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Questionnaire-based study on speech changes and delays in children using protective masks: A public health issue that cannot be ignored

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Abstract

Introduction: During the COVID-19 pandemic, the prolonged use of face masks became necessary for infection control. However, this widespread practice may have unintentionally impacted communication, particularly in children at critical stages of speech and language development.

Objective: This study aims to examine parental perceptions regarding the effect of prolonged face-mask use on speech and language development in children aged 2–8 years during the COVID-19 pandemic.

Methods: A cross-sectional study was conducted using a 14-item online questionnaire completed voluntarily by parents or legal guardians. The survey explored perceived speech and language changes, recovery following discontinuation of mask use, and whether professional intervention (e.g., speech therapy) was sought.

Results: A total of 60 participants were recruited. Language delays were more frequently reported in children under 3 years of age (38%) than in older children (22%). Following the end of mask use, 43.1% of parents reported no change in language development, 29.3% perceived no association, and 27.6% observed improvement. Among those who noticed delays, 30.8% consulted a speech therapist, 61.5% reported spontaneous recovery, and 7.7% reported no recovery. Overall, 77.3% of children showed significant language recovery after stopping mask use, 13.6% recovered partially, and 9.1% did not recover.

Conclusion: Parental perceptions suggest that prolonged mask use may have interfered with language development in some children, especially the youngest. While many children improved spontaneously, a notable proportion required professional intervention. These findings highlight the importance of early detection

and support for children potentially affected by communication while wearing masks during critical developmental periods. Further research using clinician-assessed measures is needed to validate these perceptions.

Keywords: COVID-19; Protective mask; Speech therapy; Myofunctional therapy; Periodontitis; Children

1. Introduction

The COVID-19 pandemic, which began in late 2019 and rapidly evolved into a global health crisis, radically changed social and professional interactions.[1-8] One of the most immediate and visible impacts of the pandemic was the widespread use of personal protective equipment, particularly face masks.[9-18] Masks, although essential for infection control, also affected interpersonal communication and children's language exposure.[19] The pervasive use of face masks also influenced emotional expression, interpersonal communication, and potentially the cognitive and linguistic development of children during key stages of growth. Language acquisition in early childhood relies not only on auditory input but also on visual cues, such as lip movements and facial expressions.[20-25] These non-verbal signals play a particularly critical role in early development. For children in their formative years, visual access to the face, especially the mouth, is a fundamental component of language acquisition. Observing how sounds are formed, how lips move, and how facial expressions reflect meaning provides children with vital input for developing articulation, vocabulary, and emotional understanding.[26-36]

During the pandemic, however, children experienced prolonged periods in which parents, caregivers, educators, healthcare professionals, and peers wore face coverings in nearly every setting—homes, schools, daycares, clinics, and public spaces. This dramatic environmental shift likely altered the natural course of linguistic exposure and may have impacted the trajectory of speech and language development in young children.[37-39] Unlike adults, children are less able to adapt their communication strategies during mask use, making them vulnerable to reduced visual and auditory input.[40-50] The disruption came during a sensitive developmental window when their brains are primed to acquire language through both auditory and visual channels.[51-53]

Early childhood is universally recognized as a critical period for language acquisition. It is during these years that children rapidly expand their vocabulary, internalize grammatical structures, and refine their ability to communicate effectively. These processes rely on a rich linguistic environment characterized by clear verbal interactions, meaningful social engagement, and frequent opportunities to observe and imitate others.[54-56] Learning how to pronounce sounds correctly is closely tied to visual observation of how those sounds are formed. Covering the mouth with a mask, therefore, restricts access to this visual feedback.[57] Moreover, muffled speech, reduced auditory clarity, and the absence of facial expressions can significantly limit the diversity of input available to the child. The mandatory use of masks in educational and healthcare settings has far-reaching implications.[58-67] In preschool and early school-aged children, whose cognitive and linguistic systems are still developing, this environmental interference may have contributed to delays in expressive and receptive language.[68,69] Specific challenges may have included articulation errors, limited vocabulary growth, reduced sentence complexity, and difficulties with pragmatic aspects of language, such as turn-taking, interpreting tone, and recognizing facial expressions.

In addition to the barriers created by mask-wearing, the pandemic led to a broad restructuring of educational models.[70-79] Numerous schools adopted remote or hybrid teaching formats, which, while necessary to maintain continuity of instruction, posed new challenges, particularly for young learners. Virtual platforms often suffer from poor audio quality, limited visual engagement, and a lack of spontaneity in conversation. Group dynamics, peer interaction, and unstructured verbal play, vital to language development, are largely absent in these digital environments. Even when video is available, the interactions tend to be formalized and less responsive, reducing opportunities for naturalistic speech exposure.

Furthermore, in numerous households, the use of digital devices has become a dominant feature of daily life, often replacing in-person interaction. Screen time has increased dramatically for both educational and recreational purposes.[80-82] Although technology helps maintain social connections, it also reduces opportunities for children to engage in live, face-to-face dialogue with caregivers or siblings. Extended screen time has been associated with decreased verbal output and reduced opportunities for language-rich experiences.[83-94]

Parental stress and reduced interaction during the pandemic may also have contributed to language difficulties.[95-107] These factors, in turn, can reduce a child's willingness or ability to engage in verbal interaction, further impacting language development. Masks, the most commonly used personal protective equipment, block visual access to the mouth and muffle speech, further complicating communication for young children.[108-110] Most individuals wear surgical, filtering facepiece (FFP2/FFP3) respirators, or cloth masks, all of which effectively block the view of the mouth and muffle speech. In noisy environments, or for children with mild hearing difficulties, attentional deficits, or language vulnerabilities, these barriers may have further complicated the already challenging process of decoding speech.[111,112]

The combination of these factors, including mask usage, increased screen time, reduced peer interaction, emotional stress, and limited visual speech cues, creates a significant barrier to language development. While the protective role of masks during the pandemic is unquestionable, their indirect impact on communication warrants careful study, especially among young and vulnerable populations. It is important to assess whether mask use during this sensitive developmental window contributed to language delays, to guide future interventions. If early exposure to communication while wearing masks correlates with speech delays or communication challenges, educators, clinicians, and policymakers must be prepared to implement targeted interventions.[113,114] These may include increased screening for speech and language delays, expanded access to speech therapy services, and enhanced parent training to support language-rich home environments.[115-124]

The current study aims to investigate the impact of early exposure to communication in contexts where masks are worn. By administering a structured questionnaire to parents of young children, we investigate the perceived correlation between the prolonged use of protective face masks during the COVID-19 pandemic and the development of speech or language difficulties. The questionnaire explored parental perceptions, observed changes in their children's communicative behavior, and the need for professional support, such as speech therapy, was required. It also inquired whether improvements were observed once mask usage was reduced or discontinued.[125-129] Importantly, this investigation focuses not on laboratory conditions but on real-life experiences, as reported by families navigating an unprecedented global crisis. Their responses offer valuable insights into how environmental conditions, such as reduced visibility of facial expressions and muffled speech, may have contributed to observable changes in children's communication. Furthermore, this community-based data collection offers a practical and accessible method for understanding the broad psychosocial impacts of public health measures.[130-136] As society begins to emerge from the acute phase of the pandemic and mask mandates are lifted in many regions, it is critical to reflect on the lessons learned. Public health measures, such as mask-wearing, while necessary, must be evaluated not only for their epidemiological effectiveness but also for their psychosocial and developmental side effects.[137-143] For young children, who are in a delicate phase of linguistic and emotional growth, the consequences of restricted communication may be long-lasting unless recognized and addressed early. In light of these considerations, the current study seeks to offer valuable insights into the implications of pandemic-related protective measures on childhood language development.[144,145] While definitive conclusions require longitudinal studies and larger sample sizes, this research aims to raise awareness and stimulate further exploration into supporting children in recovering from any setbacks and ensuring optimal developmental outcomes.[146(p2),147]

Recent studies have highlighted how early developmental vulnerabilities interact with environmental challenges to shape communication outcomes. For example, an innovative approach for detecting autism spectrum disorder using explainable features and smart web applications underscored the complexity of communication difficulties in children with neurodevelopmental conditions.[148,149] This line of research suggests that environmental barriers, such as mask-wearing, may further exacerbate pre-existing communication vulnerabilities.

Similarly, a large-scale birth cohort study from South Korea has demonstrated that prenatal and infant exposure to antibiotics was associated with increased risk of neuropsychiatric disorders in children.[150] Such findings reinforce the importance of investigating how diverse environmental exposures, including widespread mask usage, may influence language development during sensitive periods.

The primary aim of this study is to investigate a possible correlation between prolonged face mask use during the COVID-19 pandemic and speech/language development in children aged 2–8 years. The secondary aim is to evaluate parental perceptions of language recovery after discontinuation of mask use and to assess whether families sought professional intervention (e.g., speech therapy) or observed spontaneous improvement.

2. Methods

2.1. Study design

The study was conducted as an exploratory, questionnaire-based investigation. Parents or legal guardians were the study participants and provided information regarding

their children's speech and language development during the COVID-19 pandemic. The sample size was determined by the number of parents/legal guardians who voluntarily participated during the data collection period, rather than by an a priori power analysis. A total of 60 parents/legal guardians whose children were visiting private dental practices (Bari, Rome, and Civitavecchia, Italy) for routine dental check-ups and/or orthodontic consultations were recruited for this study. Data collection took place between May 2023 and December 2024. All participants provided written informed consent in accordance with the Declaration of Helsinki. The questionnaire was completed online by parents/legal guardians, and no direct interventions were performed on the children. Participants were included if they had children aged 2–8 years and agreed to participate voluntarily. Exclusion criteria included parents/legal guardians of children with pre-existing, diagnosed language disorders or cognitive impairments unrelated to pandemic conditions. One limitation of the methodology is the self-reported nature of the responses, which may introduce recall or perception bias.

Participants were given a bilingual survey in English and Italian consisting of 14 questions specifically developed for this study. The survey was distributed online using Google Forms (Google LLC, United States).

2.2. Data collection

The questionnaire link was distributed via email. All collected data were anonymized and assigned a unique ID and timestamp. Parents/legal guardians were invited to complete the questionnaire voluntarily, without any follow-up reminders. The purpose of the questionnaire was to explore parental perceptions of their children's language development during the COVID-19 pandemic. Parents/legal guardians were asked to complete the questionnaire without any financial or material compensation. The questionnaire was specifically developed for this study and, due to constraints imposed by fluctuating COVID-19 pandemic waves, pre-testing was not feasible. All participants provided informed consent and accepted the privacy policy for the protection of their own and their children's personal data before completing the survey. No personal information that could identify individuals was collected, and the data were analyzed only in aggregate form. The 14 questions included in the survey are as follows:

(i) Age of the child
(ii) Sex of the child
(iii) Child's age during the pandemic period
(iv) Number of children in the household
(v) Your occupation (parent/legal guardian)
(vi) Did you work during the pandemic?
(vii) Where did your child spend most of the pandemic period?
(viii) During the 2 years of the pandemic, how did your child spend most of his/her time?
(ix) Has your child undergone neuropsychiatric evaluations?
(x) Do you think mask use has affected your child's language learning?
(xi) Since mask use was discontinued, have you noticed any improvement in your child's language development?
(xii) Where did your child spend the lockdown period?
(xiii) If your child experienced language difficulties, how did recovery occur?
(xiv) On a scale from 1 to 3, how would you rate your child's language recovery since masks are no longer used?
- 1 = No recovery
- 2 = Partial recovery
- 3 = Good recovery

2.3. Data analysis

All questionnaire data were analyzed descriptively using frequencies, percentages, means, and ranges. No inferential statistics were performed due to the exploratory nature of the study. Data processing was carried out using Microsoft Excel.

3. Results

Parents were more likely to report language delays in children aged under 3 years during the pandemic (38%) than in older children (22%). In addition, female children showed a slightly higher rate of spontaneous language recovery (65%) compared to male children (58%). These differences may reflect underlying variation in developmental resilience or parental perception bias, which should be further investigated. We obtained the following responses: most of the children of the parents/legal guardians who participated in this study were male (53.3%) and over 5 years old at the time of the questionnaire (81.7%). During the pandemic, 33.3% of participants' children were over 5 years old, 41.7% were under 3 years old, and 25% were between 3 and 5 years old. Among the participants' children, 54% underwent a neuropsychiatric evaluation (Figure 1). Only a minority of participants (27%) reported that mask use may have influenced their children's language learning, whereas 73% did not think it had any influence (Figure 2).

Regarding parental perceptions on recovery of children's language following the discontinuation of mask use, only 27.6% of participants reported improvement, 43.1% reported no observable change, and 29.3% did not think it was related (Figure 3).

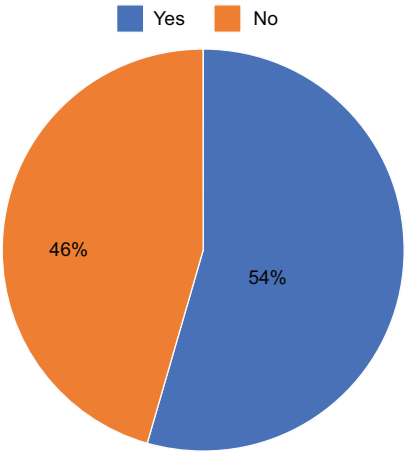

Figure 1. Proportion of children who underwent neuropsychiatric evaluation

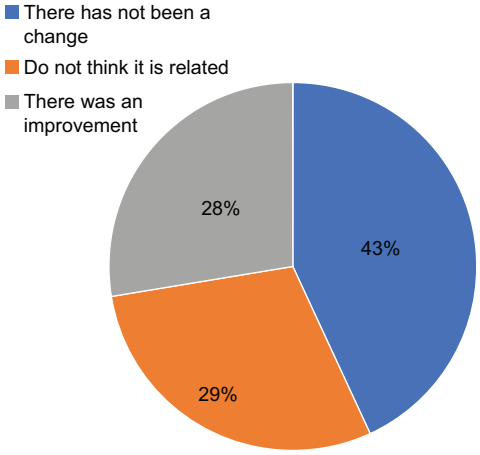

Figure 3. Parental perceptions of children's language recovery after discontinuation of face mask use

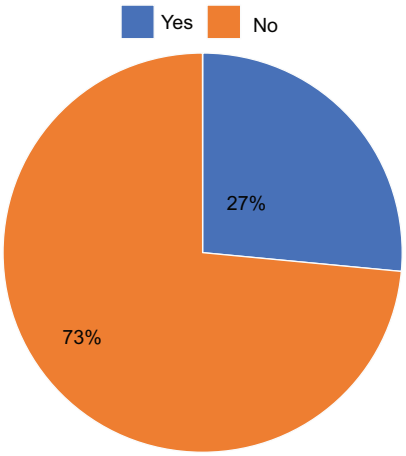

Figure 2. Parental perceptions of the influence of face mask use on children's language learning

Nearly one-third (30.8%) of participants consulted speech therapists regarding their children's language delay. As shown in Figure 3, parents reported whether they perceived an improvement in their child's language after mask discontinuation. In addition to this perception, parents were also asked to specify the degree of recovery, which is not illustrated in the figure. Nearly one-third (30.8%) consulted a speech therapist. Among these, 61.5% reported spontaneous recovery and 7.7% no recovery. Considering the entire sample, 77.3% reported full recovery, 13.6% partial recovery, and 9.1% no recovery.

4. Discussion

Several studies have suggested that early childhood education must adapt to future pandemics or airborne disease scenarios by incorporating measures such as transparent facial coverings, increased visual cues, and intentional language stimulation programs.[151-157] One potential intervention is integrating structured speech–language evaluations during routine pediatric check-ups, especially in children aged 2–4 years. Parent education programs on enriching language at home through reading, singing, and interactive play may also mitigate deficits arising from socially restrictive periods. Research on mirror neurons has revolutionized our understanding of the human brain and social behavior. However, the COVID-19 pandemic has compelled us to adhere to social distancing rules, limiting typical social interactions.[158-160] Mirror neurons were first discovered in the 1990s by Rizzolatti *et al.*,[161] and are essential for imitation, empathy, and social learning processes. These neurons activate when we perform an action and observe others performing it, enabling understanding of others' actions and sharing of emotions. In addition to their crucial role in empathy, mirror neurons facilitate social learning by enabling the acquisition of skills through observation, both in early childhood and in adulthood.

The discovery of mirror neurons has been a milestone in neuroscience, opening new perspectives for understanding human behavior and social interactions. Emotions are defined as physiological, cognitive, and behavioral responses to events occurring in the environment or within individuals. They are expressed through verbal and non-verbal communication, such as facial expressions, gestures, body movements, tone of voice, and physical contact.[162] They enable interpretation of the world and others' behavior, providing immediate responses for survival. They also regulate our behavior in continuous interaction with the environment and others. While emotions are innate, their regulation is part of a complex learning

process that requires interaction with others. From the earliest moments of life, children express their needs and associated emotions through crying and smiling, learning to regulate their expression based on caregivers' emotional response. Another element involved in emotion recognition and regulation is the function of mirror neurons, which underlie imitation. This process of emulation is rapid and immediate and forms the foundation of other processes, including learning and empathy—the ability to perceive, recognize, and understand another person's mood through facial expressions and body language.[163-165] When children see someone speaking, mirror neurons activate the brain area representing the speech apparatus, and the children unconsciously repeat the speech and movements they observe. This process facilitates rapid understanding of spoken language and supports native language acquisition.

Language acquisition depends heavily on a close relationship with the speaker. By observing facial expressions while listening to sounds, our brain learns the articulatory movements needed to produce them. In this view, language may not have emerged solely from abstract thought but also from the ability to perform and control precise articulatory movements. The ability to produce precise, stable sounds (phonemes) with the voice in sequence gave rise to a series of combinations, which became significant for communication among individuals within the same group. It is the physical ability to formulate words, combined with communicative urgency, that generates language.

During the COVID-19 pandemic, social contact was minimized, and many interactions occurred while masks covered two-thirds of the faces.[166-170] The widespread mask use substantially altered everyday social interactions. Children frequently encountered caregivers wearing masks in emotionally salient moments, such as when seeking comfort or reassurance. Numerous children also began new school years engaging with teachers and classmates whose facial expressions were largely obscured. In numerous daily interactions, the reduced visibility of facial cues limited individuals' ability to accurately interpret others' emotional states. These conditions raise important questions about how prolonged mask use may have influenced interpersonal relationships and, specifically, the cognitive process underlying emotional competence—a construct defined as the set of abilities involved in the expression, understanding, and regulation of emotions.

Moreover, facial expressions constitute a fundamental source of social and communicative information, much of which becomes inaccessible when masks are worn. In early development, infants and pre-linguistic children rely heavily on non-verbal cues, such as facial movements, affective expressions, and prosodic features, before they can comprehend linguistic content. For instance, infants often respond positively to an adult's smiling and cheerful tone even in the absence of semantic understanding. Mask use, however, obscures these visual cues and reduces opportunities for children to observe and internalize the orofacial motor patterns involved in speech production.[168,171-179] It is also crucial to note that for language acquisition, perfect sound perception is of primary importance. Face masks act as filters that attenuate the high-pitched sounds of the language's sound spectrum, limiting access to the phonetic detail required for optimal language learning. This is likely to affect children who are learning to speak, especially if they spend a long time around people wearing masks.

The results of this study highlight the need for multidisciplinary approaches in addressing potential language delays. Pediatricians, speech–language therapists, educators, and caregivers must collaborate in post-pandemic recovery strategies to ensure that affected children receive timely support. Future longitudinal studies should investigate the persistence of these language delays and assess the effectiveness of targeted early interventions. In addition, public health planning should include developmentally sensitive protocols when implementing protective measures for children.[180-182] Recent work has emphasized how public health measures, while essential, can generate unintended developmental or psychosocial consequences. For example, a systematic review of policy-driven digital health interventions highlighted the importance of evaluating both clinical benefits and environmental impacts.[183] In this context, mask mandates should be assessed not only for their effectiveness in infection control but also for their potential developmental side effects. In addition, methodological advances, such as umbrella reviews of physical activity and mental health complications, provide models for synthesizing complex evidence across multiple studies.[184,185] Future research on mask usage and child development may benefit from similar approaches, integrating diverse findings to better understand the balance between public health protection and developmental needs.

A key limitation of this study is the relatively small sample size (n = 60). The limited number of participants reduces statistical power and does not allow robust control for potential confounding variables. No formal power analysis was performed before enrollment, as the study was exploratory and constrained by the availability of respondents during the pandemic period. Therefore, the results should be interpreted with caution and cannot be generalized to the wider population. Another important limitation of this study is its retrospective, cross-sectional

design, which relies entirely on parental self-report. This approach may introduce several biases, including recall bias, social desirability bias, and subjective interpretation of language changes. Parents may also misattribute typical developmental variations to mask usage or, conversely, underreport difficulties due to pandemic-related concerns. Therefore, the results should be interpreted as perceptions rather than objective clinical assessments, and further studies employing prospective designs and standardized language evaluations are needed. A further limitation is the absence of objective language assessments or standardized developmental measures. Our results are based solely on parental perceptions, which may not accurately reflect children's actual language abilities. In addition, no pre-pandemic baseline data or professional evaluations were available for comparison, preventing definitive conclusions about causality. Therefore, the findings should be interpreted with caution and considered preliminary evidence warranting confirmation through studies employing validated instruments, clinical assessments, and longitudinal designs.

5. Conclusion

The COVID-19 pandemic has undeniably transformed social interactions and communication methods. The shift to digital communication platforms, such as WhatsApp, Google Meet, Skype, and Zoom, allowed people to maintain contact while adhering to physical distancing measures. However, in-person communication remained essential, necessitating protective measures, such as masks, to prevent direct transmission of the virus. The widespread use of protective masks, including surgical masks, N95 respirators, cloth masks, and FFP2/FFP3 respirators, introduced significant changes to daily life. These masks played a critical role in reducing the spread of COVID-19, but they also had potential implications for communication, particularly for young children. This study focused on understanding the impact of mask use on language development in young children. The findings revealed a nuanced relationship between mask use and language acquisition. While a significant proportion of parents did not perceive a direct impact on their children's language learning, a notable percentage reported challenges related to communication clarity and expression due to mask use. The obstruction of facial expressions and the reduction of voice clarity caused by masks contributed to difficulties in understanding and articulating speech, highlighting the importance of non-verbal cues in communication. Moreover, the study underscored the critical role of mirror neurons in language acquisition and emotional competence. Masks obscured facial expressions, limiting children's ability to imitate and learn from observed speech movements, which is fundamental to developing language skills. This effect was particularly pronounced in environments where children spent extended periods interacting with individuals wearing masks. Overall, while masks were essential for public health during the pandemic, their prolonged use had complex implications for communication and language development, especially among young children. As the world transitions away from pandemic-related restrictions, it is crucial to consider strategies to mitigate their impacts, support language development, and improve social interactions. Future research should continue to explore these relationships to provide comprehensive insights and practices that promote effective communication in similar situations.

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Conflict of interest

Gaetano Isola is an Editorial Board Member of this journal but was not in any way involved in the editorial and peer-review process conducted for this paper, directly or indirectly. Separately, other authors declared that they have no known competing financial interests or personal relationships that could have influenced the work reported in this paper.

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Ethics approval and consent to participate

The study was conducted in accordance with the Declaration of Helsinki and approved by the Ethics Committee of Policlinico of Bari (Prot. Numbrrrrrrrer: 00152571, February 15, 2023 JAOUCPG23ICOMETIP, Study number: 7593. Approved date: January 25,

2023, U.O. di Odontostomatologia, CODE: EAP AS, Principal investigator: Prof. F. Inchingolo, U.O. di Odontostomatologia, University Polyclinic of Bari). Written consent was obtained from each participant in the study.

Consent for publication

All participants signed informed consent and accepted the privacy policy to protect their personal data before completing the survey. No personal information that could identify individuals was collected, and the data was analyzed only in aggregate form.

Availability of data

Data are available upon request from the corresponding author.

References

1. Deng W, Sun Y, Yao X, *et al*. Masks for COVID-19. *Adv Sci (Weinh)*. 2022;9(3):2102189.

   doi: 10.1002/advs.202102189

2. Baker J. Functional voice disorders: Clinical presentations and differential diagnosis. *Handb Clin Neurol*. 2016;139:389-405.

   doi: 10.1016/B978-0-12-801772-2.00034-5

3. Bauer HH. Definition of psychogenic voice disorders. *Laryngorhinootologie*. 1991;70(2):102-104.

   doi: 10.1055/s-2007-997998

4. Baker J, Oates JM, Leeson E, Woodford H, Bond MJ. Patterns of emotional expression and responses to health and illness in women with functional voice disorders (MTVD) and a comparison group. *J Voice*. 2014;28(6):762-769.

   doi: 10.1016/j.jvoice.2014.03.005

5. Zambon F, Moreti F, Behlau M. Coping strategies in teachers with vocal complaint. *J Voice*. 2014;28(3):341-348.

   doi: 10.1016/j.jvoice.2013.11.008

6. Bassi IB, Assunção AÁ, de Medeiros AM, de Menezes LN, Teixeira LC, Côrtes Gama AC. Quality of life, self-perceived dysphonia, and diagnosed dysphonia through clinical tests in teachers. *J Voice*. 2011;25(2):192-201.

   doi: 10.1016/j.jvoice.2009.10.013

7. Memè L, Gallusi G, Strappa E, Bambini F, Sampalmieri F. Conscious inhalation sedation with nitrous oxide and oxygen in children: A retrospective study. *Appl Sci*. 2022;12(22):11852.

   doi: 10.3390/app122211852

8. Bambini F, Pellecchia M, Memè L, *et al*. Anti-inflammatory cytokines in peri-implant soft tissues: A preliminary study on humans using CDNA microarray technology. *Eur J Inflamm*. 2007;5(3):121-127.

   doi: 10.1177/1721727X0700500302

9. Al-Hammouri MM, Rababah JA. Work family conflict, family work conflicts and work-related quality of life: The effect of rotating versus fixed shifts. *J Clin Nurs*. 2023;32(15-16):4887-4893.

   doi: 10.1111/jocn.16581

10. American Academy of Pediatrics, American Academy of Pediatric Dentistry, Coté CJ, Wilson S, Work Group on Sedation. Guidelines for monitoring and management of pediatric patients during and after sedation for diagnostic and therapeutic procedures: An update. *Pediatrics*. 2006;118(6):2587-2602.

    doi: 10.1542/peds.2006-2780

11. Anahtar M, Chan LW, Ko H, *et al*. Host protease activity classifies pneumonia etiology. *Proc Natl Acad Sci U S A*. 2022;119(25):e2121778119.

    doi: 10.1073/pnas.2121778119

12. Antunes DE, Viana KA, Costa PS, Costa LR. Moderate sedation helps improve future behavior in pediatric dental patients - a prospective study. *Braz Oral Res*. 2016;30(1):e107.

    doi: 10.1590/1807-3107BOR-2016.vol30.0107

13. Appukuttan DP. Strategies to manage patients with dental anxiety and dental phobia: Literature review. *Clin Cosmet Investig Dent*. 2016;8:35-50.

    doi: 10.2147/CCIDE.S63626

14. Armfield JM. A comparison of three continuous scales used to determine the prevalence of clinically significant dental fear. *Community Dent Oral Epidemiol*. 2011;39(6):554-563.

    doi: 10.1111/j.1600-0528.2011.00628.x

15. Ashley P, Chaudhary M, Lourenço-Matharu L. Sedation of children undergoing dental treatment. *Cochrane Database Syst Rev*. 2018;12:CD003877.

    doi: 10.1002/14651858.cd003877.pub5

16. Inchingolo F, Hazballa D, Inchingolo AD, *et al*. Innovative concepts and recent breakthrough for engineered graft and constructs for bone regeneration: A literature systematic review. *Materials (Basel)*. 2022;15(3):1120.

    doi: 10.3390/ma15031120

17. Inchingolo AD, Ferrara I, Viapiano F, *et al*. Rapid maxillary expansion on the adolescent patient: Systematic review and case report. *Children (Basel)*. 2022;9(7):1046.

    doi: 10.3390/children9071046

18. Inchingolo AM, Patano A, Di Pede C, *et al*. Autologous tooth graft: Innovative biomaterial for bone regeneration. Tooth transformer® and the role of microbiota in regenerative dentistry. A systematic review. *J Funct Biomater*. 2023;14(3):132.

doi: 10.3390/jfb14030132

19. Vassar JW, Karydis A, Trojan T, Fisher J. Dentoskeletal effects of a temporary skeletal anchorage device-supported rapid maxillary expansion appliance (TSADRME): A pilot study. *Angle Orthod*. 2016;86(2):241-249.

doi: 10.2319/013015-76.1

20. Balzanelli M, Distratis P, Catucci O, *et al.* Clinical and diagnostic findings in COVID-19 patients: An original research from SG Moscati Hospital in Taranto Italy. *J Biol Regul Homeost Agents*. 2021;35(1):171-183.

doi: 10.23812/20-605-A

21. Drakesmith H, Prentice A. Viral infection and iron metabolism. *Nat Rev Microbiol*. 2008;6(7):541-552.

doi: 10.1038/nrmicro1930

22. Duangthip D, Wong MCM, Chu CH, Lo ECM. Caries arrest by topical fluorides in preschool children: 30-month results. *J Dent*. 2018;70:74-79.

doi: 10.1016/j.jdent.2017.12.013

23. Ciavarella D, Guiglia R, Campisi G, *et al*. Update on gingival overgrowth by cyclosporine A in renal transplants. *Med Oral Patol Oral Cir Bucal*. 2007;12(1):E19-E25.

24. De Gabriele O, Dallatana G, Riva R, Vasudavan S, Wilmes B. The easy driver for placement of palatal mini-implants and a maxillary expander in a single appointment. *J Clin Orthod*. 2017;51(11):728-737.

25. Avvanzo P, Ciavarella D, Avvanzo A, Giannone N, Carella M, Lo Muzio L. Immediate placement and temporization of implants: Three- to five-year retrospective results. *J Oral Implantol*. 2009;35(3):136-142.

doi: 10.1563/1548-1336-35.3.136

26. Balzanelli MG, Distratis P, Dipalma G, *et al*. Sars-CoV-2 virus infection may interfere CD34+ hematopoietic stem cells and megakaryocyte-erythroid progenitors differentiation contributing to platelet defection towards insurgence of thrombocytopenia and thrombophilia. *Microorganisms*. 2021;9(8):1632.

doi: 10.3390/microorganisms9081632

27. Balzanelli MG, Distratis P, Dipalma G, *et al.* Immunity profiling of COVID-19 infection, dynamic variations of lymphocyte subsets, a comparative analysis on four different groups. *Microorganisms*. 2021;9(10):2036.

doi: 10.3390/microorganisms9102036

28. Balzanelli MG, Distratis P, Lazzaro R, *et al*. Analysis of gene single nucleotide polymorphisms in COVID-19 disease highlighting the susceptibility and the severity towards the infection. *Diagnostics (Basel)*. 2022;12(11):2824.

doi: 10.3390/diagnostics12112824

29. Bambini F, De Stefano CA, Giannetti L, Memè L, Pellecchia M. Influence of biphosphonates on the integration process of endosseous implants evaluated using single photon emission computerized tomography (SPECT). *Minerva Stomatol*. 2003;52(6):331-338.

30. Bambini F, Giannetti L, Memè L, Pellecchia M, Selvaggio R. Comparative analysis of direct and indirect implant impression techniques an *in vitro* study. An *in vitro* study. *Minerva Stomatol*. 2005;54(6):395-402.

31. Bambini F, Greci L, Memè L, *et al.* Raloxifene covalently bonded to titanium implants by interfacing with (3-aminopropyl)-triethoxysilane affects osteoblast-like cell gene expression. *Int J Immunopathol Pharmacol*. 2006;19(4):905-914.

doi: 10.1177/039463200601900420

32. Bambini F, Memè L, Pellecchia M, Sabatucci A, Selvaggio R. Comparative analysis of deformation of two implant/abutment connection systems during implant insertion. An *in vitro* study. *Minerva Stomatol*. 2005;54(3):129-138.

33. Bambini F, Memè L, Procaccini M, Rossi B, Lo Muzio L. Bone scintigraphy and SPECT in the evaluation of the osseointegrative response to immediate prosthetic loading of endosseous implants: A pilot study. *Int J Oral Maxillofac Implants*. 2004;19(1):80-86.

34. Bavetta G, Bavetta G, Randazzo V, *et al.* A retrospective study on insertion torque and implant stability quotient (ISQ) as stability parameters for immediate loading of implants in fresh extraction sockets. *Biomed Res Int*. 2019;2019:9720419.

doi: 10.1155/2019/9720419

35. Bazrafshan N, Darby I. Retrospective success and survival rates of dental implants placed with simultaneous bone augmentation in partially edentulous patients. *Clin Oral Implants Res*. 2014;25(7):768-773.

doi: 10.1111/clr.12185

36. Bellocchio L, Bordea IR, Ballini A, *et al*. Environmental issues and neurological manifestations associated with COVID-19 pandemic: New aspects of the disease? *Int J Environ Res Public Health*. 2020;17(21):8049.

doi: 10.3390/ijerph17218049

37. Rickert SM, O'Cathain E. Pediatric voice. *Pediatr Clin North Am*. 2022;69(2):329-347.

doi: 10.1016/j.pcl.2022.01.003

38. Stachler RJ, Francis DO, Schwartz SR, *et al*. Clinical practice guideline: Hoarseness (dysphonia) (update). *Otolaryngol Head Neck Surg*. 2018;158(1_suppl):S1-S42.

doi: 10.1177/0194599817751030

39. Chang JI, Bevans SE, Schwartz SR. Otolaryngology clinic of North America: Evidence-based practice: Management of hoarseness/dysphonia. *Otolaryngol Clin North Am*. 2012;45(5):1109-1126.

doi: 10.1016/j.otc.2012.06.012

40. Abbing A, Koretsi V, Eliades T, Papageorgiou SN. Duration of orthodontic treatment with fixed appliances in adolescents and adults: A systematic review with meta-analysis. *Prog Orthod*. 2020;21(1):37.

doi: 10.1186/s40510-020-00334-4

41. Abelsson A, Willman A. Ethics and aesthetics in injection treatments with Botox and Filler. *J Women Aging*. 2021;33(6):583-595.

doi: 10.1080/08952841.2020.1730682

42. Ablon G, Bank D, Kontis TC, *et al*. Efficacy and safety of relabotulinumtoxinA liquid botulinum toxin in the treatment of lateral canthal lines: Results from the phase 3 READY-2 study. *Dermatol Surg*. 2025;51(3):277-283.

doi: 10.1097/DSS.0000000000004470

43. Abramo AC. Muscle insertion and strength of the muscle contraction as guidelines to enhance duration of the botulinum toxin effect in the upper face. *Aesthetic Plast Surg*. 2018;42(5):1379-1387.

doi: 10.1007/s00266-018-1157-3

44. Abu-Qamar MZ, Vafeas C, Ewens B, Ghosh M, Sundin D. Postgraduate nurse education and the implications for nurse and patient outcomes: A systematic review. *Nurse Educ Today*. 2020;92:104489.

doi: 10.1016/j.nedt.2020.104489

45. Ahmad M, Makati D, Akbar S. Review of and updates on hypertension in obstructive sleep apnea. *Int J Hypertens*. 2017;2017:1848375.

doi: 10.1155/2017/1848375

46. Ahn BK, Kim YS, Kim HJ, Rho NK, Kim HS. Consensus recommendations on the aesthetic usage of botulinum toxin type A in Asians. *Dermatol Surg*. 2013;39(12):1843-1860.

doi: 10.1111/dsu.12317

47. Al Hamdan EM, Algheryafi AM, Al-Ghareeb FJ, Ashri NY. Knowledge and attitude of dentists towards the use of botulinum toxin and dermal fillers in dentistry, Riyadh, Saudi Arabia. *J Cosmet Laser Ther*. 2013;15(1):46-54.

doi: 10.3109/14764172.2012.758377

48. Al-Aroomi OA, Ou Y, Sakran KA, *et al.* Effectiveness of concentrated growth factors with or without grafting materials in maxillary sinus augmentation: A systematic review. *BMC Oral Health*. 2024;24(1):1275.

doi: 10.1186/s12903-024-04952-w

49. Alam MK, Hajeer MY, Alahmed MA, Alrubayan SM, Almasri MF. A comparative study on the efficiency of clear aligners versus conventional braces in adult orthodontic patients. *J Pharm Bioallied Sci*. 2024;16(Suppl4):S3637-S3639.

doi: 10.4103/jpbs.jpbs_1161_24

50. Alam MK, Abutayyem H, Kanwal B, Shayeb MAL. Future of orthodontics-A systematic review and meta-analysis on the emerging trends in this field. *J Clin Med*. 2023;12(2):532.

doi: 10.3390/jcm12020532

51. Saccomanno S, Saran S, De Luca M, Mastrapasqua RF, Raffaelli L, Levrini L. The Influence of SARS-CoV-2 pandemic on TMJ disorders, OSAS and BMI. *Int J Environ Res Public Health*. 2022;19(12):7154.

doi: 10.3390/ijerph19127154

52. Saccomanno S, Saran S, Laganà D, Mastrapasqua RF, Grippaudo C. Motivation, perception, and behavior of the adult orthodontic patient: A survey analysis. *Biomed Res Int*. 2022;2022:2754051.

doi: 10.1155/2022/2754051

53. Saccomanno S, Quinzi V, Albani A, D'Andrea N, Marzo G, Macchiarelli G. Utility of teleorthodontics in orthodontic emergencies during the COVID-19 pandemic: A systematic review. *Healthcare (Basel)*. 2022;10(6):1108.

doi: 10.3390/healthcare10061108

54. Happernegg R, Kerbl R. The influence of wearing surgical and FFP2 face masks on physiological parameters in children and adolescents - a pilot study. *Klin Padiatr*. 2023;235(2):101-102.

doi: 10.1055/a-1976-1520

55. Sukul P, Bartels J, Fuchs P, *et al*. Effects of COVID-19 protective face masks and wearing durations on respiratory haemodynamic physiology and exhaled breath constituents. *Eur Respir J*. 2022;60(3):2200009.

doi: 10.1183/13993003.00009-2022

56. Brandini DA, Takamiya AS, Thakkar P, Schaller S, Rahat R, Naqvi AR. Covid-19 and oral diseases: Crosstalk, synergy or association? *Rev Med Virol*. 2021;31(6):e2226.

doi: 10.1002/rmv.2226

57. *Reduced Speech: All is Variability - Warner - 2019 - WIREs Cognitive Science*. Wiley Online Library. Available from: https://wires.onlinelibrary.wiley.com/doi/10.1002/wcs.1496 [Last accessed on 2025 Jul 10].

58. Alfallaj H. Pre-prosthetic orthodontics. *Saudi Dent J*. 2020;32(1):7-14.

doi: 10.1016/j.sdentj.2019.08.004

59. Alfarafisa NM, Chou Y, Santika R, Riestiano BE, Soedjana H, Syamsunarno MRAA. Adipose-derived stem cell products and combination therapies for the treatment of pathological scars: A review of current preclinical and clinical studies. *Clin Cosmet Investig Dermatol*. 2025;18:1309-1337.

doi: 10.2147/CCID.S511067

60. Allanqawi T, Alkadhimi A, Fleming PS. Postgraduate orthodontic education: An international perspective

on content and satisfaction levels. *J World Fed Orthod*. 2023;12(6):239-244.

doi: 10.1016/j.ejwf.2023.08.004

61. Almasoud NN. Extraction of primary canines for interceptive orthodontic treatment of palatally displaced permanent canines: A systematic review. *Angle Orthod*. 2017;87(6):878-885.

doi: 10.2319/021417-105.1

62. Almekkawy M, Chen J, Ellis MD, *et al*. Therapeutic systems and technologies: State-of-the-art applications, opportunities, and challenges. *IEEE Rev Biomed Eng*. 2020;13:325-339.

doi: 10.1109/RBME.2019.2908940

63. Almukhtar RM, Fabi SG. The masseter muscle and its role in facial contouring, aging, and quality of life: A literature review. *Plast Reconstr Surg*. 2019;143(1):39e-48e.

doi: 10.1097/PRS.0000000000005083

64. Almuzian M, Alharbi F, McIntyre G. Extra-oral appliances in orthodontic treatment. *Dent Update*. 2016;43(1):74-76, 79-82.

doi: 10.12968/denu.2016.43.1.74

65. Angelo-Khattar M. A novel onabotulinumtoxinA treatment technique to obtain predictable outcomes in eyebrow position and shape. *Clin Cosmet Investig Dermatol*. 2020;13:781-787.

doi: 10.2147/CCID.S275841

66. Araco A, Francesco A. Prospective randomized clinical study of a new topical formulation for face wrinkle reduction and dermal regeneration. *J Cosmet Dermatol*. 2021;20(9):2832-2840.

doi: 10.1111/jocd.13937

67. Artese F. A broader look at interceptive orthodontics: What can we offer? *Dental Press J Orthod*. 2019;24(5):7-8.

doi: 10.1590/2177-6709.24.5.007-008.edt

68. Saccomanno S, Manenti RJ, Giancaspro S, *et al*. Evaluation of the effects on SpO2 of N95 mask (FFP2) on dental health care providers: A cross-sectional observational study. *BMC Health Serv Res*. 2022;22:248.

doi: 10.1186/s12913-022-07648-5

69. Bein B, Bachmann M, Huggett S, Wegermann P. SARS CoV-2/COVID-19: Evidence-based recommendation on diagnosis and therapy. *Anasthesiol Intensivmed Notfallmed Schmerzther*. 2020;55(4):257-265.

doi: 10.1055/a-1146-8674

70. Biondi M, Picardi A. Temporomandibular joint pain-dysfunction syndrome and bruxism: Etiopathogenesis and treatment from a psychosomatic integrative viewpoint. *Psychother Psychosom*. 1993;59(2):84-98.

doi: 10.1159/000288651

71. Bishara SE, Warren JJ, Broffitt B, Levy SM. Changes in the prevalence of nonnutritive sucking patterns in the first 8 years of life. *Am J Orthod Dentofacial Orthop.* 2006;130(1):31-36.

doi: 10.1016/j.ajodo.2004.11.033

72. Blondin MS, Bryan JL, Wiesemann GS, Kerekes DT, Dang J, Mast BA. Nonsurgical aesthetic treatment conversion to surgery: Implications for patient selection and practice modeling. *Ann Plast Surg*. 2025;94(6S Suppl 4):S493-S496.

doi: 10.1097/SAP.0000000000004386

73. Borba A, Matayoshi S, Rodrigues M. Avoiding complications on the upper face treatment with botulinum toxin: A practical guide. *Aesthetic Plast Surg*. 2022;46(1):385-394.

doi: 10.1007/s00266-021-02483-1

74. Borda AF, Garfinkle JS, Covell DA, Wang M, Doyle L, Sedgley CM. Outcome assessment of orthodontic clear aligner vs fixed appliance treatment in a teenage population with mild malocclusions. *Angle Orthod*. 2020;90(4):485-490.

doi: 10.2319/122919-844.1

75. Borodic G. Botulinum toxin, immunologic considerations with long-term repeated use, with emphasis on cosmetic applications. *Facial Plast Surg Clin North Am*. 2007;15(1):11-16, v.

doi: 10.1016/j.fsc.2006.10.001

76. Borsky KL, Rodrigues JN, Rodrigues R. The effect of climate on the dose requirements of botulinum toxin A in cosmetic interventions. *Plast Reconstr Surg*. 2024;154(1):57e-62e.

doi: 10.1097/PRS.0000000000010913

77. Braccini F, Catoni I, Belfkira F, *et al*. SAMCEP Society consensus on the treatment of upper facial lines with botulinum neurotoxin type A: A tailored approach. *J Cosmet Dermatol*. 2023;22(10):2692-2704.

doi: 10.1111/jocd.15768

78. Braccini F, Dohan Ehrenfest DM. Advantages of combined therapies in cosmetic medicine for the treatment of face aging: Botulinum toxin, fillers and mesotherapy. *Rev Laryngol Otol Rhinol (Bord)*. 2010;131(2):89-95.

79. Brandt B, Lutfiyya MN, King JA, Chioreso C. A scoping review of interprofessional collaborative practice and education using the lens of the Triple Aim. *J Interprof Care*. 2014;28(5):393-399.

doi: 10.3109/13561820.2014.906391

80. Spiegel JR, Hawkshaw M, Sataloff RT. Dysphonia related to medical therapy. *Otolaryngol Clin North Am*. 2000;33(4):771-784.

doi: 10.1016/s0030-6665(05)70243-7

81. Souza AMV, Duprat AC, Costa RC, Pimenta JO, Andrade FFS, Silva FF. Use of inhaled versus oral steroids for acute dysphonia. *Braz J Otorhinolaryngol*. 2013;79(2):196-202.

doi: 10.5935/1808-8694.20130035

82. Lipworth BJ. Systemic adverse effects of inhaled corticosteroid therapy: A systematic review and meta-analysis. *Arch Intern Med*. 1999;159(9):941-955.

doi: 10.1001/archinte.159.9.941

83. Kane MAC. A double-blind, randomized, placebo-controlled, two-dose comparative study of botulinum toxin type A for treating glabellar lines in Japanese subjects. *Aesthetic Plast Surg*. 2008;32(6):933-935.

doi: 10.1007/s00266-008-9197-8

84. Kane MAC, Monheit G. The practical use of abobotulinumtoxinA in aesthetics. *Aesthet Surg J*. 2017;37(suppl_1):S12-S19.

doi: 10.1093/asj/sjw285

85. Kane M, Donofrio L, Ascher B, *et al*. Expanding the use of neurotoxins in facial aesthetics: A consensus panel's assessment and recommendations. *J Drugs Dermatol*. 2010;9(1 Suppl):s7-s22; quiz s23-s25.

86. Kang GCW, Hsiao YC, Huang JJ, *et al*. Aesthetic durable forehead contouring in asians with fat grafting and botulinum toxin. *Ann Plast Surg*. 2019;82(1S Suppl 1):S59-S65.

doi: 10.1097/SAP.0000000000001704

87. Kang SH, Moon SH, Rho BI, Youn SJ, Kim HS. Wedge-shaped polydioxanone threads in a folded configuration ("Solid fillers"): A treatment option for deep static wrinkles on the upper face. *J Cosmet Dermatol*. 2019;18(1):65-70.

doi: 10.1111/jocd.12557

88. Kantor J. Synergistic effect of combination deoxycholic acid and botulinum toxin (the Bellatox technique) for the treatment of submental fullness. *J Am Acad Dermatol*. 2017;76(6):e209-e211.

doi: 10.1016/j.jaad.2017.01.041

89. Karapantzou C, Jakob M, Canis M. Neurotoxin injection in benign submandibular gland hypertrophy: A first choice treatment. *Laryngoscope Investig Otolaryngol*. 2020;5(2):217-220.

doi: 10.1002/lio2.363

90. Karsai S, Raulin C. Botox and Dysport: Is there a dose conversion ratio in dermatology and aesthetic medicine? *J Am Acad Dermatol*. 2010;62(2):346-347.

doi: 10.1016/j.jaad.2008.12.028

91. McAllister A, Sjölander P. Children's voice and voice disorders. *Semin Speech Lang*. 2013;34(2):71-79.

doi: 10.1055/s-0033-1342978

92. McAllister A. Voice disorders in children with oral motor dysfunction: Perceptual evaluation pre and post oral motor therapy. *Logoped Phoniatr Vocol*. 2003;28(3):117-125.

93. Inchingolo F, Inchingolo AM, Latini G, *et al*. Oxidative stress and natural products in orthodontic treatment: A systematic review. *Nutrients*. 2023;16(1):113.

doi: 10.3390/nu16010113

94. Saccomanno S, Deli R, Di Cintio G, De Corso E, Paludetti G, Grippaudo C. Retrospective epidemiological study of mandibular rotational types in patients with orthodontical malocclusion. *Acta Otorhinolaryngol Ital*. 2018;38(2):160-165.

doi: 10.14639/0392-100X-1682

95. Carvalho AJA, Lemos SMA, Goulart LMHF. Language development and its relation to social behavior and family and school environments: A systematic review. *Codas*. 2016;28(4):470-479.

doi: 10.1590/2317-1782/20162015193

96. Weibel S, Rücker G, Eberhart LH, *et al*. Drugs for preventing postoperative nausea and vomiting in adults after general anaesthesia: A network meta-analysis. *Cochrane Database Syst Rev*. 2020;10(10):CD012859.

doi: 10.1002/14651858.CD012859.pub2

97. Bulstrode NW, Grobbelaar AO. Long-term prospective follow-up of botulinum toxin treatment for facial rhytides. *Aesthetic Plast Surg*. 2002;26(5):356-359.

doi: 10.1007/s00266-002-2047-1

98. Camacho M, Certal V, Abdullatif J, *et al*. Myofunctional therapy to treat obstructive sleep apnea: A systematic review and meta-analysis. *Sleep*. 2015;38(5):669-675.

doi: 10.5665/sleep.4652

99. Camargo CP, Xia J, Costa CS, *et al*. Botulinum toxin type A for facial wrinkles. *Cochrane Database Syst Rev*. 2021;7(7):CD011301.

doi: 10.1002/14651858.CD011301.pub2

100. Cannistraci AJ, Friedrich JA. A multidimensional approach to bruxism and TMD. *N Y State Dent J*. 1987;53(8):31-34.

101. Carruthers A, Carruthers J. Cosmetic uses of botulinum A exotoxin. *Adv Dermatol*. 1997;12:325-347; discussion 348.

102. Carruthers A, Bruce S, Cox SE, Kane MAC, Lee E, Gallagher CJ. OnabotulinumtoxinA for treatment of moderate to severe crow's feet lines: A review. *Aesthet Surg J*. 2016;36(5):591-597.

doi: 10.1093/asj/sjw025

103. Carruthers A, Bruce S, de Coninck A, *et al*. Efficacy and safety of onabotulinumtoxinA for the treatment of crows feet lines: A multicenter, randomized, controlled trial. *Dermatol Surg*. 2014;40(11):1181-1190.

doi: 10.1097/DSS.0000000000000128

104. Carruthers A, Carruthers J. Botulinum toxin type A for the treatment of glabellar rhytides. *Dermatol Clin*. 2004;22(2):137-144.

doi: 10.1016/s0733-8635(03)00071-8

105. Carruthers A, Carruthers J, Coleman WP 3rd, *et al*. Multicenter, randomized, phase III study of a single dose of incobotulinumtoxinA, free from complexing proteins, in the treatment of glabellar frown lines. *Dermatol Surg*. 2013;39(4):551-558.

doi: 10.1111/dsu.12100

106. Carruthers A, Carruthers J, De Boulle K, Lowe N, Lee E, Brin MF. Treatment of crow's feet lines and forehead lines with Botox (onabotulinumtoxinA): Development, insights, and impact. *Medicine (Baltimore)*. 2023;102(S1):e32496.

doi: 10.1097/MD.0000000000032496

107. Carruthers A, Carruthers J, Monheit GD, Davis PG, Tardie G. Multicenter, randomized, parallel-group study of the safety and effectiveness of onabotulinumtoxinA and hyaluronic acid dermal fillers (24-mg/ml smooth, cohesive gel) alone and in combination for lower facial rejuvenation. *Dermatol Surg*. 2010;36 Suppl 4:2121-2134.

doi: 10.1111/j.1524-4725.2010.01705.x

108. Saccomanno S, Martini C, D'Alatri L, Farina S, Grippaudo C. A specific protocol of myo-functional therapy in children with Down syndrome. A pilot study. *Eur J Paediatr Dent*. 2018;19(3):243-246.

doi: 10.23804/ejpd.2018.19.03.14

109. Vainio L. Connection between movements of mouth and hand: Perspectives on development and evolution of speech. *Neurosci Biobehav Rev*. 2019;100:211-223.

doi: 10.1016/j.neubiorev.2019.03.005

110. Vainio L, Tiippana K, Tiainen M, Rantala A, Vainio M. Reaching and grasping with the tongue: Shared motor planning between hand actions and articulatory gestures. *Q J Exp Psychol (Hove)*. 2018;71(10):2129-2141.

doi: 10.1177/1747021817738732

111. Teresa DM, Stefano M, Annalisa M, Enrico M, Vincenzo C, Giuseppe M. Orthodontic treatment of the transposition of a maxillary canine and a first premolar: A case report. *J Med Case Rep.* 2015;9:48.

doi: 10.1186/s13256-015-0521-z

112. Saccomanno S, Berretin-Felix G, Coceani Paskay L, Manenti RJ, Quinzi V. Myofunctional therapy part 4: Prevention and treatment of dentofacial and oronasal disorders. *Eur J Paediatr Dent*. 2021;22(4):332-334.

doi: 10.23804/ejpd.2021.22.04.12

113. Bourke L, Lingwood J, Gallagher-Mitchell T, López-Pérez B. The effect of face mask wearing on language processing and emotion recognition in young children. *J Exp Child Psychol*. 2023;226:105580.

doi: 10.1016/j.jecp.2022.105580

114. Ger E, Manfredi M, Osório AAC, *et al*. Duration of face mask exposure matters: Evidence from Swiss and Brazilian kindergartners' ability to recognise emotions. *Cogn Emot*. 2024;38(6):857-871.

doi: 10.1080/02699931.2024.2331795

115. Zou J, Meng M, Law CS, Rao Y, Zhou X. Common dental diseases in children and malocclusion. *Int J Oral Sci*. 2018;10(1):7.

doi: 10.1038/s41368-018-0012-3

116. Zhou S, Liu H, Pan Z, *et al*. Observation of safety and efficacy of botulinum toxin type A in the treatment of tear troughs and mild yelid bags. *J Cosmet Dermatol*. 2025;24(6):e70253.

doi: 10.1111/jocd.70253

117. Zhou R, Fei Y, Sun L, Guo J, Zhou X, Zhang X. BTX-A rejuvenation: Regional botulinum toxin-A injection of the platysma in patients with facial sagging. *Aesthetic Plast Surg*. 2019;43(4):1044-1053.

doi: 10.1007/s00266-019-01396-4

118. Zhou R, Pan B, Wang C, Wang D. Mandibular rim trilogy with botulinum toxin injection: Reduction, projection, and lift. *Facial Plast Surg*. 2017;33(1):102-108.

doi: 10.1055/s-0037-1600525

119. Zheng Z, Yin J, Cheng B, Huang W. Materials selection for the injection into vaginal wall for treatment of vaginal atrophy. *Aesthetic Plast Surg*. 2021;45(3):1231-1241.

doi: 10.1007/s00266-020-02054-w

120. Zhang Y, Gu L, Du B, Xu J, Du S. Knowledge, attitude, and practice of orthodontic treatment among student patients preparing for or undergoing treatment. *Sci Rep.* 2025;15:17838.

doi: 10.1038/s41598-025-97801-x

121. Zhang W, Wen Y, Zhong Y, Chen Q. Meta-analysis of adverse reactions of botulinum toxin A in facial rejuvenation treatment. *Aesthetic Plast Surg*. 2025;49(9):2305-2314.

doi: 10.1007/s00266-024-04539-4

122. Zhang W, Si LY. Obstructive sleep apnea syndrome (OSAS) and hypertension: Pathogenic mechanisms and possible therapeutic approaches. *Ups J Med Sci*. 2012;117(4):370-382.

doi: 10.3109/03009734.2012.707253

123. Zhang M, Yang Y, Shi Y, *et al*. A comprehensive ultrasound investigation of lower facial and neck structure. *Aesthetic Plast Surg*. 2025;49(1):1-12.

doi: 10.1007/s00266-024-04313-6

124. Zhang B, Gong J, He L, *et al*. Exosomes based advancements for application in medical aesthetics. *Front Bioeng Biotechnol*. 2022;10:1083640.

doi: 10.3389/fbioe.2022.1083640

125. Arrigoni R, Ballini A, Santacroce L, *et al*. Another look at dietary polyphenols: Challenges in cancer prevention and

treatment. *Curr Med Chem*. 2022;29(6):1061-1082.

doi: 10.2174/0929867328666210810154732

126. Ballini A, Cantore S, Farronato D, *et al.* Periodontal disease and bone pathogenesis: The crosstalk between cytokines and *Porphyromonas gingivalis*. *J Biol Regul Homeost Agents*. 2015;29(2):273-281.

127. Ballini A, Cantore S, Fotopoulou EA, *et al*. Combined sea salt-based oral rinse with xylitol in orthodontic patients: Clinical and microbiological study. *J Biol Regul Homeost Agents*. 2019;33(1):263-268.

128. Ballini A, Cantore S, Saini R, *et al*. Effect of activated charcoal probiotic toothpaste containing *Lactobacillus paracasei* and xylitol on dental caries: A randomized and controlled clinical trial. *J Biol Regul Homeost Agents*. 2019;33(3):977-981.

129. Ballini A, Gnoni A, De Vito D, *et al*. Effect of probiotics on the occurrence of nutrition absorption capacities in healthy children: A randomized double-blinded placebo-controlled pilot study. *Eur Rev Med Pharmacol Sci*. 2019;23(19):8645-8657.

doi: 10.26355/eurrev_201910_19182

130. Botzer E, Quinzi V, Salvati SE, Coceani Paskay L, Saccomanno S. Myofunctional therapy Part 3: Tongue function and breastfeeding as precursor of oronasal functions. *Eur J Paediatr Dent*. 2021;22(3):248-250.

doi: 10.23804/ejpd.2021.22.03.13

131. Edmunds J, Miles SC, Fulbrook P. Tongue-tie and breastfeeding: A review of the literature. *Breastfeed Rev*. 2011;19(1):19-26.

132. Inchingolo AD, Malcangi G, Ceci S, *et al*. Antispike immunoglobulin-G (IgG) titer response of SARS-CoV-2 mRNA-vaccine (BNT162b2): A monitoring study on healthcare workers. *Biomedicines*. 2022;10(10):2402.

doi: 10.3390/biomedicines10102402

133. Inchingolo F, Tatullo M, Abenavoli FM, *et al*. Severe anisocoria after oral surgery under general anesthesia. *Int J Med Sci*. 2010;7(5):314-318.

doi: 10.7150/ijms.7.314

134. Inchingolo AM, Inchingolo AD, Latini G, *et al*. Caries prevention and treatment in early childhood: Comparing strategies. A systematic review. *Eur Rev Med Pharmacol Sci*. 2023;27(22):11082-11092.

doi: 10.26355/eurrev_202311_34477

135. Inchingolo F, Tatullo M, Abenavoli FM, *et al.* Surgical treatment of depressed scar: A simple technique. *Int J Med Sci*. 2011;8(5):377-379.

doi: 10.7150/ijms.8.377

136. Inchingolo AM, Inchingolo AD, Nardelli P, *et al.* Stem cells: Present understanding and prospects for regenerative dentistry. *J Funct Biomater*. 2024;15(10):308.

doi: 10.3390/jfb15100308

137. Sansores-España LD, Morales F, Arriola-Pacheco F, *et al*. Gingival crevicular fluid as Biomarker's source for Alzheimer's disease. *Odovtos Int J Dent Sci*. 2022;24(1):156-176.

doi: 10.15517/ijds.2022.49232

138. Sarrabayrouse MAM. Indications and limitations for the use of botulinum toxin for the treatment of facial wrinkles. *Aesthetic Plast Surg*. 2002;26(4):233-238.

doi: 10.1007/s00266-002-2030-x

139. Sattler G. Current and future botulinum neurotoxin type A preparations in aesthetics: A literature review. *J Drugs Dermatol*. 2010;9(9):1065-1071.

140. Sattler G, Callander MJ, Grablowitz D, *et al.* Noninferiority of incobotulinumtoxinA, free from complexing proteins, compared with another botulinum toxin type A in the treatment of glabellar frown lines. *Dermatol Surg*. 2010;36 Suppl 4:2146-2154.

doi: 10.1111/j.1524-4725.2010.01706.x

141. Saybel A, Artemenko A, Nikitin S, Kurenkov A. A prospective, neurophysiologic comparative study to assess the efficacy and duration of effect of incobotulinumtoxinA and abobotulinumtoxinA in the treatment of crow's feet. *J Drugs Dermatol*. 2015;14(11):1291-1296.

142. Sangle R, Parab M, Gujare A, Dhatrak P, Deshmukh S. Effective techniques and emerging alternatives in orthodontic tooth movement: A systematic review. *Med Novel Technol Devices*. 2023;20:100274.

doi: 10.1016/j.medntd.2023.100274

143. Saltvig I, Matzen SH. Incidental treatment of a subclinical chronic tension-type headache by cosmetic use of botulinum toxin A: A case report. *Case Rep Dermatol*. 2017;9(3):249-253.

doi: 10.1159/000484657

144. Boyd KL, Saccomanno S, Coceani Paskay HL, Quinzi V, Marzo G. Maldevelopment of the cranio-facial-respiratory complex: A Darwinian perspective. *Eur J Paediatr Dent*. 2021;22(3):225-229.

doi: 10.23804/ejpd.2021.22.03.9

145. Saccomanno S, Saran S, Paskay LC, *et al.* Risk factors and prevention of choking. *Eur J Transl Myol*. 2023;33(4):11471.

doi: 10.4081/ejtm.2023.11471

146. Gelb M, Montrose J, Paglia L, Saccomanno S, Quinzi V, Marzo G. Myofunctional therapy Part 2: Prevention of dentofacial disorders. *Eur J Paediatr Dent*. 2021; 22(2):163-167.

doi: 10.23804/ejpd.2021.22.02.15

147. *New Trends in Myofunctional Therapy: Occlusion, Muscles and Posture*. ResearchGate. Available from: https://www.researchgate.net/publication/348754734_new_trends_in_

myofunctional_therapy_occlusion_muscles_and_posture [Last accessed on 2025 Jul 10].

148. Rony MAT, Johora FT, Thalji N, *et al*. Innovative approach to detecting autism spectrum disorder using explainable features and smart web application. *Mathematics*. 2024;12(22):3515.

doi: 10.3390/math12223515

149. Alam MS, Elsheikh EAA, Suliman FM, Rashid MM, Faizabadi AR. Innovative strategies for early autism diagnosis: Active learning and domain adaptation optimization. *Diagnostics (Basel)*. 2024;14(6):629.

doi: 10.3390/diagnostics14060629

150. Oh J, Woo HG, Kim HJ, *et al*. Prenatal and infant exposure to antibiotics and subsequent risk of neuropsychiatric disorders in children: A nationwide birth cohort study in South Korea. *Psychiatry Res*. 2024;340:116117.

doi: 10.1016/j.psychres.2024.116117

151. Cantore S, Mirgaldi R, Ballini A, *et al*. Cytokine gene polymorphisms associate with microbiogical agents in periodontal disease: Our experience. *Int J Med Sci*. 2014;11(7):674-679.

doi: 10.7150/ijms.6962

152. Casu C, Mosaico G, Natoli V, Scarano A, Lorusso F, Inchingolo F. Microbiota of the tongue and systemic connections: The examination of the tongue as an integrated approach in oral medicine. *Hygiene*. 2021;1(2):56-68.

doi: 10.3390/hygiene1020006

153. Cenzato N, Farronato M, Tartaglia FC, *et al*. Soft tissue facial morphology in growing patients with different occlusal classes. *J Pers Med*. 2024;14(10):1042.

doi: 10.3390/jpm14101042

154. Ceratti C, Maspero C, Consonni D, *et al*. Cone-beam computed tomographic assessment of the mandibular condylar volume in different skeletal patterns: A retrospective study in adult patients. *Bioengineering (Basel)*. 2022;9(3):102.

doi: 10.3390/bioengineering9030102

155. Cerkezi S, Nakova M, Gorgoski I, *et al*. The role of sulfhydryl (thiols) groups in oral and periodontal diseases. *Biomedicines*. 2024;12(4):882.

doi: 10.3390/biomedicines12040882

156. Charitos IA, Del Prete R, Inchingolo F, *et al*. What we have learned for the future about COVID-19 and healthcare management of it? *Acta Biomed*. 2020;91(4):e2020126.

doi: 10.23750/abm.v91i4.10253

157. Cirulli N, Ballini A, Cantore S, *et al*. Mixed dentition space analysis of a Southern Italian population: New regression equations for unerupted teeth. *J Biol Regul Homeost Agents*. 2015;29(2):515-520.

158. Saxena R, Gupta V, Rakheja V, Dhiman R, Bhardawaj A, Vashist P. Lifestyle modification in school-going children before and after COVID-19 lockdown. *Indian J Ophthalmol*. 2021;69(12):3623-3629.

doi: 10.4103/ijo.IJO_2096_21

159. Warkad VU. Commentary: Online school in COVID-19 pandemic: Impact on lifestyle and ocular health. *Indian J Ophthalmol*. 2021;69(12):3631-3632.

doi: 10.4103/ijo.IJO_2779_21

160. Mohan A, Sen P, Shah C, Jain E, Jain S. Prevalence and risk factor assessment of digital eye strain among children using online e-learning during the COVID-19 pandemic: Digital eye strain among kids (DESK study-1). *Indian J Ophthalmol*. 2021;69(1):140-144.

doi: 10.4103/ijo.IJO_2535_20

161. Rizzolatti G, Fadiga L, Gallese V, Fogassi L. Premotor cortex and the recognition of motor actions. *Brain Res Cogn Brain Res*. 1996;3(2):131-141.

doi: 10.1016/0926-6410(95)00038-0

162. Shetty P. Speech and language delay in children: A review and the role of a pediatric dentist. *J Indian Soc Pedod Prev Dent*. 2012;30(2):103-108.

doi: 10.4103/0970-4388.99979

163. Piancino MG, Di Benedetto L, Matacena G, Deregibus A, Marzo G, Quinzi V. Paediatric Orthodontics Part 3: Masticatory function during development. *Eur J Paediatr Dent*. 2019;20(3):247-249.

doi: 10.23804/ejpd.2019.20.03.15

164. Thümmler R, Engel EM, Bartz J. Strengthening emotional development and emotion regulation in childhood-as a key task in early childhood education. *Int J Environ Res Public Health*. 2022;19(7):3978.

doi: 10.3390/ijerph19073978

165. *Emotional Self-Regulation in the Early Years: The Role of Cognition, Metacognition and Social Interaction*. ResearchGate. Available from: https://www.researchgate.net/publication/336579571_emotional_self-regulation_in_the_early_years_the_role_of_cognition_metacognition_and_social_interaction [Last accessed on 2025 Jul 10].

166. Moore A, Lynch H, Boyle B. Can universal design support outdoor play, social participation, and inclusion in public playgrounds? A scoping review. *Disabil Rehabil*. 2022;44(13):3304-3325.

doi: 10.1080/09638288.2020.1858353

167. Schipperijn J, Madsen CD, Toftager M, *et al*. The role of playgrounds in promoting children's health - a scoping review. *Int J Behav Nutr Phys Act*. 2024;21(1):72.

doi: 10.1186/s12966-024-01618-2

168. Pawlowski CS, Madsen CD, Toftager M, Amholt TT, Schipperijn J. The role of playgrounds in the development of children's fundamental movement skills: A scoping review. *PLoS One*. 2023;18(12):e0294296.

doi: 10.1371/journal.pone.0294296

169. Chen X, Wang F, Zhang H, Lin Y, Zhu S, Yang Y. Effectiveness of wearable activity trackers on physical activity among adolescents in school-based settings: A systematic review and meta-analysis. *BMC Public Health*. 2025;25(1):1050.

doi: 10.1186/s12889-025-22170-z

170. Brickwood KJ, Watson G, O'Brien J, Williams AD. Consumer-based wearable activity trackers increase physical activity participation: Systematic review and meta-analysis. *JMIR Mhealth Uhealth*. 2019;7(4):e11819.

doi: 10.2196/11819

171. Jalongo MR. The effects of COVID-19 on early childhood education and care: Research and resources for children, families, teachers, and teacher educators. *Early Child Educ J*. 2021;49(5):763-774.

doi: 10.1007/s10643-021-01208-y

172. Ali U, Herbst CM, Makridis CA. The impact of COVID-19 on the U.S. child care market: Evidence from stay-at-home orders. *Econ Educ Rev*. 2021;82:102094.

doi: 10.1016/j.econedurev.2021.102094

173. Almond D, Mazumder B. The 1918 influenza pandemic and subsequent health outcomes: An analysis of SIPP data. *Am Econ Rev*. 2005;95(2):258-262.

doi: 10.1257/000282805774669943

174. Ambrose AJH. Inequities during COVID-19. *Pediatrics*. 2020;146(2):e20201501.

doi: 10.1542/peds.2020-1501

175. Barnett LM, Hnatiuk JA, D'Souza N, Salmon J, Hesketh KD. What factors help young children develop positive perceptions of their motor skills? *Int J Environ Res Public Health*. 2021;18(2):759.

doi: 10.3390/ijerph18020759

176. Niemistö D, Barnett LM, Cantell M, Finni T, Korhonen E, Sääkslahti A. Socioecological correlates of perceived motor competence in 5- to 7-year-old Finnish children. *Scand J Med Sci Sports*. 2019;29(5):753-765.

doi: 10.1111/sms.13389

177. Barnett LM, Ridgers ND, Hesketh K, Salmon J. Setting them up for lifetime activity: Play competence perceptions and physical activity in young children. *J Sci Med Sport*. 2017;20(9):856-860.

doi: 10.1016/j.jsams.2017.03.003

178. Barnett LM, Hnatiuk JA, Salmon J, Hesketh KD. Modifiable factors which predict children's gross motor competence: A prospective cohort study. *Int J Behav Nutr Phys Act*. 2019;16(1):129.

doi: 10.1186/s12966-019-0888-0

179. O'Neill JR, Williams HG, Pfeiffer KA, *et al*. Young children's motor skill performance: Relationships with activity types and parent perception of athletic competence. *J Sci Med Sport*. 2014;17(6):607-610.

doi: 10.1016/j.jsams.2013.10.253

180. Mohamad Nor N, Rashid RA. A review of theoretical perspectives on language learning and acquisition. *Kasetsart J Soc Sci*. 2018;39(1):161-167.

doi: 10.1016/j.kjss.2017.12.012

181. Inchingolo AD, Patano A, Coloccia G, *et al*. Treatment of class III malocclusion and anterior crossbite with aligners: A case report. *Medicina (Kaunas)*. 2022;58(5):603.

doi: 10.3390/medicina58050603

182. Inchingolo AD, Patano A, Coloccia G, *et al.* The efficacy of a new AMCOP® elastodontic protocol for orthodontic interceptive treatment: A case series and literature overview. *Int J Environ Res Public Health*. 2022;19(2):988.

doi: 10.3390/ijerph19020988

183. Rahmati M, Lee S, Yon DK, *et al*. Physical activity and prevention of mental health complications: An umbrella review. *Neurosci Biobehav Rev*. 2024;160:105641.

doi: 10.1016/j.neubiorev.2024.105641

184. Gentili A, Failla G, Melnyk A, *et al.* The cost-effectiveness of digital health interventions: A systematic review of the literature. *Front Public Health*. 2022;10:787135.

doi: 10.3389/fpubh.2022.787135

185. *Policy-Driven Digital Health Interventions for Health Promotion and Disease Prevention: A Systematic Review of Clinical and Environmental Outcomes*. Available from: https://www.mdpi.com/2227-9032/13/18/2319 [Last accessed on 2025 Sep 26].