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## To compare effect of daily and weekly vitamin D in adult trauma patients with vitamin D deficiency

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### Abstract

**Background:** Daily and weekly vitamin D dose are frequently used in treatment of vitamin D deficiency. This study analyses their individual roles in the management of vitamin D deficiency. And also to know significance of Singh index in adult trauma patient.

**Material & Method:** A Randomized Comparative Study was conducted in the Department of Orthopaedics, Mahatma Gandhi Hospital, Jaipur from January, 2017 to June, 2018 on a sample size of 60 patients diagnosed with vitamin D deficiency. Singh index was calculated in all patients enrolled in the study.

**Results:** On Comparing effect of daily and weekly dosing in vitamin D deficient patient, weekly dose was more effective at short term i.e. 3 months but both were equally effective after 9 months. There was no significant association between Singh index and vitamin D deficiency in adult trauma patients.

**Conclusion:** Given the potential of vitamin D in fracture healing, the clinicians treating adult fracture patients should be aware of the frequent presence of vitamin D deficiency. Regular supplement of vitamin D therapy provided a favorable outcome in the trauma patients. Weekly and daily dosing are both effective to correct vitamin D deficiency but with weekly doses normal levels are achieved earlier.

**Keywords:** weekly dose vs daily dose, vitamin D deficiency, singh index, fracture healing

### 1. Introduction

Vitamin D deficiency is very common in India in all age groups Vitamin D is associated with cancer, immune deregulation, diabetes, cardiovascular health, muscle function and mental health [1, 2]. It is also important for mineralization of bone and fracture healing [3, 4].

Vitamin D is a fat soluble vitamin which is important for musculoskeletal development, maintenance, and function. Vitamin D increases bone mineral density, decreases osteoporotic fracture in both sexes and all age group.

In India prevalence of vitamin D deficiency is quoted as varying from 50-90% and is often associated with low dietary calcium intake [5]. Some studies suggest that prevalence in India is much higher than expected.

Vitamin D regulates calcium and phosphate levels in blood thus affecting bone metabolism. Absorption of calcium from gut depends on 25OHD status of individual and reaches its peak when vitamin D level is sufficient (i.e. >30ng/ml) [6, 7]. Optimal calcium levels would minimize secondary hyperparathyroidism and increase bone mineral density during period of rapid growth (childhood, adolescence). This will contribute to 'peak bone mass' and can effectively prevent osteoporosis at later age [8, 9]. So adequate vitamin D and calcium levels are important in reducing rate of postmenopausal osteoporosis and consequent fracture risk.

### “Levels of Vitamin D is

- Adequate when serum 25(OH)D level is > 30ng/ml
- Insufficient when 25(OH)D level is 20-30 ng/ml and
- Deficient when 25(OH) D level is < 20ng/ml” [4, 5].

Vitamin D deficiency has been correlated with muscle weakness, fragility fractures, and, most recently, fracture nonunion [10]. Supplementation with vitamin D and calcium has lowered these risk. Weekly dose of 60,000 IU as loading dose for 8 weeks and then maintenance dose

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of 800-1000 IU/day is sufficient to achieve adequate level [11]. Another regime is daily dosing with 800-1000 IU of vitamin D [12]. The pharmacology of vitamin D is better for dose intervals longer than daily [13, 14] and data shows better adherence of patient to less frequent dosing [15, 16].

Our objective was to compare effect of weekly or daily use of vitamin D in correcting vitamin D deficiency.

Vitamin D deficiency causes progressive osteoporosis and results in definitive changes in trabecular pattern, which can be assessed by Singh index in upper end of femur [17]. Therefore, we also studied X-rays of our patients and graded them 1 to 6 according to the disappearance of the normal trabecular pattern. Studies have shown a link between a Singh index of less than three and fractures of the hip, wrist, and spine. Our other objective is to calculate Singh index among adult trauma patients and find its correlation with vitamin D deficiency.

## 2. Material & Method

- Relevant patient details would be obtained.
- Various required investigations including

### 1. Routine Investigations:

CBC, ESR, RBS, HIV, HBsAg, Urea, Creatinine, Electrolyte, BT, CT, PT, INR, SGOT, SGPT.

### 2. Specific investigations:

Vitamin D level

Calcium level

X-ray PBH

- Type of study:** Randomized Comparative Study.
- Period of study:** The study will start from January, 2017 to October, 2018
- Place of study:** Department of Orthopedics, Mahatma Gandhi medical college and hospital, Jaipur
- Sample size** - 60 patients admitted in orthopedic trauma ward will be included in the study.

### • Plan of study

#### Inclusion criteria

- Trauma patient admitted in mahatma Gandhi hospital from 18 to 50 years of age.

#### Exclusion criteria

- Patients taking HRT or anti convulsants.
- Patients having a chronic debilitating illness (Cancer, AIDS, CHF, COPD).
- Renal disease patients (Creatinine level >1.5mg/dl).

- Liver disease patients (Bilirubin>2.0mg/dl).
- Malabsorption syndrome/Gastrectomy/Steroid dependent.

## Work Up

From each subject, a 10ml of blood sample was drawn and was placed in an ice box. The sample was then transported to our laboratory. In laboratory, the serum was separated after centrifugation at 3000 RPM for 15 minutes at 4 degree Celsius.

For further analysis, this serum was then estimated for Vitamin D level using Vitros Eci immunology (CLIA) analyser present at our Microbiology laboratory. PBH X-ray AP view was taken of all the subjects and was analysed.

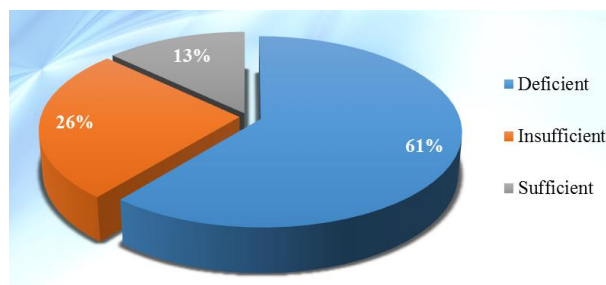
- By simple random sampling, 60 deficient patients will be divided into 2 groups A and B.
- Group A will get daily calcium and vitamin D supplement. In addition to that Group B will get additional weekly vitamin D supplement and follow up will be done by checking vitamin D levels at 3,6,9 months.
- Using statistical analysis, data will be entered in Microsoft office excel. Appropriate statistical test will be used to find significant association.
- $P < 0.005$  will be considered statically significant.

## 3. Results

Of 100 patients in our study, mostly patients 87% were below optimal levels, 61% were found to be vitamin D deficient, 26% insufficient and only 13% were found to have sufficient vitamin D levels (i.e. >30 ng/ml).

**Table 1:** Vitamin D Status

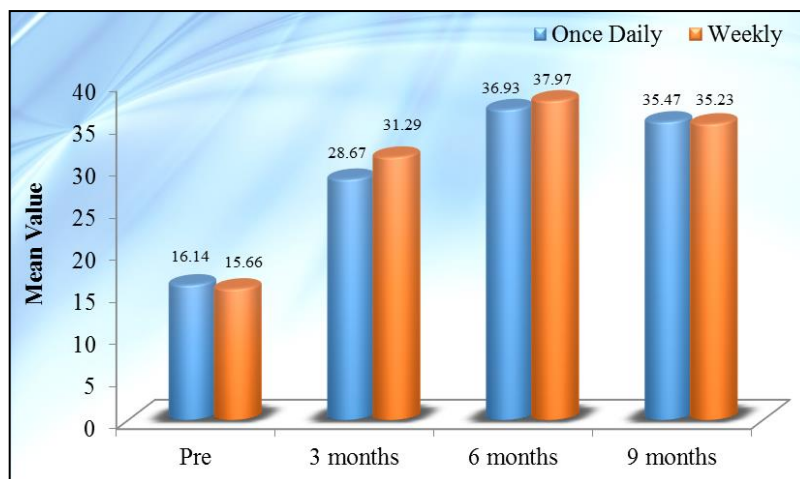
Vitamin D	Patient
Deficient	61
Insufficient	26
Sufficient	13



**Fig 1:** Vitamin D Status

**Table 2:** Vitamin D Supplementation

Vitamin D Given	Pre		3 month		6 month		9 month		P value
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	
Once Daily	16.14	2.04	28.67	5.85	36.93	5.28	35.47	3.69	$p < 0.001$
Weekly	15.66	1.97	31.29	4.46	37.97	3.89	35.23	3.96	$p < 0.001$



**Fig 2: Vitamin D Supplementation**

60 deficient patients were randomized in two groups and one group was given weekly followed by daily dosing, while other was given only daily regime. At 3 month follow up, both had significantly decrease deficiency but weekly dose patients had more increase in Vitamin D levels compare to daily group. At

6 month follow up, both groups show almost same effect and most patients deficiency was treated. At 9 months, both groups show slight decrease in vitamin D levels but well above deficiency level.

**Table 3: Singh Index**

Vitamin D	Singh Index							
	1		2		3		4	
	No.	%	No.	%	No.	%	No.	%
<20 = Deficient (1)	13	21.31	24	39.34	23	37.7	1	1.64
20-30 = Insufficient (2)	6	24	12	48	7	28	0	0
>30 Sufficient (3)	3	21.43	7	50	4	28.57	0	0

Singh index was calculated in all patient and no significant association was found with Vitamin D status.

#### 4. Discussion

The significance of vitamin D levels is not known in most of the trauma patients worldwide. The patients in our study may be considered to represent a productive cross section of the community considering the average age. None of the patients had been tested or treated for Vitamin D deficiency prior to their admission at our institution.

The effect of Vitamin D on muscle power and function in a dose/level dependent manner is well known and replacement therapy in rehabilitative phase post trauma or surgery might be especially beneficial [18, 19].

M Brinker *et al.* evaluated patients with an unexplained nonunion and found that a majority of patients (84%) had a metabolic bone disorder, the commonest being Vitamin D deficiency and union occurred in some patients with just medical treatment [20].

We suggest that trauma surgeons should be vigilant about level of vitamin D in treating the patients with fractures so that good healing can be achieved and their post-operative results can be improved. Bone remodeling and callus formation need vitamin D in desirable level as suggested by clinical and experimental studies [21, 22].

Clinicians should be aware that mostly trauma patients are vitamin D deficient and uptake from food is generally insufficient to retain adequate serum concentrations of vitamin D [23]. Consequently, active supplementation is the only effective way for vitamin D deficient patients to complement their deficiency.

Robertson *et al* conducted study on 201 adult trauma patient with vitamin D deficiency. After supplementation 80% of them improved [24].

60 deficient patients were randomized in two groups and one

group was given weekly followed by daily dosing, while other was given only daily regime. At 3 month follow up, both had significantly decrease deficiency but weekly dose patients had more increase in Vitamin D levels compare to daily group. At 6m, 9m follow up both regime was equally effective.

#### 5. Conclusion

Our study indicates that continued vigilance is required to adequately treat a low serum 25-OH vitamin D level.

Regular supplement of vitamin D therapy provided a favorable outcome in the trauma patients. Other modalities of Vitamin D supplementation such as, sun exposure and diet modification with fortification in this patient group in the recovery/ rehabilitative period post injury is of considerable importance.

It is said that "Prevention is better than cure". This is true for Vitamin D insufficiency and deficiency which are easily preventable. Thus, the current recommendations of adequate exposure and supplementation should be adhered to avoid Vitamin D deficiency in the Indian population.

#### 6. Declarations

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Conflict of interest: None

Ethical Approval: obtained prior to study

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