SMART DENTAL UPDATES

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Dear Doctor,

Greetings from Micro Labs Limited. We are happy to bring you **"SMART DENTAL UPDATES"** which contain latest and interesting news in the field of Dentistry.

This issue contains:

- **Correlation between early childhood non-nutritive sucking habits and malocclusion**
- **Association between Chronic Periodontal Disease and development of Hypertension**
- **Comparison of Temperature Rise, Time Efficiency, and Cut Quality of Apicectomy using various methods**
- **Case report on successful localization of a calcified root canal using dynamic navigation system**

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Medical Team, Micro Labs Limited

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Correlation between early childhood non-nutritive sucking habits and malocclusion

INTRODUCTION

Non-Nutritive Sucking

Sucking habits in infants are classified into two categories: nutritive sucking (e.g., breastfeeding and bottle-feeding) and non-nutritive sucking (NNSH), which includes digit or pacifier sucking. While nutritive sucking is essential for feeding and stimulates the development of orofacial muscles, NNSH does not fulfill a feeding purpose but still promotes muscle activity.[1] NNSH is common from birth to around 1 or 2 years of age, with a pacifier and digit sucking being the most prevalent behaviors. However, prolonged NNSH, especially beyond infancy, can have adverse effects on the development of the stomatognathic system, including issues with dental occlusion and facial growth. Although the detrimental effects of extended pacifier use are widely acknowledged, two systematic reviews have identified a lack of robust evidence and underscored the need for higher-quality evidence.[2] This study aims to assess the impact of the DentoBon pacifier on dental occlusion at age 7, relative to other pacifiers, and to investigate how the duration of pacifier or digit sucking influences occlusion. The trial follows children from birth to age 7 to explore the long-term effects of sucking behaviors on dental development.

METHODS

This prospective, randomized controlled trial was conducted to evaluate the effect of pacifier use on dental occlusion in children. Firstborn children who were born in 2008 were enrolled, with those whose parents consented randomized into three groups: (1) study pacifier, (2) other pacifiers, or (3) no pacifier. The study pacifier, designed to reduce adverse effects on dental development, was provided free of charge from birth to age 2. Follow-ups were done at age 2, and parents/guardians provided information on the child's oral health, sucking habits, and their educational level. The questions covered tooth brushing frequency, meal timing, and the use of fluoride, xylitol, or probiotic products. Sucking behaviors such as breastfeeding, bottle use, pacifier use, and thumb sucking were also assessed. The primary outcome was posterior crossbite, and secondary outcomes included overjet, overbite, anterior crossbite, and crowding. Multivariable logistic regression was used for analysis, adjusting for potential confounders like pacifier use, breastfeeding duration, and maternal education. Statistical significance was set at $P < 0.05$. Intention-to-treat and per-protocol analyses were performed to minimize bias.

RESULTS

A total of 804 children during their first school year were enrolled in the study, with 451 (230 males, 221 females) completing dental examinations at 7 years. The children were divided into three groups: 47 used the study pacifier, 270 used non-study pacifiers, and 134 used no

pacifier. After matching for maternal education, the analysis included 47 children in the study pacifier group, 240 in the non-study pacifier group, and 96 in the no-pacifier group. At age 7, the prevalence of posterior crossbite was significantly lower in the no-pacifier group (1%) compared to the study pacifiers (4%) and non-study pacifier group (7%) (P = 0.029) (Table 1). No significant difference was found between the study pacifier and non-study pacifier groups (P = 0.510) or between the study pacifier and no pacifier groups (P = 0.136). Duration of pacifier use was associated with a higher prevalence of posterior crossbite: 7% in those using pacifiers for 12+ months vs. 1% for <11 months (P = 0.003). Digit sucking for ≥12 months was linked to increased crowding (36%) vs. 16% for <6 months (P = 0.016), but other malocclusions (overjet, deep bite, open bite) were not significantly affected. After matching for maternal education, there were no significant differences in malocclusion rates between groups, except for a higher prevalence of posterior crossbite in the non-study pacifier group (6%) compared to the no-pacifier group (1%) (P = 0.029).

Group	Study Pacifier (47)	Non-Study Pacifier (270)	No Pacifier (134)	P Value
Posterior Crossbite	4	7	1	0.029
Anterior Crossbite	0	4	5	0.155
Increased Overjet	11	13	12	0.926
Deep Bite	19	19	22	0.702
Open Bite	0	0	2	0.354
Crowding	17	16	20	0.513

Table 1. Prevalence of Malocclusions in 7-Year-Old Children Based on Pacifier Use Between Ages 0 and 2

DISCUSSION

The current study found no significant difference in posterior crossbite between children using orthodontic pacifiers and conventional pacifiers (7%), with non-users having a lower prevalence. This suggests that pacifier type does not significantly impact malocclusion development, in contrast to previous studies that found orthodontic pacifiers may reduce risks of malocclusions.[3,4] Duration of Pacifier Use and Malocclusions: Prolonged pacifier use (≥12 months) was significantly associated with a higher prevalence of posterior crossbite (7%) compared to shorter use (<11 months, 1%, P = 0.003). This aligns with previous longitudinal studies but contrasts with findings from Warren et al. which showed no significant association.[2]

CONCLUSION

The prolonged use of pacifiers, particularly for a duration of one year or more, has been linked to the development of posterior crossbite. It is recommended that parents or guardians be advised to discontinue or significantly reduce pacifier use after the child's first birthday to mitigate this risk.

> Prolonged pacifier use (≥12 months) increases the risk of posterior crossbite, so it's recommended to stop pacifier use by age one.

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Association between Chronic Periodontal Disease and development of Hypertension

INTRODUCTION

Chronic periodontal disease increases the risk of hypertension, but recovery from PD may help reduce this risk.

Hypertension is a major risk factor for cardiovascular diseases, stroke, and mortality and, affecting an estimated 1.4 billion people globally by 2025. While modifiable factors such as high salt intake, low potassium, weight gain, and inactivity contribute to its development, genetic factors also play a role. Addressing these modifiable risk factors can help reduce hypertension risk, but some cases remain unexplained, underscoring the need for further research to identify additional factors.[1] Periodontal disease (PD) is an inflammatory condition that affects the supporting structures of teeth, ranging from gingivitis to periodontitis, which involves tissue destruction due to an inflammatory response. Although PD is more common in adults, it can also affect children. Increasing evidence suggests a link between PD and systemic conditions like hypertension, with systemic inflammation being a potential common mechanism. Despite these findings, large-scale studies investigating the impact of PD progression or improvement on hypertension risk are scarce.[2] So, this study aimed to explore how changes in PD status, either progression or recovery, may influence hypertension risk in a large national population.

METHODS

This nationwide cohort study included individuals aged 20+ who underwent oral health exams in 2003 and either 2005 or 2006, resulting in 706,584 participants after excluding those with incomplete data or a history of hypertension. Periodontal disease (PD) was assessed based on

probing depth and gingival inflammation, categorizing participants into PD-free, PD-recovered, PD-developed, and PD-chronic groups. Hypertension incidence was the primary outcome, defined by ICD-10 codes, antihypertensive prescriptions, or high blood pressure during health exams. Participants were followed until December 2020. Covariates included age, sex, BMI, income, smoking, alcohol consumption, physical activity, and comorbidities. Statistical analyses included Chi-square, ANOVA, Kaplan-Meier survival curves, and Cox regression to calculate hazard ratios, adjusting for confounders. Sensitivity analysis excluded those diagnosed with hypertension within one year after the index date. Statistical significance was set at $p<0.05$.

RESULTS

A total of 253,003 participants (35.8%) were classified into the PD-free group, 140,143 (19.8%) into the PD-recovered group, 132,397 (18.7%) into the PD-developed group, and 181,041 (25.6%) into the PD-chronic group. The PD-chronic group exhibited the highest proportion of males, smokers, and alcohol consumers, while the PD-free group had the lowest prevalence of these factors. ~~The prevalence of diabetes, dyslipidemia, and renal disease was higher in the PD-recovered and PD-developed groups, with the PD-chronic group showing the highest rates for these conditions~~. Over 14.3 years, 34% of participants developed hypertension. Kaplan-Meier survival curves indicated the risk of developing hypertension, with the PD-chronic group showing the highest risk, followed by the PD-recovered and PD-developed groups, and the PD-free group exhibiting the lowest risk (Figure 1). In multivariate analysis, both the PD-recovered (HR: 1.06, 95% CI: 1.04–1.07, $p <0.001$) and PD-chronic (HR: 1.10, 95% CI: 1.09–1.11, $p <0.001$) groups had significantly elevated risks for hypertension. Pairwise comparisons further revealed that the PD-chronic group had a higher risk of hypertension than the PD-recovered group (HR: 1.04, 95% CI: 1.02–1.05, $p <0.001$), and the PD-developed group exhibited a higher hypertension risk than the PD-free group (HR: 1.03, 95% CI: 1.02–1.04, $p <0.001$). Sensitivity analyses corroborated these results.

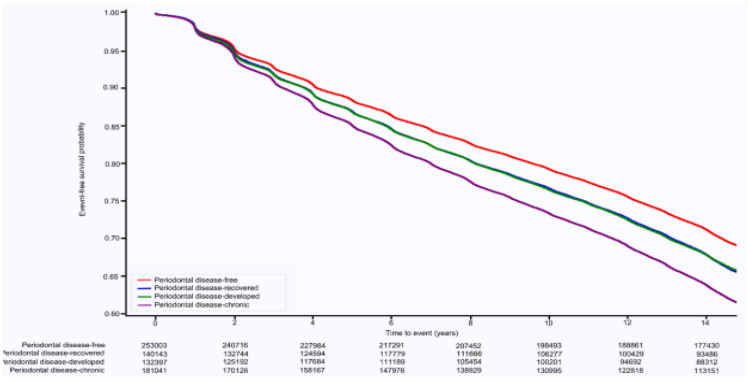

Figure 1. Kaplan-Meier survival curves for hypertension incidence based on changes in periodontal disease

DISCUSSION

The current study indicated that persistent periodontal disease (PD) significantly elevates the risk of hypertension, while recovery from PD is associated with a reduced risk. Although the hazard ratios observed are modest, suggesting that baseline factors such as age, BMI, and lifestyle may exert a more substantial influence on hypertension risk, these findings are consistent with previous studies reporting a link between PD and hypertension.[3] Additionally, the study supports the notion that managing PD, particularly through recovery, may mitigate hypertension risk. This was in line with controlled studies demonstrating that periodontal treatment reduces systemic inflammation and improves endothelial function, mechanisms that may contribute to the observed reduction in hypertension risk.[4]

CONCLUSION

Chronic periodontal disease (PD) is associated with an elevated risk of developing hypertension. Although the increase in risk is relatively modest, recovery from PD may have a protective effect in reducing hypertension risk.

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Comparison of Temperature Rise, Time Efficiency, and Cut Quality of Apicectomy using various methods

INTRODUCTION

Er: YAG laser and conventional rotary instruments are safe and efficient for apicectomy, with Er: YAG offering superior cut quality.

Over the past few decades, advancements in dental surgery have led to the development of more precise, minimally invasive techniques aimed at reducing pain. Traditionally, osseous surgery was performed using hand and rotary instruments, which required extensive irrigation to manage heat production and exerted considerable pressure, particularly when working with brittle or fractured bones.[1] In recent years, piezoelectric devices have been introduced, offering greater precision in procedures such as tooth apicectomy, thereby reducing pain and swelling. However, studies have noted an increased incidence of cracks and smear layers on resected surfaces when using piezoelectric devices. The introduction of Er: YAG lasers has further advanced endodontic surgery by effectively removing hard tissue, minimizing vibration, and eliminating the smear layer, which can reduce the risk of cracks. Nevertheless, improper settings on the laser can lead to thermal damage and longer procedure times. Despite these advancements, few studies

have compared the effectiveness of piezoelectric devices, rotary instruments, and Er: YAG lasers in apicectomy.[2] So, this study aimed to compare the temperature rise, procedure time, and cut quality of these three techniques in apicectomy.

METHODS

Twenty-four freshly extracted single-rooted teeth, stored in 10% formalin for up to 3 months, were divided into four groups (n=6) to evaluate apicectomy techniques. An artificial apical lesion was simulated using silicone rubber, and each tooth was placed in a plaster mold, from which fenestration was created to expose the root end. The groups underwent apicectomy using four different methods: G1 – Piezosurgery with NINJA tip, D1 power, and water spray at 30 mL/min; G2 – Diamond bur with a high-speed handpiece (KaVo, Germany) at 300,000 rpm and water irrigation; G3 – Er:YAG laser at 200 mJ, 30 Hz, with water cooling at 14 mL/min in light contact mode; and G4 – Er:YAG laser at 250 mJ, 30 Hz, with water cooling at 14 mL/min in light contact mode. The apicectomies were performed at a 90° angle to the root axis, removing 3 mm from the apical portion. Temperature was monitored near the root apex, and procedure time was recorded. After surgery, the resected surfaces were examined using a stereomicroscope and SEM to assess crack initiation, smear layer formation, and dentinal tubule exposure. The smear layer was scored based on tubule exposure, and statistical analysis was performed using the Kappa and Kendall tests for inter-examiner agreement, as well as Kruskal-Wallis and Dunn tests to compare time, temperature, and cut quality across groups, with significance set at $p < 0.05$.

RESULTS

The temperature rise was greatest in the piezosurgery group (G1), followed by the Er: YAG laser groups (G4 and G3), with the diamond bur group (G2) showing the least increase. G1 had a significant number of samples (4) with a temperature rise over 6°C, with a maximum increase of 10.7°C. The time required for apicectomy was longest for G1 (100.14 s), significantly longer than the other groups, with no significant time differences between G2, G3, and G4. Table 1 shows the temperature change data for each group. The cut quality was best in the Er: YAG laser groups, with fewer cracks observed (16.67%) compared to G1 and G2 (33.33%). Smear layer formation and dentinal tubule exposure were evaluated, showing that the Er: YAG laser groups scored higher than other methods, with G3 (200 mJ) achieving better results than G4 (250 mJ), and the piezosurgery group scoring the lowest.

Specimen	Piezoelectric device	Diamond bur	Er: YAG laser (200 mJ/30Hz)	Er: YAG laser (250 mJ/30Hz)
1	+	-	-	-
2	-	+	-	+
3	-	+	-	-
4	-	-	+	-
5	+	-	-	-
cracked tooth (%)	33.33%	33.33%	16.67%	16.67%

Table 1: Cracks Observed on Resectioned Root Surfaces Attributed to Specimens in Each Group

DISCUSSION

The piezosurgery group (G1) took 3-4 times longer for apicectomy than the Er: YAG laser and diamond bur groups, consistent with prior studies. The Er: YAG laser's cutting speed improved with higher energy (250 mJ).[2] The Er: YAG laser groups (G3 and G4) showed superior cut quality with fewer cracks and less smear layer compared to the piezosurgery (G1) and diamond bur (G2) groups. This supports previous findings that the Er: YAG laser offers cleaner surfaces, enhancing tissue healing.[3,4]

CONCLUSION

Both Er: YAG laser and conventional rotary instruments demonstrated safety and efficiency for apicectomy, with superior cut quality observed compared to piezoelectric equipment. The Er: YAG laser appears to be a promising alternative for apicectomy.

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Case report on successful localization of a calcified root canal using dynamic navigation system

INTRODUCTION

The use of advanced tools such as the dental operating microscope (DOM), ultrasonic tips, long shank burs, and cone-beam computed tomography (CBCT) has significantly improved the precision of root canal treatment by aiding in the identification and planning of partially obstructed or calcified root canals. Despite these advancements, accessing and preparing calcified canals remains challenging and time-consuming.[1,2] Guided endodontics, which incorporates computer-assisted static navigation guides and dynamic navigation systems (DNS), has emerged as a novel approach to address these challenges. Static navigation guides, based on CBCT data, provide precise, conservative root canal treatment by guiding dental drills. However,

Dynamic Navigation System (DNS) is a precise and effective technique for managing calcified root canals, reducing iatrogenic errors, and preserving dentin when traditional methods fail.

Figure 1: The lingual surfaces of teeth #8 and #9 show tooth-colored fillings that are partially detached.

these systems have limitations, including suitability only for straight or mildly curved root portions, incompatibility with water cooling, and the high cost and complexity of fabrication. Additionally, modifications during procedures are not feasible, creating difficulties in the event of mishaps. Pulp canal occlusion (PCO) further complicates root canal treatments, making successful localization and treatment of calcified canals increasingly difficult.[3] This case report presents a calcified root canal using DNS, following a failed attempt with traditional DOM techniques, highlighting the potential of DNS for complete root canal retreatment and aesthetic restoration.

CASE PRESENTATION

A 43-year-old male was referred to the endodontic department for retreatment of a calcified root canal in tooth #9 and underfilling in tooth #8. The patient had a history of root canal treatment and resin veneer restorations several years ago, with a portion of the veneer falling off, requiring aesthetic restoration. One month prior, root canal retreatment of tooth #8 had been attempted at another hospital but was halted due to calcification. Clinical and radiographic examination revealed calcification in tooth #9 and underfilling in tooth #8, with CBCT confirming complete calcification in tooth #9 and a deviated drill path (Figure 1). Treatment involved root canal retreatment under dynamic navigation guidance, with preoperative CBCT data used to plan the approach, ensuring minimal risk of perforation. Real-time navigation helped to precisely locate the calcified canal and monitor the depth and angle during the procedure. After root canal dredging and retreatment, both canals were filled successfully, with no clinical symptoms at the 3-month follow-up, and periapical healing was observed (Figure 2). Aesthetic restoration was performed with fiber posts and zirconia crowns. At the 6- and 12-month follow-ups, there were no signs of complications, and the patient was satisfied with the functional and aesthetic outcomes. Long-term follow-up is planned to assess the overall success of the treatment.

Figure 2: Two-week follow-up showing the fit of all-ceramic crowns on teeth #8 and #9.

DISCUSSION

The current study highlights the use of Dynamic Navigation System (DNS) for accurate localization and treatment of calcified root canals, demonstrating its effectiveness in achieving precise access cavity preparation and successful root canal retreatment. This is consistent with previous study by Jain et al.[4] Additionally, this case study reinforces the advantages of DNS over traditional freehand techniques, including better precision in root canal access, reduced risk of perforation, and enhanced safety during the procedure. These findings align with earlier studies that emphasize DNS's ability to guide endodontic procedures with higher accuracy, thereby increasing the success rate of treatment while minimizing the risk of errors.[3]

CONCLUSION

This case report suggested that DNS may be a promising technique with high accuracy and effectiveness to reduce the risk of iatrogenic errors and provide maximal preservation of dentin, when the traditional treatment of calcified root canals approaches failure (lateral perforation).

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