Patients with unilateral Charcot foot: medial convexity deformity versus rocker bottom deformity

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Background and aim

Patients with diabetes mellitus have high risk to develop plantar ulcers with subsequent amputations. The chronic Charcot foot increases the risk: the deformity in midfoot and/or in other sites of the foot is the cause of abnormal pressure on the weight bearing sites of the foot. Presence of amputations changes dramatically the weight bearing.

The aim of this study was to find the changes in plantar pressure distribution in Charcot foot in case of rocker-bottom, medial convexity, and dorsal prominence deformities in presence of minor amputations.

Studied groups

- Group1 – patients with rocker-bottom or medial convexity without amputations
- Group 2 – patients with rocker-bottom or medial convexity with toe amputations (big- second toes and third-fifth toes)
- Group 3 – patients with dorsal prominence without amputations
- Group 4 - patients with dorsal prominence with amputations of big toe

Characteristics of patients (n=42)

	Age, years	Gender (m/f)	Diabetes type (1/2)	Duration of diabetes, years
Gr.1 (24)	51 (12)	11/13	9/15	19 (10)
Gr.2 (5)	53 (12)	2/3	2/3	19 (13)
Gr.3 (7)	39 (10)	3/4	3/4	15 (6)
Gr.4 (6)	50 (11)	3/3	3/3	18 (6)

Pressure distribution measurement protocol and data analysis

- Five dynamic records of each foot were made with first step procedure using emed-at 25 system (novel, Munich).
- novel database diabetes was used to store clinical and pressure measurement data.
- Peak and mean pressures, maximum force, force-time integrals, time parameters were calculated with novel-projects.
- automask program was used for foot areas detection.
- Parameters were calculated for each subject and averaged across the groups.
- Statistical analysis was performed with Pearson`s correlation coefficients (significance level - p<0.01) and ANOVA (p<0.001)
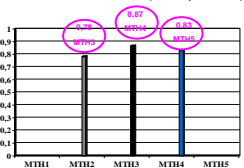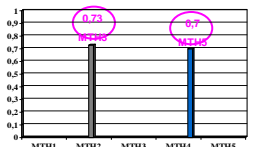
Results

Correlation coefficients (peak pressure)
Patients with rocker-bottom and medial convexity without amputations
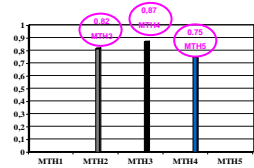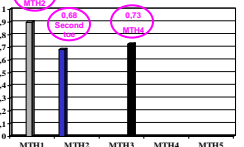
Correlation coefficients (mean pressure)
Patients with rocker-bottom and medial convexity without amputations
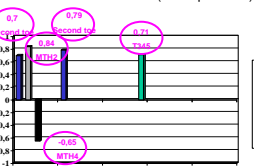
Correlation coefficients (peak pressure)
Patients with dorsal prominence without amputations
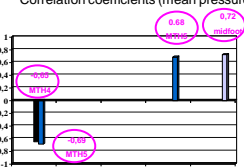
Correlation coefficients (peak pressure)
Patients with dorsal prominence with big toe amputation
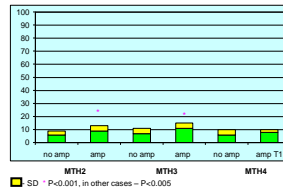
Correlation coefficients (mean pressure)
Patients with dorsal prominence with big toe amputation
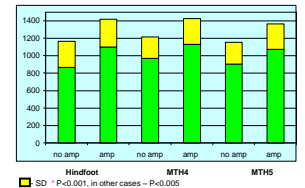
Correlation coefficients (mean pressure)
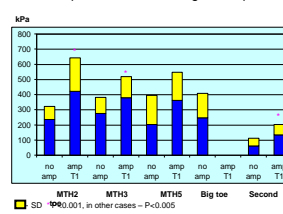Patients with dorsal prominence without amputations

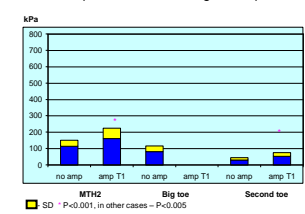Force-time integrals in patients with rocker-bottom and medial convexity without amputations and with toes amputation

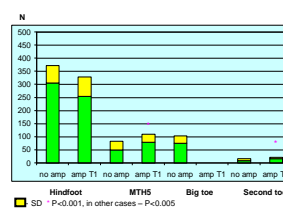Contact time in patients with rocker-bottom or medial convexity without amputations and with toes amputation

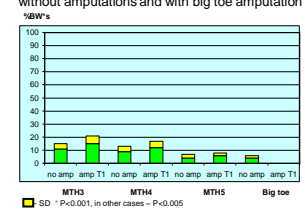Peak pressure in patients with dorsal prominence without amputations and with big toe amputation

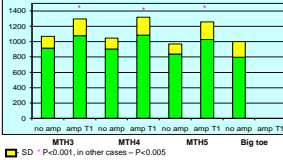Mean pressure in patients with dorsal prominence without amputations and with big toe amputation

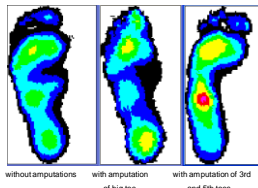Maximum force in patients with dorsal prominence without amputations and with big toe amputation

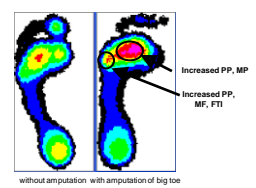Force-time integral in patients with dorsal prominence without amputations and with big toe amputation

Contact time in patients with dorsal prominence without amputations and with big toe amputation

Average MPP for patients with rocker-bottom and medial convexity

without amputations / with amputation of big toe / with amputation of 3rd and 5th toes

Average MPP for patients with dorsal prominence

without amputation / with amputation of big toe

Increased PP, MP
Increased PP, MF, FTI

Conclusion

- ✓ Minor amputations in patients with rocker-bottom and medial convexity result in increase of contact time and force-time integrals under the hindfoot, central and lateral metatarsal heads (in compliance with [1]: increased contact time – 20%)
- ✓ Significant changes in pressure distribution were found in patients with dorsal prominence: amputation of big toe causes the increase of loading and contact time under central and lateral metatarsal heads
- ✓ Biomechanical changes in patients with dorsal prominence and amputation of big toe are characterized by lateral loading shift (in compliance with [2]: significantly increased peak pressures under lateral metatarsal heads in feet with a great toe amputation)

Literature

1. Wolfe L, Stess RM, Graf PM: Dynamic pressure analysis of the diabetic Charcot foot. *J Am Pod Med Assoc* 81:281–287, 1991
2. Lavery LA, Lavery DC, Quebedeax-Farnham TL: Increased foot pressures after great toe amputation in diabetes. *Diabetes Care* 18:1460–1462, 1995