Pedographic findings in 461 patients in a foot and ankle outpatient clinic – definition of standard pedographic patterns for typical pathologies

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Introduction

Pedography is the most sophisticated method for biomechanical analysis in foot and ankle. Standard force distribution patterns for physiologic (normal) conditions had been defined on the basis of a sufficient number of examined individuals. However, standard force distribution patterns for certain pathologic conditions have not been established so far. Consequently, pedographic data could be compared with physiologic data only but not with standard pathologic data. The goal of this study was to create a basis for a definition of standard pedographic force disctribution patterns for different typical pathologic conditions

Methods

Patients who visited a foot and ankle outpatient clinic from October 1, 2006 to December 31, 2007 were included. Demographic data, clinical and radiological findings were registered. Standardized pedography (three trials, walking, third step, bilateral) using an EMED™ platform and software (Novel Inc., Munich, Germany) was performed. The patients were grouped regarding different typical pathologies such as Hallux valgus or flatfoot. The pedographic data were analyzed and compared between and within groups (ANOVA). Standard pedographic patterns were extracted from the data for the different pathologies. The definition of a standard was considered to be possible if no statistical differences within one group was found ($p>0.05$), and if the power of this special analysis adequate (>0.8). The defined standard data for the different pathologies were also compaired with known physiologic pedographic patterns (ANOVA). The null hypothesis at the $p<0.05$ level means there is no difference between groups, and the defined standard data for the different pathologies and known physiologic pedographic patterns.

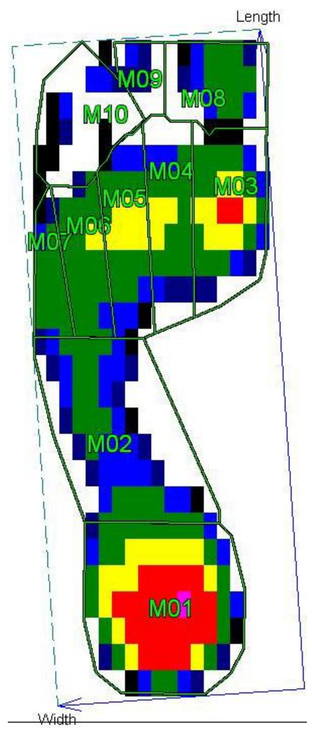
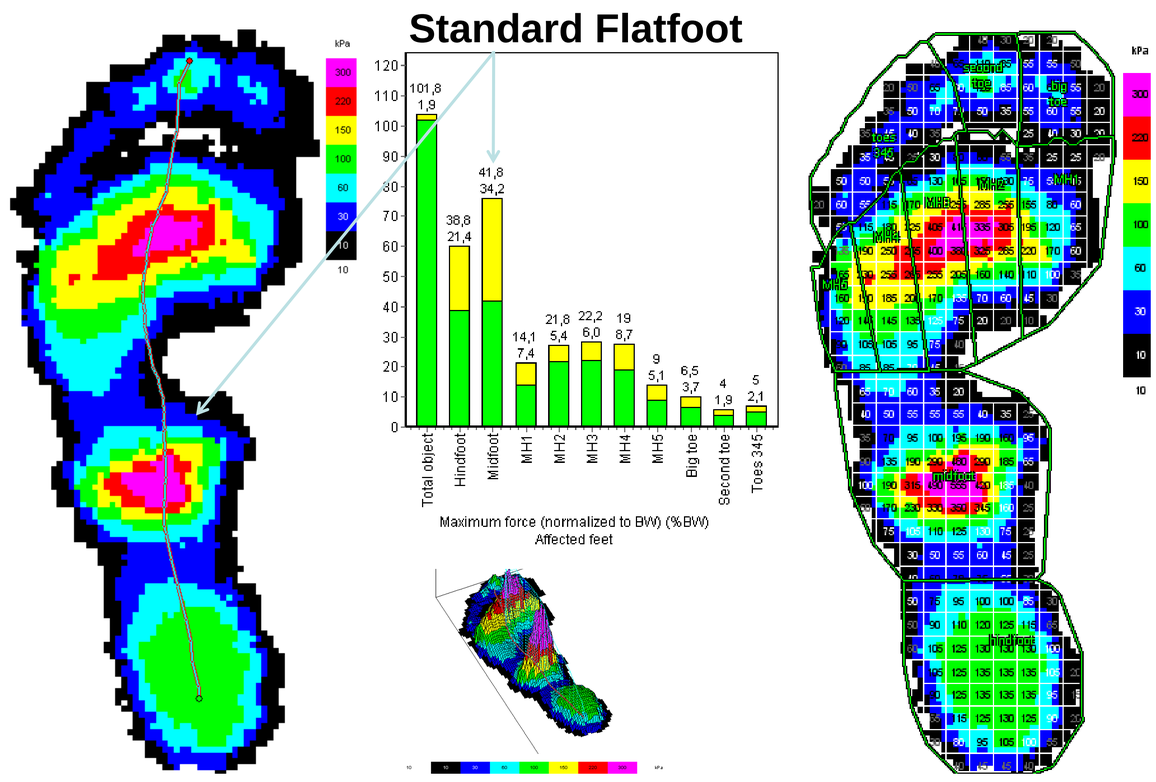


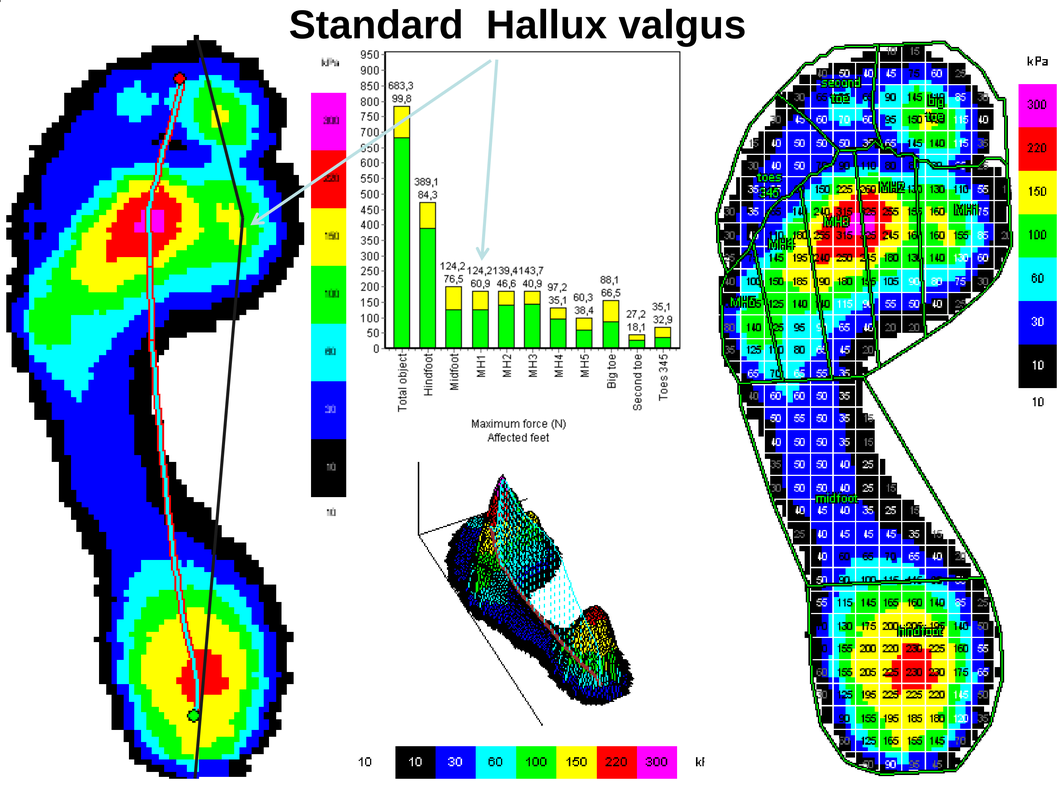
Figure left: Image from computerized mapping. The following regions are defined by the mapping process:
M1, hindfoot;
M2, midfoot;
M3, 1st metatarsal head;
M4, 2nd metatarsal head;
M5, 3rd metatarsal head;
M6, 4th metatarsal head;
M7, 5th metatarsal head;
M8, 1st toe;
M9, 2nd toe;
M10, 3rd-5th toe.

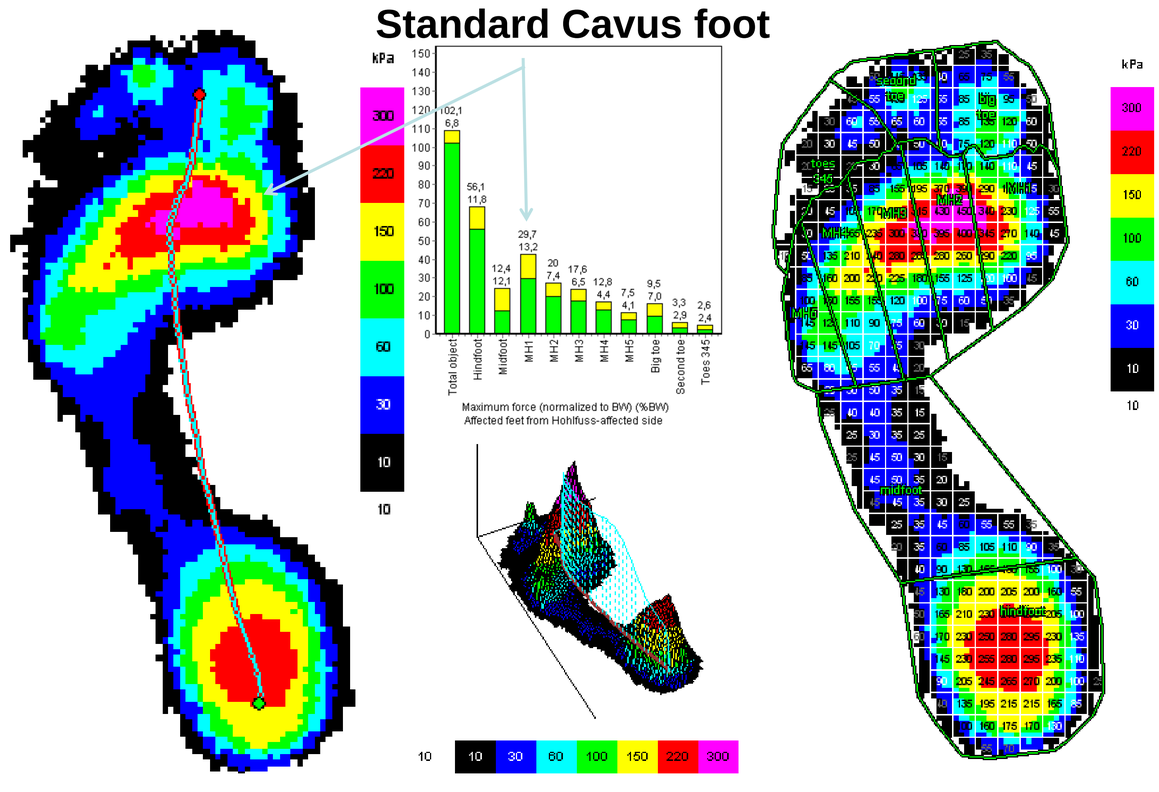
Results

461 patients were included. 312 were female and 149 male. The mean age was 53 years. The patients were grouped as follows (n=192 (42%) individuals in more than one group): forefoot / isolated Hallux valgus, n=113 (25%); forefoot Hallux valgus & claw toes, n=58 (13%); forefoot others, n=110 (24%); midfoot deformity, n=36 (8%); midfoot others, n=40 (9%); hindfoot varus deformity, n=18 (4%); hindfoot valgus deformity, n=36 (8%); hindfoot others, n=79 (17%); ankle deformity, n=56 (12%); ankle instability, n=15 (3%); flatfoot, n=73 (16%); cavus foot, n=19 (4%).

The standard pedographic parameters (contact time, contact area, maximum force, mean force, etc.) differed between groups (ANOVA, $p<0.05$). These parameters differed not within the groups (ANOVA, $p\geq0.05$) for all groups except forefoot others, midfoot deformity, midfoot others, ankle deformity, hindfoot others. The power of this analysis was >0.8 for all subgroups except ankle instability and cavus foot. “Mean” pedographic patterns were defined if possible (see definition in methods). The null-hypothesis was rejected for the comparison between pathogical groups, and between the defined standard data for the different pathologies and known physiologic pedographic patterns.







Conclusion

Typical pathologic foot and ankle conditions show a specific and typical force distribution pattern that differs from known physiologic data. A basis for the comparison of pedographic data with standard data for pathologic conditions was established patiants with the following pathologies, isolated Hallux valgus, Hallux valgus & claw toes, hindfoot varus deformity, hindfoot valgus deformity, flatfoot, cavus foot. This data may serve as a valuable tool in foot and ankle diagnostics.