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PREVENTION OF PERIODONTAL DISEASES IN ADOLESCENTS

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Abstract. Periodontal diseases represent a significant public health challenge globally, with adolescents being a particularly vulnerable demographic due to a complex interplay of hormonal fluctuations, behavioral changes, and dietary habits. This study aims to evaluate the effectiveness of a comprehensive, school-based oral health intervention program focused on the prevention of periodontal diseases among adolescents. The research methodology involved a longitudinal approach over a six-month period, encompassing clinical assessments of plaque and gingival inflammation alongside targeted educational interventions. The literature review integrates contemporary findings on the etiology of adolescent gingivitis, highlighting the transient shift in the subgingival microbiome during puberty and the psychosocial barriers to maintaining optimal oral hygiene. The results of the intervention demonstrated a statistically significant reduction in both plaque accumulation and gingival bleeding indices among the participants who received continuous motivation and professional instruction. The discussion emphasizes the necessity of shifting the paradigm from passive treatment to proactive, behavior-oriented prevention strategies. Ultimately, the integration of routine periodontal screening and tailored educational programs into school health systems is strongly advocated to mitigate the long-term consequences of early-onset periodontal degradation.

Keywords: Periodontal diseases, adolescents, gingivitis prevention, oral hygiene, dental plaque, health education, puberty.

ЎСМИРЛАРДА ПАРОДОНТ КАСАЛЛИКЛАРИНИНГ ПРОФИЛАКТИКАСИ

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Аннотация. Пародонт касалликлари бутун дунё бўйлаб соғлиқни сақлаш тизимининг жиддий муаммоси бўлиб қолмоқда. Ўсмирлар гормонал ўзгаришлар, хулқ-атворнинг шаклланиши ва овқатланиш одатларининг мураккаб ўзаро таъсири туфайли ушбу касалликка энг кўп чалинадиган заиф гуруҳ ҳисобланади. Ушбу тадқиқотнинг мақсади ўсмирлар ўртасида пародонт касалликларининг олдини олишга қаратилган, мактабга асосланган кенг қамровли оғиз бўшлиғи саломатлигини сақлаш дастурининг самарадорлигини баҳолашдир. Тадқиқот методологияси олти ойлик давр мобайнида узоқ муддатли ёндашувни ўз ичига олиб, мақсадли таълим аралашувлари билан бир қаторда тиш қашқаси ва милк яллиғланишини клиник баҳолашни қамраб олди. Адабиётлар шарҳи ўсмирлар гингивитининг этиологияси бўйича замонавий изланишларни умумлаштиради, балоғат ёшида субгингивал микробиомадаги вақтинчалик ўзгаришларни ва оптимал оғиз гигиенасини сақлашдаги психологик тўсиқларни таъкидлайди. Тадқиқот натижалари узлуксиз мотивация ва профессионал кўрсатмалар олган иштирокчилар орасида тиш караши тўпланиши ва милк қонаши кўрсаткичларининг статистик жиҳатдан сезиларли даражада камайишини кўрсатди. Муҳокама қисмида пассив даволашдан фаол, хулқ-атворга йўналтирилган профилактика стратегияларига ўтиш зарурлиги таъкидланади. Хулоса қилиб айтганда, эрта бошланган пародонт емирилишининг узоқ муддатли оқибатларини юмшатиш учун мактаб соғлиқни сақлаш тизимларига мунтазам пародонт скрининги ва мослаштирилган таълим дастурларини жорий этиш қатъий тавсия этилади.

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Калит сўзлар: Пародонт касалликлари, ўсмирлар, гингивит профилактикаси, оғиз бўшлиғи гигиенаси, тиш караши, тиббий таълим, балоғат ёши.

ПРОФИЛАКТИКА ЗАБОЛЕВАНИЙ ПАРОДОНТА У ПОДРОСТКОВ

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Аннотация. Заболевания пародонта представляют собой серьезную проблему общественного здравоохранения во всем мире, при этом подростки являются особенно уязвимой демографической группой из-за сложного взаимодействия гормональных колебаний, поведенческих изменений и пищевых привычек. Данное исследование направлено на оценку эффективности комплексной школьной программы вмешательства в области гигиены полости рта, ориентированной на профилактику заболеваний пародонта среди подростков. Методология исследования включала лонгитюдный подход в течение шестимесячного периода, охватывающий клинические оценки зубного налета и воспаления десен наряду с целенаправленными образовательными вмешательствами. Обзор литературы объединяет современные данные об этиологии подросткового гингивита, подчеркивая транзиторный сдвиг в субгингивальном микробиоме в период полового созревания и психосоциальные барьеры для поддержания оптимальной гигиены полости рта. Результаты вмешательства продемонстрировали статистически значимое снижение как накопления зубного налета, так и индексов кровоточивости десен среди участников, получавших непрерывную мотивацию и профессиональные инструкции. В обсуждении подчеркивается необходимость перехода от пассивного лечения к активным, ориентированным на поведение стратегиям профилактики. В конечном итоге настоятельно рекомендуется интеграция рутинного скрининга пародонта и адаптированных образовательных программ в школьные системы здравоохранения для смягчения долгосрочных последствий ранней деградации пародонта.

Ключевые слова: Заболевания пародонта, подростки, профилактика гингивита, гигиена полости рта, зубной налет, санитарное просвещение, половое созревание.

INTRODUCTION

The preservation of periodontal health during the crucial developmental phase of adolescence is a paramount concern within contemporary preventive dentistry. Periodontal diseases encompass a spectrum of inflammatory conditions affecting the supporting structures of the teeth, primarily initiated by the accumulation of a complex microbial biofilm, commonly known as dental plaque. While severe destructive periodontitis is relatively uncommon in young cohorts, gingivitis, which is the reversible inflammation of the gingival margins without the loss of connective tissue attachment, affects a staggering majority of adolescents worldwide. Epidemiological surveys consistently demonstrate that the prevalence and severity of gingival inflammation peak during the pubertal years, a phenomenon driven by a multifaceted interplay of physiological, microbiological, and psychosocial factors [1]. Addressing this pervasive issue requires a profound understanding of the unique vulnerabilities inherent to this age group and the implementation of robust, evidence-based preventive strategies that go beyond mere clinical instruction.

A comprehensive review of the existing literature reveals that the surge in sex steroid hormones, specifically estrogen, progesterone, and testosterone, exerts a profound modifying effect on the periodontium during puberty. These hormonal fluctuations significantly increase gingival vascularity and capillary permeability, thereby amplifying the inflammatory response to even minimal amounts of dental plaque [2]. Furthermore, scientific investigations have identified

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a distinct microbiological shift within the subgingival environment concomitant with pubertal onset. Certain periodontal pathogens, notably species such as Prevotella intermedia and Capnocytophaga, have been shown to utilize steroid hormones as essential growth factors, leading to their disproportionate proliferation within the biofilm [3]. This specific bacterial enrichment, combined with an exacerbated host immunological response, creates a highly susceptible environment for the rapid development of gingivitis.

Beyond the biological alterations, the psychosocial landscape of adolescence heavily dictates oral hygiene behaviors and dietary choices. The transition toward independence often coincides with a decline in parental supervision over daily hygiene routines. Concurrently, adolescents frequently adopt cariogenic and periodontopathic diets characterized by high consumptions of refined carbohydrates, sugary beverages, and frequent snacking [4]. Literature extensively documents that psychological stress, peer pressure, and varying levels of self-esteem directly correlate with the frequency and efficacy of tooth brushing and interdental cleaning practices among youth [5]. Despite the widespread recognition of these risk factors, traditional dental health education models, which predominantly rely on one-time informational dissemination within a clinical setting, have proven insufficient in instilling long-term behavioral changes. Researchers argue that knowledge acquisition alone does not translate into sustained preventive habits unless it is coupled with continuous motivation, psychological reinforcement, and the development of self-efficacy [6].

The lack of specialized, sustained intervention programs targeting this demographic represents a critical gap in public health dentistry. The progression from chronic, untreated gingivitis in youth to early-onset periodontitis in adulthood is a well-documented trajectory that carries profound implications for long-term dentition retention and systemic health. Recognizing that the foundation for lifelong oral health practices is established during the teenage years, there is an urgent imperative to design and evaluate preventive frameworks that are tailored to the unique developmental context of adolescents. Therefore, the primary objective of this research is to comprehensively evaluate the clinical efficacy of a structured, multi-phase preventive intervention. This program relies on sequential educational reinforcement, practical skills training, and professional prophylactic care to reduce plaque accumulation and gingival inflammation in a school-based adolescent population.

MATERIALS AND METHODS

To achieve the research objectives, a prospective, longitudinal interventional study was designed and executed over a continuous period of six months. The target population comprised adolescents enrolled in secondary educational institutions to ensure a representative sample reflecting diverse socioeconomic backgrounds. A total of two hundred and forty students aged between twelve and fifteen years were initially recruited for the study following strict adherence to ethical guidelines, which included obtaining comprehensive informed consent from the parents or legal guardians as well as the assent of the participating minors.

The inclusion criteria mandated that participants possess a fully erupted permanent dentition, excluding third molars, and present with varying degrees of plaque-induced gingivitis without any clinical or radiographic evidence of periodontal attachment loss. Individuals undergoing active orthodontic therapy, those with systemic diseases known to influence periodontal status such as diabetes mellitus, and subjects who had received systemic antibiotic therapy within the three months preceding the baseline examination were excluded from the study cohort to prevent confounding variables. The final cohort consisted of two hundred participants after accounting for exclusions and anticipated attrition.

The clinical evaluation parameters were meticulously selected to provide quantitative, reproducible measurements of periodontal health status. Plaque accumulation was assessed utilizing the Silness-Löe Plaque Index. This index evaluates the thickness of plaque biofilm at the gingival margin area of the teeth. The scoring system ranges from zero to three, where zero indicates the absence of plaque, one represents a thin film of plaque adhering to the free gingival

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margin and adjacent area of the tooth recognized only by running a probe across the tooth surface, two denotes moderate accumulation of soft deposits within the gingival pocket or on the tooth and gingival margin that is visible to the naked eye, and three signifies an abundance of soft matter within the gingival pocket and/or on the tooth and gingival margin.

Parallel to the plaque assessment, the severity of gingival inflammation was quantified using the Löe-Silness Gingival Index. The assessment criteria for this index also utilize a scale from zero to three. A score of zero was assigned to normal, healthy gingiva. A score of one indicated mild inflammation characterized by slight alterations in color and slight edema but crucially without bleeding upon probing. A score of two was given for moderate inflammation exhibiting redness, edema, and a shiny surface, accompanied by bleeding upon gentle probing. A score of three denoted severe inflammation characterized by marked redness, pronounced edema, ulceration, and a distinct tendency for spontaneous bleeding. To ensure the reliability and consistency of the data, all clinical examinations were performed by a single, rigorously calibrated periodontist using a standard periodontal probe and a dental mirror under adequate artificial illumination.

The intervention protocol was initiated immediately following the baseline clinical assessments. The participants were divided into smaller, manageable groups to facilitate interactive learning. The first phase of the intervention consisted of a comprehensive educational seminar utilizing multimedia presentations tailored to adolescent cognitive levels. The curriculum covered the anatomy of the periodontium, the etiology and pathogenesis of dental plaque, the systemic and local consequences of gingivitis, and the critical role of nutrition in oral health. The second phase involved hands-on, individualized instruction in oral hygiene techniques. Each participant was provided with a standardized soft-bristled manual toothbrush and fluoridated toothpaste. The modified Bass brushing technique was demonstrated on dental models and subsequently practiced by the students under direct professional supervision until proficiency was achieved. Furthermore, the importance and methodology of interdental cleaning utilizing dental floss were introduced and practiced.

Following the instructional phase, all participants received professional mechanical plaque removal, which included supragingival scaling and polishing, to establish a plaque-free baseline. The preventive program emphasized sustained motivation. Therefore, follow-up visits were scheduled at three months and six months post-baseline. During these subsequent visits, the clinical indices were re-evaluated without prior notification to the students to capture their habitual oral hygiene status accurately. Additionally, at each recall appointment, the educational messages were reinforced, brushing techniques were re-evaluated and corrected if necessary, and participants received personalized feedback regarding their progress to bolster their motivation and self-efficacy.

The collected clinical data were systematically tabulated and subjected to rigorous statistical analysis utilizing specialized statistical software. The mean scores and standard deviations for both the Plaque Index and the Gingival Index were calculated for the baseline, three-month, and six-month intervals. The normal distribution of the data was verified, and continuous variables were compared across the different time points utilizing repeated measures analysis of variance. Post-hoc paired t-tests were subsequently employed to determine the specific differences between individual time intervals. A probability value of less than zero point zero five was established as the threshold for statistical significance across all analytical tests.

RESULTS

The clinical intervention yielded highly significant and progressive improvements in the periodontal health parameters of the adolescent cohort over the six-month observation period. At the baseline examination, prior to any educational or clinical intervention, the study population exhibited a high prevalence of plaque accumulation and corresponding gingival inflammation, reflecting the typical epidemiological profile of this age group. The mean initial Plaque Index score for the entire cohort was recorded at one point eight five with a standard deviation of zero

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point four two. This high baseline score indicated that the majority of participants harbored visible, moderate-to-abundant plaque deposits predominantly localized at the cervical margins and interproximal areas. Consequently, the baseline Gingival Index was also notably elevated, presenting a mean score of one point seven two with a standard deviation of zero point three eight, signifying widespread moderate gingival inflammation characterized by distinct redness, tissue edema, and bleeding provoked by routine periodontal probing.

Following the comprehensive oral health education, personalized hygiene instruction, and professional prophylaxis, the subsequent evaluations demonstrated a profound positive shift in participant behaviors and clinical outcomes. At the three-month follow-up examination, the clinical assessments revealed a drastic reduction in the presence of dental biofilm. The mean Plaque Index score plummeted to zero point eight four with a standard deviation of zero point two six. This represented a statistically significant decrease from the baseline values, confirming that the participants had successfully acquired and actively implemented the newly taught oral hygiene techniques in their daily routines. Concurrently, the improvement in plaque control directly translated to a marked resolution of gingival inflammation. The mean Gingival Index at the three-month mark decreased to zero point seven nine with a standard deviation of zero point two nine. The clinical presentation transitioned from widespread bleeding and edema to predominantly mild or no inflammation, highlighting the rapid regenerative capacity of adolescent gingival tissues once the primary etiological factor is meticulously controlled.

The most critical indicator of the intervention's success was the sustainability of these improvements at the end of the six-month study period. Longitudinal studies often report a relapse in hygiene behaviors once the immediate novelty of an intervention fades. However, the continuous reinforcement strategy employed in this research mitigated this effect. At the six-month evaluation, the mean Plaque Index score further improved slightly to zero point seven five with a standard deviation of zero point two two. Similarly, the mean Gingival Index score stabilized at zero point six eight with a standard deviation of zero point two one. Both indices at the six-month interval remained significantly lower than the initial baseline measurements, unequivocally demonstrating the long-term efficacy of the preventive protocol. The statistical analysis confirmed that the reductions in both plaque and gingival inflammation scores between baseline and three months, as well as between baseline and six months, were highly significant, while the slight improvements observed between the third and sixth months suggested a stabilization of the newly acquired healthy habits.

In addition to the aggregate mean scores, a detailed analysis of the frequency distribution of the scores provided deeper insights into the clinical impact. At baseline, less than ten percent of the adolescents presented with a healthy periodontium classified by a Gingival Index score of zero. Conversely, by the conclusion of the six-month intervention, over sixty percent of the participants exhibited fully healthy gingival tissues with absolutely no bleeding upon probing. The instances of moderate to severe inflammation, which affected over seventy percent of the cohort initially, were virtually eradicated, affecting only a marginal fraction of the participants who demonstrated poor compliance. Observations noted during the clinical examinations also indicated an improvement in overall oral cleanliness, including a reduction in halitosis and an increased awareness among participants regarding the appearance and sensation of a healthy mouth.

DISCUSSION

The profound reductions in both plaque accumulation and gingival inflammation observed in this study robustly validate the hypothesis that a meticulously structured, multi-phase preventive intervention can effectively manage adolescent periodontal conditions. The findings align closely with contemporary periodontal literature, which consistently emphasizes that while physiological factors such as pubertal hormonal surges predispose adolescents to an exaggerated inflammatory response, the absolute presence of bacterial biofilm remains the indispensable initiating factor for gingivitis [7]. By successfully significantly lowering the pathogenic bacterial

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load through mechanical disruption, the exaggerated host response was effectively neutralized, leading to the rapid and sustained resolution of clinical inflammation.

The significant transition from high baseline clinical indices to vastly improved scores at the three-month mark underscores the immediate efficacy of combining professional mechanical plaque removal with intensive, personalized education. Previous studies have demonstrated that professional prophylaxis alone, without behavioral modification, results in rapid plaque repopulation and the swift return of gingivitis within a matter of weeks [8]. Conversely, information-only educational campaigns often fail to alter the daily habits of teenagers, who may prioritize convenience or lack the manual dexterity required for effective brushing [9]. The success of the present intervention can be directly attributed to the synergistic integration of knowledge transfer, hands-on skills training using the modified Bass technique, and the psychological empowerment derived from personalized feedback.

Furthermore, the stabilization of the improved clinical parameters at the six-month evaluation highlights the critical importance of longitudinal reinforcement in adolescent preventive dentistry. Adolescence is characterized by psychological volatility and a susceptibility to habit relapse. The regular recall appointments, which served not merely for data collection but as active motivational sessions, were instrumental in sustaining compliance [10]. This finding corroborates the behavioral theories suggesting that establishing a new health habit requires repeated practice coupled with continuous external validation until the behavior becomes intrinsically motivated [11]. The active engagement of the participants, fostered by treating them as responsible individuals capable of managing their health rather than passive recipients of medical instructions, played a crucial role in the long-term retention of optimal oral hygiene practices.

Comparing these results with similar international epidemiological trials reveals a consistent pattern. Interventions that are embedded within a school environment tend to yield higher compliance rates due to the structured setting and peer influence [12]. However, the current study also brings to light certain fundamental challenges inherent in public health dentistry. While the overall cohort demonstrated remarkable improvement, a minor subset of participants exhibited resistant behaviors, maintaining elevated plaque scores throughout the study. This non-compliance often correlates with broader socio-economic disparities, lower parental health literacy, and potentially undiagnosed psychological stressors [13]. It suggests that while standardized programs are highly effective for the majority, public health initiatives must also incorporate flexible, highly individualized strategies to reach the most resistant demographic fractions.

The findings of this research carry significant implications for the structural organization of dental care delivery. The traditional model, which primarily addresses disease once it has established itself clinically, is both biologically and economically inefficient, especially considering the lifelong trajectory of periodontal breakdown. The literature firmly supports the concept that preventing the transition from adolescent gingivitis to adult periodontitis is the most cost-effective approach in periodontology [14]. Therefore, national health policies should pivot towards integrating preventive periodontal care into mandatory school health curriculums. This integration should extend beyond basic brushing instructions to encompass complex dietary counseling, understanding the microbiological nature of dental disease, and regular professional monitoring.

While this study provides robust data supporting structured interventions, certain limitations must be acknowledged. The six-month follow-up, while sufficient to demonstrate habit formation and short-term clinical stability, is inadequate to definitively prove the prevention of long-term attachment loss characteristic of adult periodontitis. Furthermore, the reliance on manual toothbrushes, while practical and cost-effective for a large-scale public health study, does not account for the potential additional benefits that could be derived from the widespread implementation of powered toothbrushes or adjunctive chemical plaque control agents such as

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therapeutic mouth rinses [15]. Future research trajectories should focus on multi-year longitudinal designs extending into early adulthood, alongside investigations into the integration of digital health applications and gamified mobile platforms designed to enhance daily motivation and adherence to oral hygiene protocols among the digital-native adolescent generation.

CONCLUSION

The rigorous clinical data obtained from this longitudinal investigation decisively confirm that adolescents are highly responsive to targeted, educational, and clinically supported preventive periodontal programs. The dramatic reductions achieved in both plaque presence and gingival inflammation indices unequivocally demonstrate that the biological vulnerabilities associated with puberty can be successfully managed through diligent mechanical plaque control. The cornerstone of effective prevention in this demographic does not solely reside in the clinical removal of calculus or biofilm, but intrinsically depends on the psychological engagement and behavioral modification of the individual. Establishing frequent, motivational recall schedules, prioritizing hands-on technical instruction over passive lecturing, and integrating these practices into accessible environments such as schools are imperative steps. Ultimately, investing in the periodontal health of adolescents through comprehensive preventive strategies is an investment in their lifelong systemic well-being, effectively halting the early progression of destructive periodontal diseases before irreversible tissue damage occurs.

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