

# Effect of a Vibration Based Rehabilitation Concept on Gross Motor Function in Children with Osteogenesis Imperfecta

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## Conclusion

- The interval rehabilitation concept, including side alternating Whole Body vibration is safe in children with OI.
- Mobility, gross motor function, BMC and lean mass increased during the 12 months concept.
- Growth rate was comparable to healthy children during the concept.

## Background

Osteogenesis imperfecta (OI) is a rare hereditary disease affecting the skeletal system leading to pathological fractures, scoliosis, dwarfism and immobility. Additionally, in patients where the disease is caused by a collagenopathy many are affected by hyperlaxity of ligaments and joints. Besides medical treatment (bisphosphonates) and surgical procedures to treat deformities of long bones and fractures (telescopic rods) intensive physiotherapy is an essential part of an interdisciplinary treatment approach.

**Objective:** The aim of this retrospective analysis was to describe the effect of a multi-modular physiotherapeutic concept, including side-alternating whole body vibration (WBV) on the muscular-skeletal system and on mobility of children with OI. Primary outcome parameter was the Gross Motor Function Measure (GMFM) before and after 12 months.

## Patients

Data of 37 children (24 male; mean age: 8.57 years) were analyzed. The severity of the disease was classified according to the Sillence classification: OI type 1 n=3; OI type 3 n=12; OI type 4 n=22. 30 patients received a therapy with i.v. bisphosphonates prior and during the training concept. Mobility was assessed with the "Gross Motor function measure" (GMFM) and the skeletal system was evaluated using Dual Energy X-ray absorption (DXA).

## Intervention

The children participated in the Cologne rehabilitation program "On your feet" to improve their motor function. This training includes 3 weeks of physiotherapy, 6 months of whole body vibration (WBV) training (Galileo System®) and 6 months of follow-up.

Schedule during whole concept						
M 0			M 6			M 12
1 <sup>st</sup> in-patient stay	Home based WBV-training	2 <sup>nd</sup> in-patient stay	Home based WBV-training	1 <sup>st</sup> out-patient visit	Follow up	2 <sup>nd</sup> out-patient visit
13 days	3 months	6 days	3 months	1 day	6 months	1 day
Schedule during in-patient stay						
Daily	2 x 50 min	PT	Physiotherapy includes techniques like muscle stretching, massage, and different exercises for muscle-coordination, -force, balance and endurance training.			
	3 x (3x3) min	WBV	Galileo® WBV-system (Novotec Medical GmbH, Pforzheim, Germany) – side alternating vibrating platform amplitude:0-3.9 mm – frequency range: 15-20 Hz Galileo TT® is a tilt-table with a Galileo® WBV-system at the foot end for non-standing children – angle of verticalisation (0-90°) can be altered individually – training starts from individual, comfortable angle and processes during training			
Weekly	3 x 40 min each	BWSTT	– LOKO System (WOODWAY® GmbH Weil/Rhein, Germany) treadmill with harness system – body weight is supported to the child's individual needs – convenient speed to train the repetitive walking pattern mostly for 20-30 min			
		RT	– apparatus adapted for children (Stolzenberg GmbH, Dynamed, Ertstadt, Germany) 20-30 min – increasing weight on a base of 3 x 15 repetitions			

Fig. 1: Schedule and components of the rehabilitation program

## Results

	M 0	M 12	Δ 0-12	p	n
<b>GMFM 66 (Score) (SEM)</b>	54.48 (2.414)	57.59 (2.777)	3.11	0.0007	32
<b>BMC Whole body less head / height (SEM)</b>	2.228 (0.3300)	2.680 (0.3599)	0.452	< 0.0001	27
BMD Whole body less head / height (SEM)	0.5383 (0.01639)	0.5299 (0.01529)	-0.0084	0.1887	27
BMD Whole body less head z-score (SEM)	-3.159 (0.3133)	-3.229 (0.3394)	-0.070	0.5261	17
<b>Lean mass Whole body less head / height (SEM)</b>	0.1059 (0.00537)	0.1110 (0.005729)	0.0051	0.0006	27
<b>Lean mass legs / height (SEM)</b>	0.04611 (0.003147)	0.05004 (0.003288)	0.00393	< 0.0001	27
<b>Height (cm) Mean (SEM)</b>	100.9 (3.605)	104.9 (3.721)	4.00	< 0.0001	37
Height SD Mean (SEM)	-5.828 (0.5002)	-5.962 (0.4971)	-0.134	0.2727	37
<b>Weight (kg) Mean (SEM)</b>	19.97 (2.192)	21.72 (2.253)	1.75	< 0.0001	37
BMI (kg/m <sup>2</sup> ) Mean (SEM)	18.06 (0.6237)	18.29 (0.6006)	0.23	0.1858	37
BMI SD Mean (SEM)	0.7168 (0.2336)	0.6695 (0.2266)	-0.0473	0.3557	37

Tab. 1 : Results of the multimodular rehabilitation program "On your feet" at start (M0) and after 12 months (M12). The number of participants varied due to the retrospective character of the analysis.

## Discussion

The new physiotherapy concept "On your feet" had a significant effect on mobility measured by GMFM. DXA measurements showed an increase of BMC and lean mass (as surrogate parameter for muscle mass) even after corrected for height. During the 12 months the patients showed no further deterioration of height SD. Therefore this therapeutic approach should be considered as part of an multimodular treatment concept in children with OI to improve mobility, bone stability and height.

WBV is not part of the standard care for OI and might be considered to be included in the rehabilitative procedures.