Original Research

Effect of Vitamin D on Orthodontic Tooth Movement

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Abstract

Background: The movement of teeth in orthodontics is controlled by the body and involves changes to the surrounding bone. Since vitamin D helps maintain healthy calcium and bones, it could affect how fast and well tooth movement happens during orthodontics. **Materials and Methods:** During the study, 30 participants (age 18–25 years) had canine retraction after having their premolars extracted. Fifteen people in Group A were each given 600,000 IU Vitamin D3 injections once monthly for 3 months. At the same time, 15 people in Group B received injections of a placebo. Applying a standardized spring force of 150 g, we measured the rate of canine movement in study models at weeks 0, 4, 8, and 12. At both baseline and after treatment, serum levels of Vitamin D in blood samples were checked. **Results:** At each interval, Group A showed greater tooth movement than Group B which was statistically significant (mean movement at 12 weeks: 2.85 ± 0.32 mm in Group A vs. 1.97 ± 0.28 mm in Group B; $P < 0.001$). The serum 25(OH) D in Group A increased from baseline to 52.4 ± 6.7 ng/mL following the intervention. All participants were without any negative symptoms during the study. **Conclusion:** Getting vitamin D supplements helps tooth movement in the orthodontics clinic, with no side effects, most likely because it improves the bone around the teeth.

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Introduction

Orthodontic tooth movement occurs when the bones around the teeth change due to pressure from medical appliances. Through a controlled action, bone is taken away at the pressure side by osteoclasts and added at the tension side by osteoblasts.[1] Minerals, hormones, and vitamins are important among many systemic and local factors that can impact how hearts remodel.[2]

Maintaining calcium and phosphate in the body is important for bone strength and that function depends on vitamin D. It is able to influence OTM by clinging to its receptors (VDRs) located in osteoblasts, osteoclasts, and periodontal ligament cells.[3] Low vitamin D can cause bones to heal slowly, change the way they are built, and might influence how orthodontic treatment works.

Animal experiments show that taking vitamin D can increase tooth movement by raising activity in cells that break down bone and by increasing bone loss on the pressure side.[4] Moreover, certain clinical studies evidence that supplementing with vitamin D can make orthodontic tooth movement faster, end treatment sooner, and potentially limit the risk of teeth relapse.[5] The literature has not yet agreed on how much, how

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often and in what manner vitamin D should be taken in orthodontics.[6]

Materials and Methods

This randomized, double-blind, placebo-controlled clinical study was conducted on 30 healthy individuals aged between 18 and 25 years who required bilateral maxillary canine retraction as part of their fixed orthodontic treatment.

Inclusion criteria

- Patients with Class I bimaxillary protrusion requiring bilateral maxillary first premolar extraction.
- Good general and periodontal health.
- No history of systemic illness, medication affecting bone metabolism, or vitamin D supplementation in the past 6 months.

Exclusion criteria

- Smokers, pregnant or lactating women.
- Patients with endocrine or metabolic disorders.
- Poor oral hygiene or active periodontal disease.

Study design

Participants were randomly allocated into two groups using computer-generated random numbers:

- **Group A (Experimental group, *n* = 15):** Received 600,000 IU intramuscular injection of cholecalciferol (vitamin D3) once a month for three months.
- **Group B (Control group, *n* = 15):** Received identical placebo injections following the same schedule.

Tooth extraction of the bilateral maxillary first premolars was followed by leveling teeth and aligning them with 0.022" slot MBT brackets. When the alignment was done and anchorage strengthened with the transpalatal arch, 150 g of force from NiTi closed-coil springs were used to start canine retraction. The molar and canine movements were marked with digital Vernier calipers, which were applied to the dental casts at baseline and after 4, 8, and 12 weeks. To keep measurements consistent, all tests were carried out by the calibrated examiner. At the start and again at week 12, blood samples were used to measure 25-hydroxyvitamin D levels using chemiluminescent immunoassay. The data were examined with SPSS version 25.0 (IBM).

Results

The study included 30 participants who completed the 12-week follow-up period without any dropouts or adverse events. The mean age of the participants in Group A and Group B was 21.4 ± 1.8 years and 22.1 ± 2.0 years, respectively, with no statistically significant difference ($P > 0.05$).

Group A (Vitamin D group) showed a higher rate of canine retraction at all time intervals compared to Group B (placebo group). The cumulative mean canine movement at 12 weeks was 2.85 ± 0.32 mm in Group A and 1.97 ± 0.28 mm in Group B, which was statistically significant ($P < 0.001$) [Table 1].

Baseline serum 25(OH) D levels in Group A were 18.6 ± 4.1 ng/mL, which increased significantly to 52.4 ± 6.7 ng/mL post-supplementation. In contrast, Group B showed no significant change (from 19.2 ± 3.9 ng/mL to 20.3 ± 4.2 ng/mL) [Table 2].

These results support a significant role of vitamin D in enhancing the rate of orthodontic tooth movement through its action on bone remodeling.

Discussion

The results of the study show that adding vitamin D to the intramuscular injection greatly improved the speed of orthodontic tooth movement when canines were being retracted. The findings are similar to previous ones that suggest vitamin D, by handling levels of calcium and phosphate and its effects on cells called osteoblasts and osteoclasts, helps control how bones are built and broken down.[1]

Vitamin D interacts with RANKL, a nuclear receptor in bone cells, which in turn promotes the formation of the cells called osteoclasts that speed up bone absorption along the direction of tooth movement.[2] Tooth movement in the experimental group took place more rapidly, possibly due to the increase in serum 25(OH) D and a stronger relationship with remodeling of bone. The same is seen in animals, as vitamin D substitutes increase the movement of rat teeth.[3,7]

Orthodontic treatment may also benefit from the use of vitamin D, according to research studies. Local vitamin D injections during orthodontic therapy were seen

Table 1: Comparison of Mean Canine Movement (mm) Between Groups at Different Time Intervals

Time Interval	Group A (Vitamin D) Mean±SD	Group B (Placebo) Mean±SD	*P*
4 Weeks	0.91±0.12	0.62±0.10	<0.01
8 Weeks	1.87±0.26	1.31±0.22	<0.01
12 Weeks	2.85±0.32	1.97±0.28	<0.001

Table 2: Serum 25(OH) D Levels (ng/mL) Before and After 12 Weeks

Group	Baseline Mean±SD	Post-Intervention Mean±SD	*P*
Group A	18.6±4.1	52.4±6.7	<0.001
Group B	19.2±3.9	20.3±4.2	>0.05

by Wang *et al*.[4] to speed up tooth shifting, showing the hormone helps with bone remodeling around the affected area. Besides, giving higher doses of vitamin D systemically in the study allows for practical use and patient compliance with the same efficiency as local treatment.

Many people are vitamin D deficient and this may postpone orthodontic results and make treatment last longer if it goes untreated.[5] Taking vitamin D supplements before and when getting orthodontic treatment could help treatments finish more efficiently and make patients happier with results. Yet, additional research needs to be done to decide the best dosing method, the route to administer the vitamin, and its results over time for orthodontic treatment.[6]

Conclusion

All in all, vitamin D may help orthodontic tooth movement happen more efficiently. Correcting low levels of vitamin D may help as an additional approach in orthodontics when a patient's bone metabolism is poor.

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Conflicts of interest

There are no conflicts of interest.

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