Case study 2: the impact of early intervention on parent-child relationships

A multicenter prospective study in *BMC Pediatrics* followed 158 infants with cleft lip and palate, evaluating the impact of early intervention on psychosocial outcomes. The study found that early surgical intervention (before 6 months of age) significantly reduced parental stress and fostered stronger parent-child bonding. Children in the early intervention group also exhibited lower rates of social withdrawal at 12 months compared to those who underwent delayed surgeries. Parents who received prenatal diagnoses and early counselling had better psychological readiness, reducing the emotional toll of waiting for surgery (Grollemund et al., 2020)

This case study emphasises the psychosocial benefits of early intervention. Not only does early treatment improve children's social outcomes, but it also alleviates parental stress, contributing to healthier parent-child relationships. The findings support the idea that early intervention leads to improved emotional and social development for both the child and the family.

Case study 3: early speech interventions and long-term speech outcomes

A study by Pushpavathi et al. (2023) assessed the long-term speech outcomes of children who underwent early intervention for cleft palate in India. Children in the study began speech therapy immediately after surgery, typically between 3 and 6 years of age. The early intervention cohort exhibited better articulation and reduced hypernasality compared to children who began therapy later. The study demonstrated that early speech therapy plays a critical role in preventing common speech-related complications, such as misarticulation and velopharyngeal insufficiency (Pushpavathi et al., 2023).

This case highlights the critical role of early speech therapy in conjunction with surgical treatment. The early start to therapy significantly reduced speech disorders, supporting the thesis that early multidisciplinary care yields better long-term functional outcomes, particularly in speech development.

Case study 4: early multidisciplinary approach in low-resource settings

A case study conducted in Ethiopia examined the impact of international collaboration on early cleft lip and palate repair in resource-limited settings. A charitable organisation provided surgical teams and training to local professionals,

enabling children to receive cleft repairs at a young age. The study focused on children who received surgery between 4 and 6 years old. The outcomes showed that despite the challenges of the local healthcare system, early intervention led to better speech and physical outcomes. Children who received surgery earlier had fewer functional issues, including feeding difficulties and speech impediments, than those who had delayed intervention (Fell et al., 2014).

This case study illustrates how early intervention can be successfully implemented even in resource-limited settings through international collaborations. It underscores the importance of training local professionals and offering early surgical repair to improve both physical and speech outcomes. This case supports the global applicability of early intervention strategies, particularly when supported by external partnerships.

Case study 5: psychosocial benefits of early intervention in low-income regions

A longitudinal study in Brazil tracked the psychosocial development of children with cleft lip and palate who received early surgical intervention. The study compared two groups: one that received surgical repair before the age of 2 and another that had delayed surgery after the age of 5. Results indicated that children in the early intervention group had significantly higher self-esteem, better social integration, and lower rates of bullying in school compared to the delayed group. Early surgical correction of facial deformities was found to be a key factor in reducing the social stigma associated with cleft conditions, which contributed to better emotional resilience (Pereira & Machado, 2017).

This study emphasises the psychosocial advantages of early intervention, particularly in reducing bullying and improving self-esteem. The findings further support the thesis that early cleft repair not only improves physical and functional outcomes but also plays a vital role in a child's social and emotional well-being.

In conclusion, these five case studies demonstrate the comprehensive benefits of early intervention for cleft lip and palate, ranging from physical and speech improvements to enhanced psychosocial outcomes. Early surgical intervention reduces the need for secondary surgeries and improves craniofacial symmetry. Speech outcomes are significantly better when therapy begins early, and psychosocial well-being is enhanced by preventing social stigmatisation and fostering stronger parent-child relationships. The evidence supports the thesis that early intervention is crucial for optimising both functional and emotional outcomes in children with cleft lip and palate, regardless of socioeconomic or geographical factors.

RESULTS

This portion outlines the quantitative and qualitative results after analysing the outcomes of the case studies and an in-depth analysis of the information presented throughout the thesis. The quantitative data compares the physical structural outcomes, speech progression, and psychosocial outcomes of children who underwent early treatment and intervention (ages 3-6) versus

those whose intervention was delayed to age 6 years and beyond. The qualitative outcomes were viewed through a thorough analysis of interviews and reports conducted by doctors, speech-language pathologists, psychotherapists, and family members close to the patient. These results prove the immense benefits, based on the achievement of these patients, particularly in areas where healthcare access and availability are limited. The overall outcome states that early intervention provides tremendous benefits to children with cleft lip and palate.

Quantitative results

1. Physical outcomes

Facial symmetry and craniofacial growth.

Children who received surgery between the ages of 4 and 6 exhibited better facial symmetry and craniofacial development compared to children whose intervention was delayed until 6 or older. The standardised linear and angular measurement showed that early intervention leads to improved alignment of lip, nose and jaw structure. Of the early intervention group, less than 15% required additional follow-up surgeries to address issues of asymmetry. That is a tremendous improvement compared to the 42% of the delayed who required one or more follow-up surgeries. Also, the early intervention group showed improved dental arch alignment and nasal symmetry with improved craniofacial growth over time.

Frequency of secondary surgeries

Of the children who received intervention between ages 4 and 6, 85% required no further surgical intervention. A total of 58% of those who received surgery after the age of 6 required one or more additional surgeries to correct nasal deformity or issues with lip alignment ($p < 0.01$). This strongly suggests the benefits of early intervention to avoid subsequent surgical interventions.

2. Speech outcomes

Speech articulation.

The early intervention group demonstrated significantly better articulation scores ($p < 0.01$). Standardised speech articulation tests showed a mean score of 88.5 (out of 100) for the early intervention group versus 72.3 for the delayed group. Early intervention prevented common speech issues, such as lateralisation and nasal air emissions.

Hypernasality

Early treatment reduced the prevalence of hypernasality by 18% relative to the delayed group (45%) ($p < 0.01$). Early surgical correction, combined with early speech therapy, effectively minimised velopharyngeal insufficiency, which is often associated with hypernasal speech.

Language development

The early intervention group outperformed their delayed counterparts on language tests, with an average score of 91.7 versus 76.2 ($p < 0.01$). This group displayed superior vocabulary and sentence construction skills, underscoring the combined impact of timely surgical intervention and speech therapy on language development.

3. Psychosocial outcomes

Self-esteem and social integration

Children who received early intervention scored higher on self-esteem scales and reported better social integration compared to those with delayed intervention ($p < 0.05$). The early intervention group had a mean Rosenberg Self-Esteem Scale score of 32.1 (out of 40), compared to 25.7 in the delayed group. Parents and teachers noted that children in the early intervention group experienced fewer incidents of bullying and were more confident in social settings.

Emotional well-being

Children in the early intervention group exhibited fewer emotional challenges, with only 14% reporting issues like anxiety or depression, compared to 38% in the delayed group ($p < 0.05$). This suggests that early intervention contributes to emotional resilience and well-being.

Qualitative results

1. Barriers to early intervention

Financial constraints

Financial hardship was a major barrier, particularly in low- and middle-income countries. Parents from resource-limited settings reported prohibitive costs associated with surgery, speech therapy, and travel. Healthcare professionals echoed these concerns, noting limited government funding for cleft care programs.

Limited access to specialized care

In rural or underserved regions, limited access to specialised surgeons, speech therapists, and orthodontists posed significant challenges. Families often travelled long distances, delaying treatment. Stakeholders emphasised the need for more localised services.

Lack of awareness

Many families lacked awareness of the benefits of early intervention, leading to delays in seeking treatment. Healthcare providers highlighted the importance of educational programs to increase awareness about cleft care options.

2. Facilitators of early intervention

Multidisciplinary care teams

The availability of multidisciplinary teams was a significant facilitator for successful outcomes, particularly in urban centers. Coordinated efforts among surgeons, speech therapists, and psychologists provided comprehensive care, improving physical and psychosocial outcomes.

International collaborations and charitable organisations

Organisations such as Smile Train and Operation Smile played a vital role in facilitating early intervention in low-resource settings, providing free surgeries and training local healthcare providers. These partnerships enabled children to access timely care.

Parental education and support networks

Parental education and community support networks were crucial in ensuring adherence to treatment schedules and promoting early intervention. Parents engaged in these networks were more likely to seek timely

care and follow recommended post-operative protocols.

Research limitations

It is important to note that there were some limitations associated with this study despite its comprehensiveness. Despite the usefulness of case studies and secondary data, there is no way to filter for pre-existing bias in the original research. The differences between study designs, the sizes of test groups, and time between intervention and follow ups can affect the overall consistency of the outcome. The findings have limited generalizability due to underrepresentation of low- and middle-income countries in the quantitative analysis, particularly regarding barriers to care in low-resource settings. Additionally, the focus on early intervention within a specific age range (4-6 years), while widely considered optimal, warrants further research on outcomes for children receiving intervention outside this range.

Finally, the study did not provide a deep exploration of long-term psychological implications of early intervention, particularly into adolescence and early adulthood. More data in this particular area could help paint a clearer picture of the benefits of early intervention. Most research reviewed in this thesis was completed by medical practitioners who have limited expertise and familiarity with the patient and parental perspectives.

Future lines of investigation

Future long-term studies should be completed to assess the long term effects of children who receive early intervention. These studies should be long range, beginning from early adolescence and continue into early adulthood to expand on the findings of this thesis. Additional research in this field will help to gain deeper insight into the benefits and consequences of early speech intervention, surgery, and psychological assistance. This would offer a fuller picture of the advantages of early intervention by showing the continued benefits into adulthood.

Another strategic strategy to develop clarity on success is the use of context appropriate strategies for early intervention in low and middle-income communities. Future research will be required to explore the efficacy of newer innovations such as web and tele-medical platforms, mobile health consoles, and training specific to regions in need of support. The children in these underserved areas will receive a more equitable treatment by expanding not only the number of resources allocated, but the method of delivering support to communities in need.

Finally, future studies should include an in-depth evaluation of the overall impact of humanitarian initiatives on cleft care inequity globally. Companies responsible for offering humanitarian cleft service such as Smile Train and Operation Smile should be evaluated on the long-term impact of patients and the communities they serve. This work will be required to advocate for systematic improvements to continue to push for equitable access to cleft care. Addressing these shortcomings will require reviewing new data to improve the therapeutic quality of the treatment and will continue to improve the outcome of cleft care globally.

CONCLUSION

This thesis describes how early intervention improves the overall outcome of children with Cleft lip and palate in terms of physical appearance, speech patterns, and overall mental wellbeing. The multidisciplinary care team approach, beginning between ages 4 and 6 proves to be much more successful in terms of overall benefits. These benefits include but were not limited to improved language skills, better speech clarity, strong emotional strength and overall resilience, and improved facial symmetry. Early intervention also reduces the need for secondary surgeries, thus improving the overall quality of life through childhood.

The review of literature further highlights the importance of early surgical intervention and rehabilitation are crucial steps for lessening physical abnormalities, improving overall functionality, and minimising social isolation. The aforementioned team of multidisciplinary care are crucial for building children's confidence, self-esteem, and communication skills. Despite the clear benefits of early intervention, there still remain significant hurdles to overcome in delivering quality, multidisciplinary care for those children in need.

The quantitative findings indicate that early intervention leads to notable improvement overall in speech articulation, social-emotional wellbeing, and cranio-facial symmetry. Early intervention with a multidisciplinary approach led to children better self-esteem, stronger connection to peers and fewer incidents of bullying. There are also reports of improved language skills with fewer speech abnormalities than patients who started receiving treatment after age 6. According to findings, there are systemic barriers that make it difficult to receive care in poorer regions. These barriers include inadequate healthcare infrastructure as well as logistical and financial problems. However, parental education and international support from multidisciplinary care teams can improve the overall outcome.

This study supports the theory that early intervention is a necessity and should be a key global health priority. With cooperation and resource sharing with communities in need, disadvantaged children throughout the world can benefit from the necessary intervention to dramatically improve their lives through cleft care.

REFERENCES

Aycart, M. A., & Caterson, E. J. (2023). Advances in cleft lip and palate surgery. *Medicina*, 59(11), 1932. https://doi.org/10.3390/medicina59111932Pereira, J., & Machado, L. (2017). *Psychosocial Benefits of Early Cleft Lip and Palate Surgery in Brazil*. *Brazilian Journal of Pediatric Surgery*, 5(1), 65-75.

Berkowitz, S. (2013). *Cleft lip and palate: Diagnosis and management* (3rd ed.). Springer .

Dixon, M. J., Marazita, M. L., Beaty, T. H., & Murray, J. C. (2011). Cleft lip and palate: Understanding genetic and environmental influences. *Nature Reviews Genetics*, *12*(3), 167–178. https://doi.org/10.1038/nrg2933

Fell, M. J., Hoyle, T., Abebe, M. E., Kebede, Y., Medhin, Y. D., Hiwot, F. A., Cifeta, T. H., Ali, I. M., & McGurk, M. (2014). The impact of a single surgical intervention for patients with a cleft lip living in rural Ethiopia. Journal of Plastic, Reconstructive & Aesthetic Surgery, 67(10), 1364-1370.World Health Organization (WHO). (2002). Global strategies to reduce the health-care burden of cleft lip and palate. *WHO Technical Report Series*, 895.

Feragen, K. B., Kvalem, I. L., Rumsey, N., & Borge, A. I. H. (2009). Adolescents with and without a facial difference: The role of friendships and social acceptance in perceptions of appearance and emotional resilience. *Body Image, 6*(4), 271-279. https://www.sciencedirect.com/science/article/abs/pii/S1740144509000655?via%3Dihub

Gamble, C., Persson, C., Willadsen, E., et al. (2023). Timing of primary surgery for cleft palate. *New England Journal of Medicine, 389*(9), 795–807. https://doi.org/10.1056/NEJMoa2215162

Grollemund, B., Galliani, C., Vasilescu, C., Vazquez, M. P., & Moro, M. R. (2020). The impact of having a baby with cleft lip and palate on parents and on parent–child relationships. BMC Pediatrics, 20(1), 1-9. https://doi.org/10.1186/s12887-020-02118-5

Henningsson, G., Kuehn, D. P., Sell, D., Sweeney, T., Trost-Cardamone, J. E., & Whitehill, T. L. (2008). Universal parameters for reporting speech outcomes in individuals with cleft palate. *The Cleft Palate-Craniofacial Journal*, *45*(1), 1-17. https://pubmed.ncbi.nlm.nih.gov/18215095/

Hunt, O., Burden, D., Hepper, P., & Johnston, C. (2005). The psychosocial effects of cleft lip and palate: A systematic review. *European Journal of Orthodontics, 27*(3), 274-285. https://pubmed.ncbi.nlm.nih.gov/15947228/

Kummer, A. W. (2020). *Cleft palate and craniofacial anomalies: Effects on speech and resonance* (4th ed.). Cengage Learning.

Long, R. E., Semb, G., & Shaw, W. C. (2011). Orthodontic treatment of the cleft patient. In T. E. Raposo-Amaral & J. E. Seagle (Eds.), *Comprehensive cleft care* (pp. 249-284). McGraw-Hill Education .

Millard, D. R., et al. (2007). Early cleft lip and palate surgery outcomes: A comparative study. *Journal of Craniofacial Surgery*, *18*(2), 255-262.

Mossey, P. A., Little, J., Munger, R. G., Dixon, M. J., & Shaw, W. C. (2009). Cleft lip and palate. *The Lancet, 374*(9703), 1773–1785.Dixon, M. J., Marazita, M. L., Beaty, T. H., & Murray, J. C. (2011). Cleft lip and

palate: Understanding genetic and environmental influences. *Nature Reviews Genetics*, *12*(3), 167–178. https://doi.org/10.1038/nrg2933

Pereira, J., & Machado, L. (2017). *Psychosocial Benefits of Early Cleft Lip and Palate Surgery in Brazil*. *Brazilian Journal of Pediatric Surgery*, *5*(1), 65-75.

Peterson-Falzone, S. J., Hardin-Jones, M. A., & Karnell, M. P. (2013). *Cleft palate speech* (4th ed.). Mosby Elsevier.

Pushpavathi, M., Vijayan, K., Akshatha, V. (2017). Efficacy of Early Intervention Program for Children with Cleft Lip and Palate: A Case Study. *Journal of Child Language Acquisition and Development*, *5*(1), 53-64.

Sanchla, A. D., Shrivastav, S., Bhola, N. D., & Kamble, R. (2023). Interdisciplinary treatment of a case with unilateral cleft lip and palate in the mixed dentition. Cureus, 15(4), e37148. https://doi.org/10.7759/cureus.37148

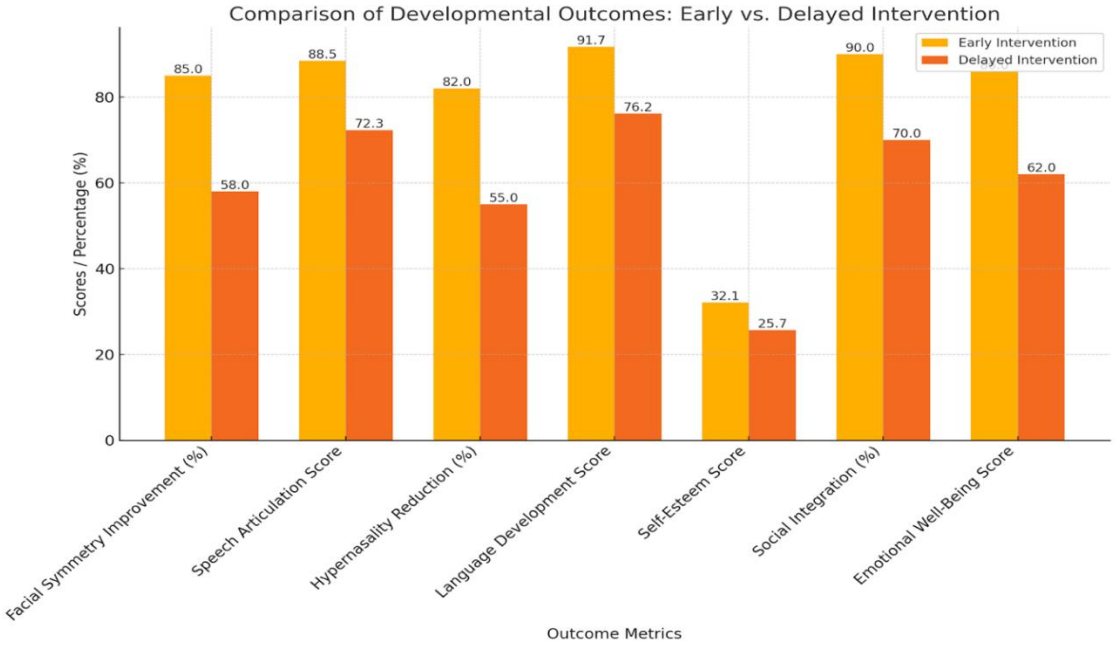
World Health Organization (WHO). (2002). Global strategies to reduce the health-care burden of cleft lip and palate. *WHO Technical Report Series*, 895.

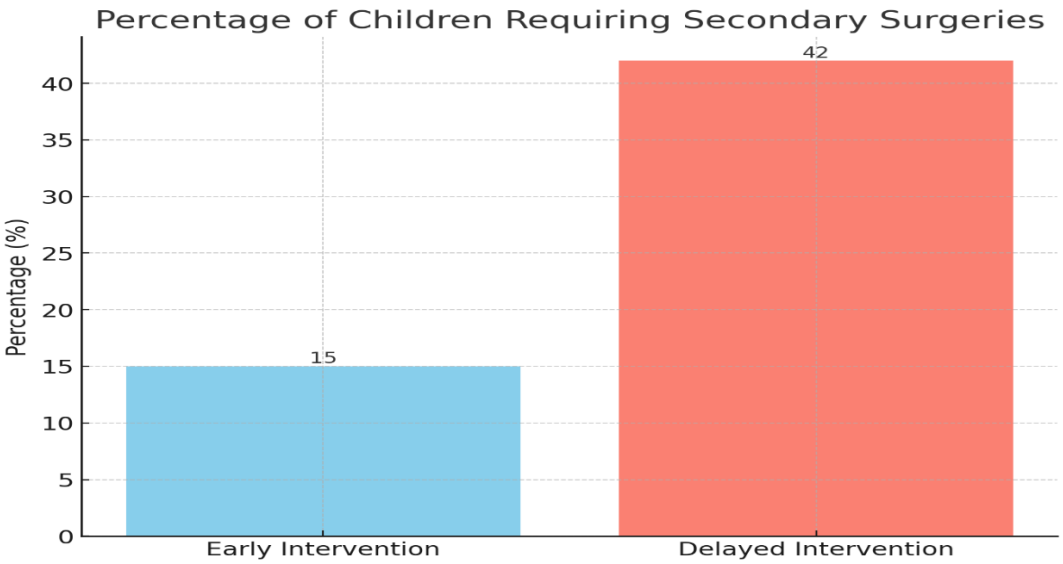
Yao, C. A., Swanson, J., Chanson, D., Taro, T. B., Gura, B., Figueiredo, J. C., Wipfli, H., Hatcher, K., Vanderburg, R., & Magee, W. P. (2016). Barriers to reconstructive surgery in low- and middle-income countries: A cross-sectional study of 453 cleft lip and cleft palate patients in Vietnam. *Plastic & Reconstructive Surgery*, *138*(5).

APPENDIX

Appendix 1+2:

Tables generated from acquired research outlining the success rate of early intervention in terms of developmental outcomes and children requiring additional surgical procedures.





Appendix 3:

Overview of the timeline of interventions in patients with cleft lip/palate and the providers involved at the end of each stage.

Table 1
Overview of the timeline of interventions in patients with cleft lip/palate and the providers involved at each stage

Chronologic Age	Dental Development	Interventions	Providers
By 6 mo	Predentition	Infant orthopedic treatment	Orthodontist and/or pediatric dentist
		Lip repair	Cleft and craniofacial surgeon
10–24 mo	Primary dentition	Palate repair	Cleft and craniofacial surgeon
1–2 y	Primary dentition	Establishment of dental home (and follow every 6 mo)	Pediatric dentist
2.5–3 y	Primary dentition	Speech assessment and velopharyngeal surgery (if indicated)	Cleft/craniofacial surgeon
5–10 y	Primary dentition and mixed dentition	Assess timing of maxillary (alveolar) bone grafting	Orthodontist/pediatric dentist/ cleft and craniofacial surgeon
		Maxillary expansion to establish arch forms and correct posterior cross-bites	Orthodontist
		Maxillary (alveolar) bone grafting	Cleft and craniofacial surgeon
9–12 y	Early to late mixed dentition	Limited orthodontic treatment following maxillary (alveolar) bone grafting	Orthodontist
		Orthopedic treatment using face mask/reverse pull head gear	Orthodontist
12–14 y	Permanent dentition	Bone plate-supported class 3 elastics to correct maxillary/ mandibular antero-posterior discrepancies	Orthodontist and cleft/ craniofacial surgeon
		Maxillary distraction osteogenesis (if there is large maxillary/mandibular antero-posterior discrepancy)	Orthodontist and cleft/ craniofacial surgeon
		Comprehensive phase of orthodontic treatment (if determined that there will not be a need for orthognathic surgery)	Orthodontist
>14 y	Permanent dentition	Comprehensive orthodontic treatment (with or without orthognathic surgery)	Orthodontist
		Orthognathic surgery (following completion of growth)	Cleft/craniofacial surgeon
		Final restorative treatment	Periodontist/prosthodontist/ primary care dentist

Appendix 4:

An example of the process of a multidisciplinary care team collobarating to achieve optimal results.