

Results of a user survey concerning the sub-ischial VPS socket system

The VPS System (Vacuum Pressure Socket System) from Vogel Orthopädie Technik has been on the market since 2022. The evaluation of 30 questionnaires is intended to help classify and assess the socket system. Prof Dr Jürgen Rütt (Private Orthopaedic Practice Dr Theben, Cologne) was involved in respect of the design and evaluation of the questionnaire used, in order to confirm the quality of the data collected.

Key words: sub-ischial prosthesis socket, vacuum adhesion, femur length, vascular diseases

Introduction

With socket systems involving the ischium ramus, problems frequently arise in the area of the contact points. The proximity to the hygiene area as well as possible restrictions in the freedom of movement are also detrimental. In addition, the socket forms can have negative effects on sitting comfort [1, 2].

When cycling, the constructively necessary side or base support points on the ischium ramus frequently cause problems, as these come into contact with the saddle. Users regularly comment that they get caught on the saddle or that their choice of saddle is restricted. As a result, sportspersons either dispense fully with a prosthesis socket or wear special constructions that do not collide with the saddle.

Classical and previous sub-ischial socket systems achieve their greatest reduction value in the socket entry plane (\emptyset 2.5–3.5%). This value decreases distally. As a result, they counter the compression-stocking principle, a factor that must be seen critically in particular with patients who were suffering from vascular disease at the time of their amputation (approx. 73%) [3].

However, this procedure is necessary in order to ensure that previous sub-ischial socket systems can stabilise either through muscular blocking and/or high reduction values of up to 6%, and to avoid unwanted rotation of the socket around the stump or shifting [4, 5].

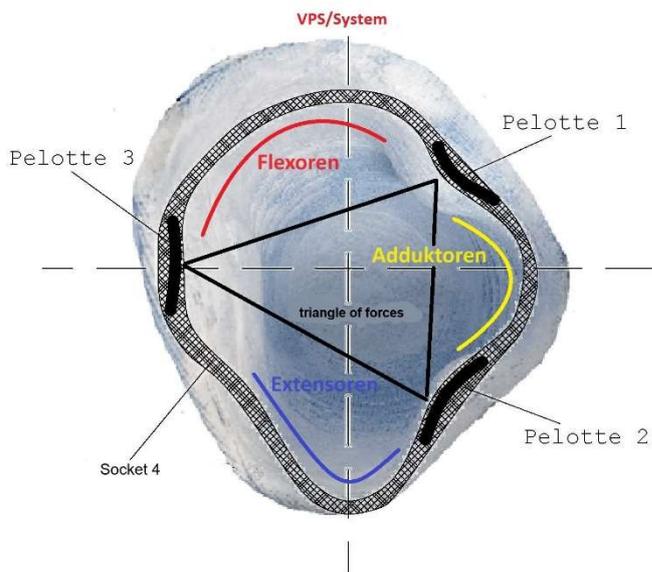


Fig.1 triangle of forces

In this respect, the sub-ischial VPS System adopts a completely new approach, because the creation of a triangle of forces in the rest areas between the main muscle groups means that the socket is stable even when at rest (Fig. 1). This is achieved at the casting stage with the help of a special casting device, the "Dimplemat" (Fig. 2). This ensures that only a volume shift and not a volume reduction results. As the

prosthesis socket does not therefore have to be held in position in the socket entry plane via volume reduction and/or muscle blocking, there is no need for a special reduction in the volume in this area. The working is therefore based on a specially developed reduction table.



Fig.2 Dimplemat

This is based on RAL Quality Label 387/1 [6], thus ensuring integral strength and adhesion of the prosthesis socket. With this "compression-stocking principle" the lowest reduction value occurs in the socket entry plane (\varnothing 0.8–1.1%) and increases distally. This revolutionary approach has not

previously been described in any other socket technology known to me. Consequently, the convergence with the hydrostatic principle is implemented here, as a result of which the tissue transitions show themselves fluently and account is taken of the point that approx. 73% of all amputees were suffering from vascular disease at the time of their amputation (Fig. 3). The aim of the survey is to obtain an assessment of this completely new approach by the users.



Fig.3 tissue transitions

Method

To enable better classification of the VPS System and to check the operating principle, an anonymous questionnaire [7] was developed that reflects the assessment of the VPS users compared to their previous socket treatment. The orthopaedic technicians certified by Vogel Orthopädie Technik are asked to complete the questionnaire together with the user after a wearing period of at least one month. All users got on well with the previous treatment. The desire to test the VPS System was based above all on the hope of being able to improve the socket comfort. An elementary need that has already been reflected in several surveys [8, 9].

In a cross-sectional examination the first 30 treatments carried out by a total of nine certified companies in the period up to mid-February 2024 were evaluated. They provide indications concerning:

- a) User (age, degree of mobility etc.)
- b) General satisfaction
- c) Comparison with the previous socket system
- d) Stability of gait mechanics
- e) Conclusion of the user

Results

Concerning a) 30 questionnaires were evaluated. The users had an average age of 53, weighed 94.2 kg and were 175 cm tall. The average degree of mobility was 2.7 and the stump length stated was $< 2/3$ and $> 1/3$ in relation to the contra-lateral side. 15 of the persons questioned were treated with a ramus prosthesis socket, 12 with a prosthesis socket

encompassing the ischium and three participants with a sub-ischial system (MWK socket). Nine users had a locking system and 21 had already been treated with a vacuum-adhesion socket system, of which 16 with liner and five without. The median use of the VPS System at the time of the survey was 13 weeks (IQR5-47). A sensitivity analysis between the two groups with a use period < 13 weeks versus > 13 weeks showed no significant differences.

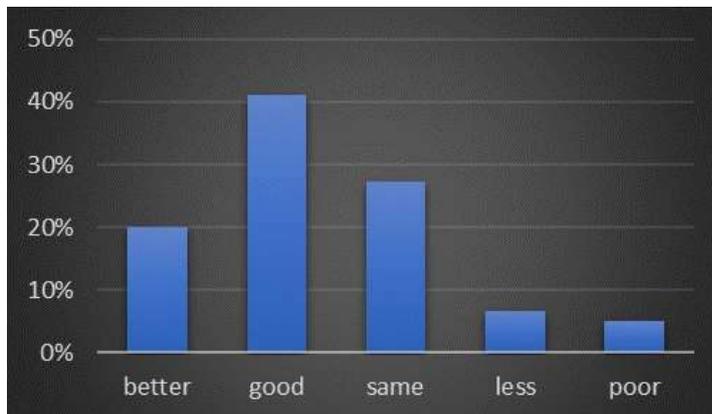


Fig. 4 General Satisfaction

Concerning b) The question asked under "General Satisfaction" (Fig. 4) was how the users experience the VPS prosthesis socket in everyday life. In addition to the general assessment, the questions asked here concerned the aspects "fit on the stump", "weight of the

prosthesis", "standing", "walking/running", "sitting", "balance standing/walking", "exhaustion", "putting on", "socket size" and "going to the toilet". On average 61% of the users gave the assessment "considerably better" (20%) or "better" (41%). Particularly prominent in this respect with a clear weighting of 20 or more users are the areas "fit on the stump", "sitting", "socket size" and "going to the toilet". Also prominent with a slightly above average number of > 15 to < 20 users are "satisfaction in everyday life", "walking", "balance when walking", metabolic "exhaustion (considerably less or less)" and "attachment of the prosthesis".

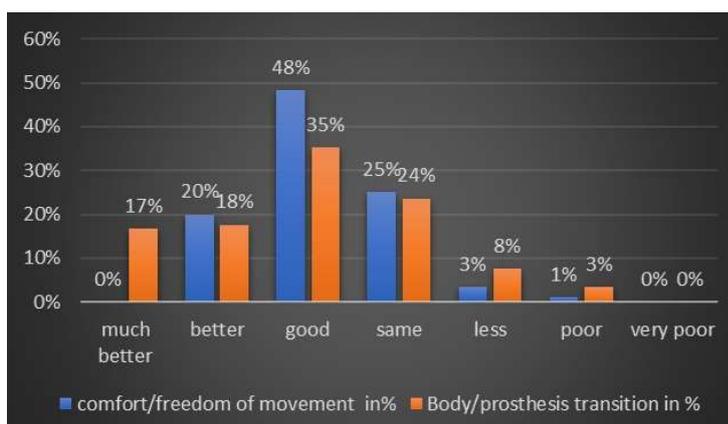
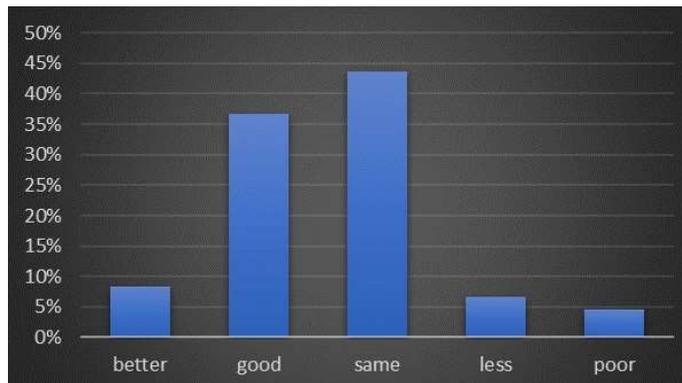


Fig. 5 comparison with the previous socket system

Concerning c) In respect of "comparison with the previous socket system" (Fig. 5) 68% of all users assessed the aspects "comfort/freedom of movement" as "better" (20%) or "good" (48%). 25% stated "unchanged" and just 3% "less" or "poor". Aspects standing out positively were above

all the areas "space in the hygiene area" and "freedom of movement in the individual directions of movement".

d) Under the point "Stability of gait mechanics" (Fig. 6), the users assessed the aspects



"stability in the standing and swinging phase", "natural gait pattern", "swinging movement", "bending and lifting". On average 45% experienced the aspects as "better" (8%) or "good" (37%). 44% assess this area as "unchanged". 7 % stated "less" and 5 % "poorer".

Fig. 6 stability of gait mechanics

Here, above all the

aspects "stability swinging phase" and "swinging movement" were found by a majority to be "considerably better" or "better" compared to the standard treatment.

As conclusion (Fig. 7), 28 of 30 users recommend the VPS System and state "socket comfort" (80%), "cycling/driving" (53%) and "hygiene" (47%) as main innovation points and reasons for their decision.

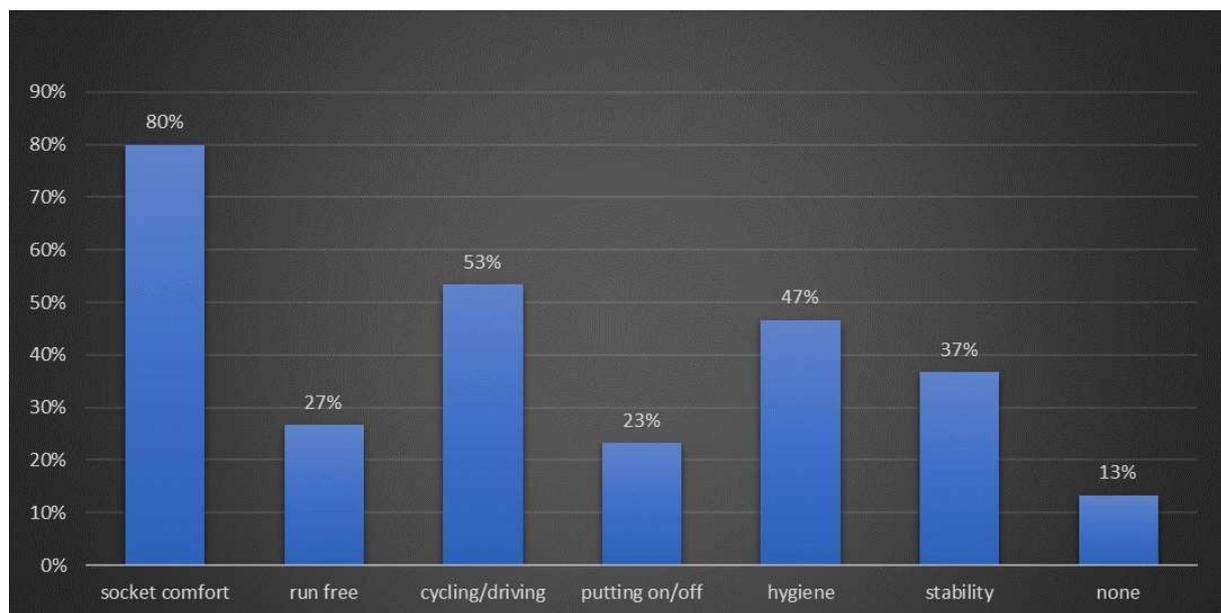


Fig.7 conclusion of the user

Conclusion

Four of the 30 users have decided against treatment with the VPS System. Two users stated their reasons as being too short a stump (femur length) coupled with instability in the system and the resulting pressure points. At the forefront for the other two were pain as well as the rejection of a vacuum adhesion socket system. Nevertheless, 28 users would recommend the socket system.

The evaluation of the results shows: Treatment with a VPS System brings the following benefits for the users: 1. Socket comfort, 2. Easy cycling/driving, 3. Freedom in the hygiene area, 4. Stability of the socket and 5. Free walking. These assessments are reflected in the individual areas. The three users who were already being treated with a sub-ischial system have decided in favour of the VPS System on the basis of the inherent stability.

Thanks to the low-threshold prerequisites (vacuum adhesion socket system as full-contact socket upwards of low end exercise capacity, mobility categories 1-4, as from medium-length stump), the VPS System is suitable for a broad spectrum of patients.

As identified under Point d. (stability of gait mechanics), its constructive elements keep the prosthesis socket very stable both in the resting position as well as when walking/running. "Shifting", i.e. the mediolateral displacement of the prosthesis socket, coupled with the detachment of the lateral application, is barely determinable in practice. Application of the "compression-stocking principle" (reduction of the stump volume on the basis of RAL Quality Label 387/1, i.e. increasing percentage-wise from proximal to distal) takes account of the fact that around 76% of the users were suffering from vascular disease at the time of the amputation.

Discussion

The number of multimorbid and geriatric patients with upper-leg amputations is constantly increasing [10]. The mobility category here is 1 to 2 as a rule. 13 users from the survey being presented fell into this mobility range. This group of users spend most of their time seated and frequently cannot attach and remove the prosthesis by themselves to go to the toilet. Thanks to the low reduction values in the socket entry plane, which increase distally, the VPS System is easy to attach and remove. The described inherent stability of the system is also of particular benefit to this group of users. In future, examinations should be carried out in terms of whether the socket comfort and the identified stability of the VPS System also increase the wearing time as well as the mobility/activity of the users.

Conflict of interest:

The author works for the company manufacturing the VPS System.

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Fig. 1 Creation of a triangle of forces in the rest areas between the main muscle groups.

Fig. 2 The Dimplemat makes it possible to set the resting points on upper-leg stumps in reproducible form.

Fig. 3 Harmonious transition between stump and socket edge.

Fig. 4 The general satisfaction of the users with the VPS System compared to the predecessor system.

Fig. 5 The VPS System in practical use compared to previous socket systems.

Fig. 6 The stability experienced compared to the previous socket system.

Fig. 7 The advantages identified by the users.

Picture credits 1-7: Tobias Vogel and Prof Dr Jürgen Rütt