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A higher glabellar soft tissue cushion is associated with a lower incidence of pilonidal sinus disease

A 3D analysis

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Abstract

Background: Mounting evidence links cut occipital hair fragments to the formation of pilonidal sinus disease (PSD). Anatomical variations in the shape of the dorsal crest between the occiput and the upper intergluteal fold may be crucial in the downward movement of hair to the glabella sacralis region.
Objective: This study aims to investigate the shape and height of the glabellar cushion and their potential influence on the development of PSD.
Patients and methods: We established a method for capturing the shape of the thoracolumbar back down to the intragluteal fold using a structured light 3D scanning device. The soft tissue surface contour of this region was measured. We developed algorithms to extract the width and shape of the canal between the erector trunci, as well as the height of the glabellar cushion. Included were 155 individuals, 94 PSD patients and 61 without PSD.
Results: Glabellar height differs significantly between PSD and non-PSD cohorts. In total, PSD was associated with a 7.8 ± 3.7 mm glabellar cushion, while non-PSD patients exhibited a 9.7 ± 3.8 mm glabellar cushion ($p = 0.0021$). In male PSD patients, the glabellar height was 7.8 ± 3.7 mm (mean ± SD), while in female PSD patients it was 7.7 ± 3.6 mm. Conversely, non-PSD males had a glabellar cushion height of 8.9 ± 2.7 mm, and non-PSD females of 10.5 ± 4.4 mm.
Conclusion: A higher glabellar region is associated with a lower incidence of pilonidal sinus disease. Therefore, elevating and bolstering the glabellar region could be beneficial for preventing recurrence.

Keywords
Recurrence · Lumbosacral region · Body mass index · Hair · Surgical flaps

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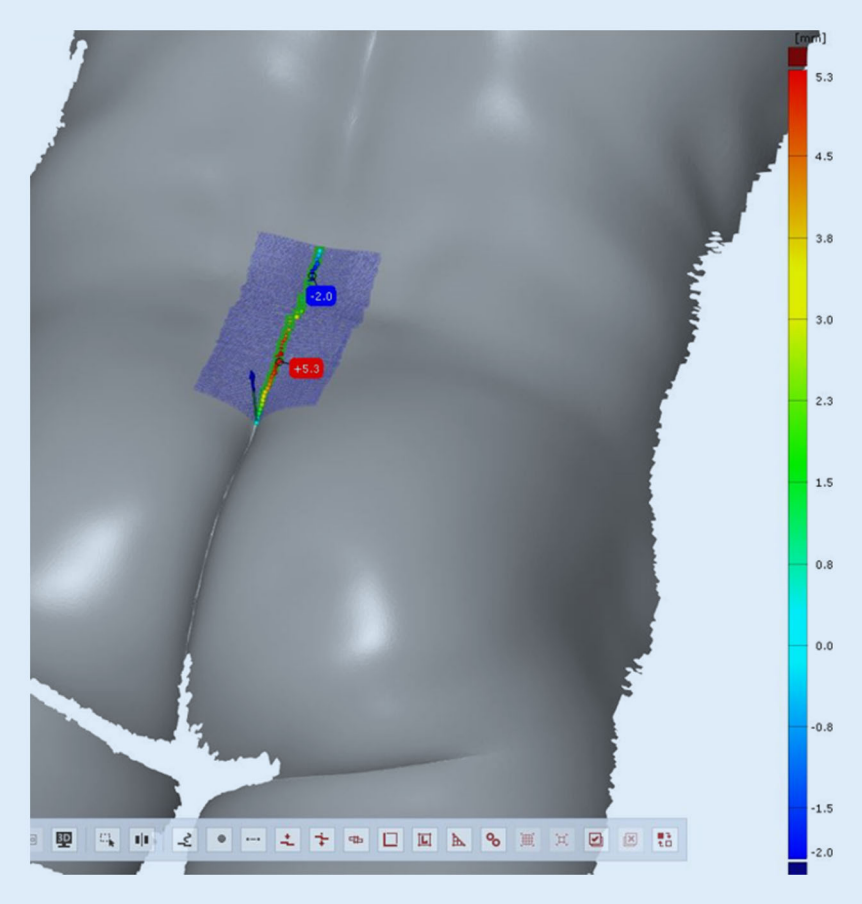

Fig. 1 ▲ Back view (optical picture captured) with midline marker from opening of intergluteal fold to most concave (ventral) lumbar point. (Copyright: D. Doll, St. Marienhospital Vechta)

The first recorded case of pilonidal disease dates back to 1833 [1]. Over the subsequent 190 years, more than 30 theories about the origins of this condition emerged, only to be later discarded. Today, through the use of electron microscopy, the causal agent has been identified: sharp [2], short, stiff [3] occipital [4] hair fragments [5] that have embedded themselves into the skin [6, 7], particularly in the upper third of the intergluteal fold. As cut hair fragments are present in the lumbar region right at the end of a dry hair cut (even with common protective measures) [8], showering and bathing are now understood to be beneficial [9, 10]: this has nothing to do with hygiene [11], but with plain cut hair removal.

There was a suggestion that a greater intergluteal depth might be linked to pilonidal disease [12], which has recently been disproven. Surgical procedures involving advancement flaps (Karydakis, Bascom) and rhomboid flaps (Limberg, Dufourmentel) show the lowest recurrence rates in PSD surgery [13]. Those diverse surgical techniques have one commonality: they alter the anatomy of the intergluteal fold and the region above. Some sources claim that the "cleft lift" technique is pivotal [14], though its significance remains unverified.

The accumulation of cut hair in the intergluteal fold and the prolonged duration it resides there due to a naturally hair-prone "catching zone" contribute to the development of pilonidal disease [15]. As hair fragments travel downward, anatomical variations in the back may either guide these fragments toward the midline or away from it. Thus, our investigation focused on primary anatomical differences between persons with and without PSD spanning from the thoracoabdominal region to the intergluteal fold. The region cranial to the intergluteal fold is called the glabella sacralis and represents the focus of this study. Given the mobile nature of this delicate soft tissue region, manual measurements, especially with heavy instruments, may be unreliable [12], as they distort tissue position and shape upon measurement. To mitigate this, we employed optical 3D 300–400 nm light frame matrix projection on untouched patients. This study aims to investigate the shape and height of the glabellar cushion and its potential influence on the development of PSD. The null hypothesis says that the height of the glabellar cushion is not associated with developing PSD.

Materials and methods

Measuring tool

A high-precision ATOS Compact Scan Sensor (Carl Zeiss GOM Metrology GmbH, Braunschweig, Germany) was used for the measurements. This stereo device utilizes projected light patterns to capture the three-dimensional shape of the scanned object. The scanner's light source projects a series of parallel lines onto the target, and these lines are altered by the surface's contours. This alteration is captured by two stereo cameras. During image postprocessing, a 3D point is computed for nearly every pixel.

The measuring setup encompassed a standardized field of view measuring 1200 × 900 × 880 mm and a tripod stand for stabilization. Structured light projection was facilitated using an enclosed artificial blue light source with a wavelength range of 400–500 nm, which was projected onto the defined region of interest spanning from the thoracolumbar junction to the intergluteal fold.

Participants were positioned in an upright standing posture, without gluteal compression, a commonly adopted daily stance. The scanning process took less than 15 s per individual.

Both the scanning process and the subsequent postprocessing were conducted using GOM Software version 2022, the standard software utilized at Carl Zeiss GOM Metrology GmbH Braunschweig for examination of point clouds and meshes. Differing from industrial parts, our area of interest lacked prerecorded alignment or inspection schemes. This necessitated development of a rotation- and transla-

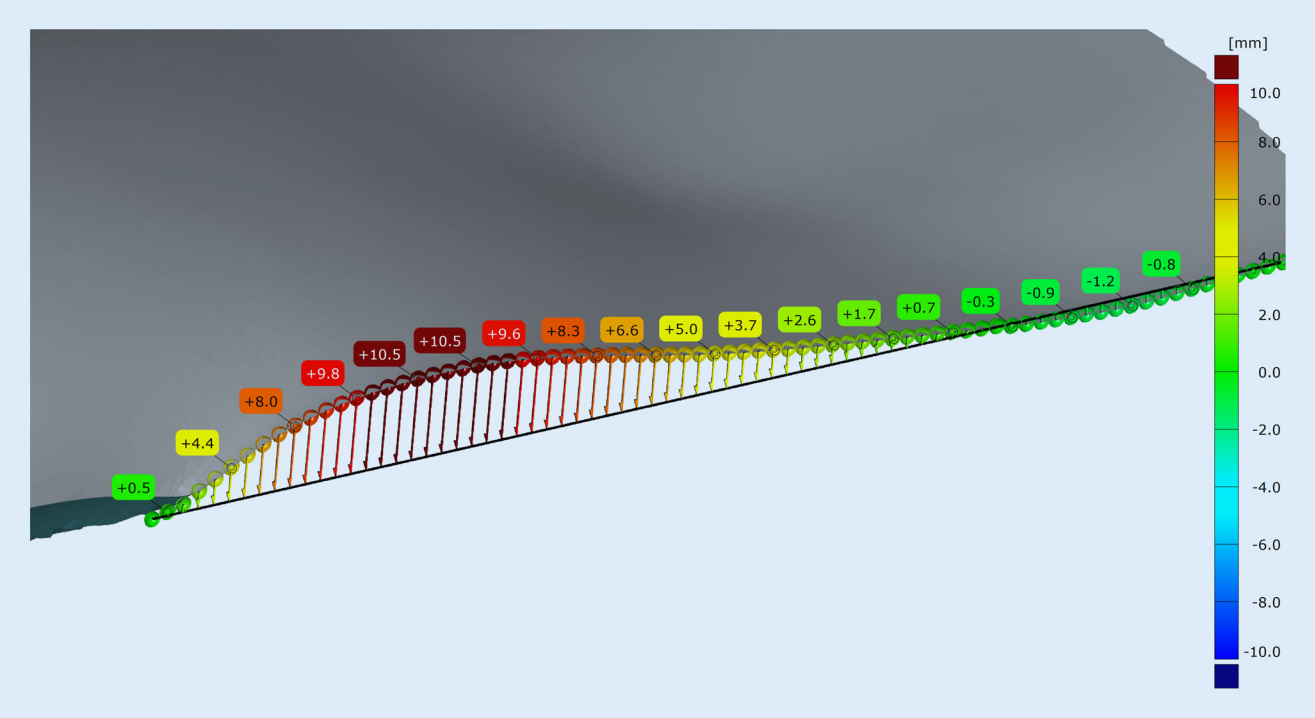

Fig. 2 ▲ Following definition of the intergluteal opening point (*left side*) and the most concave lumbar point (*right side*), height (here: 10.5 mm), point of maximal height, length of the glabellar cushion, and steepness could be harvested by algorithm. (Copyright: D. Doll, St. Marienhospital Vechta)

tion-invariant alignment process to establish a foundational coordinate system for result comparison. The finalized coordinate system was established with the intergluteal fold as the origin, the x-axis oriented toward the vertebral column midline, and the remaining rotation fixed with reference to the line connecting the hips. Since there were no references for geometric dimensions for the measuring algorithms of the software, a new inspection strategy was implemented using the integrated Python API, a bidirectional link to the Python scripting language, enhancing the software's functionality by creating a regular grid based on the unstructured mesh. This approach enabled us to directly compare scan data within a controlled environment, evaluating distances, slopes, and other factors from all directions.

Cohort

We measured a consecutive cohort comprising 94 PSD patients (73 males, 21 females) and 61 non-PSD participants (31 males, 30 females) from a German population, all of whom provided informed consent by signing the study protocol. Increased hygiene regulations due to coronavirus SARS-CoV-2 (COVID-19) where applied.

For each individual, optical 3D measurements were conducted on the lumbosacral region, while the individual stood upright (**Fig. 1**). The midline was identified, and a region of interest (depicted in blue) was captured, extending for 3 cm on each side. Specific points were identified and labelled: the cranial opening of the intergluteal fold and the most ventral point of the lumbar spine. By drawing a line between these two points along the midline, the craniocaudal contour of the glabellar cushion was analyzed in relation to this line.

Maximum height, craniocaudal length, and steepness (glabellar height divided by glabellar length) were either measured or calculated (as shown in **Fig. 2**). Additionally, the widest point of the intermuscular gap between the erector trunci was measured.

Statistical analysis

The study data were recorded in an Excel spreadsheet (Excel 2016, Microsoft Corporation, Redmond, WA, USA). Statistical analyses were conducted using SPSS version 26.0 (IBM Corp., Armonk, NY, USA).

Ethics

Ethics approval was applied for and granted by the Ethics Committee of the Saarland University Homburg/Saar 59/22 from 11.07.2022 (chair: Prof. Dr. Grundmann) and by the Ethics Committee of the County Ethics Chamber Lower Saxony in Hannover of the GRAE/151/2022 from 19.8.2022 (chair: Prof. Dr. Creutzig). All patients approached for participation in this study agreed willingly and their informed written consent was obtained.

Results

The cohort was 155 patients. Ages ranged from 17 to 82 years, with an average of 39 years ± 15 years (mean ± standard deviation). The average body mass index (BMI) was 27.3 kg/m^2 ± 5.2 kg/m^2 SD, with a range of 17.8 kg/m^2 to 50.6 kg/m^2. The histograms illustrating age and BMI distribution are shown in **Figs. 3 and 4**, re-

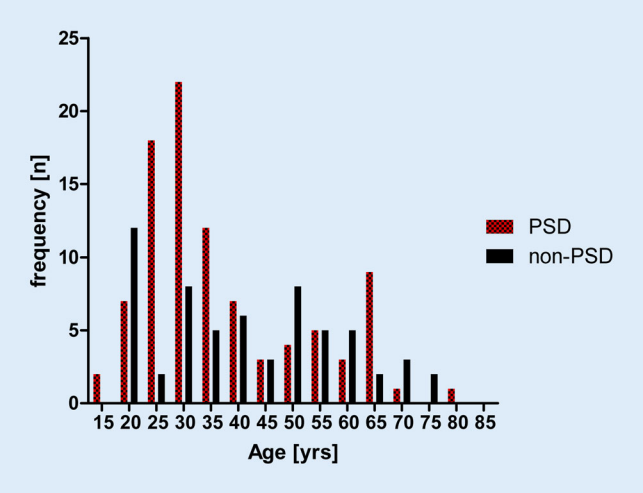

Fig. 3 ▲ Age distribution of all patients measured. Age of pilonidal sinus disease (*PSD*) patients (*red*) and non-PSD participants (*black*) do not differ statistically ($p > 0.05$; t-test). (Copyright: D. Doll, St. Marienhospital Vechta)

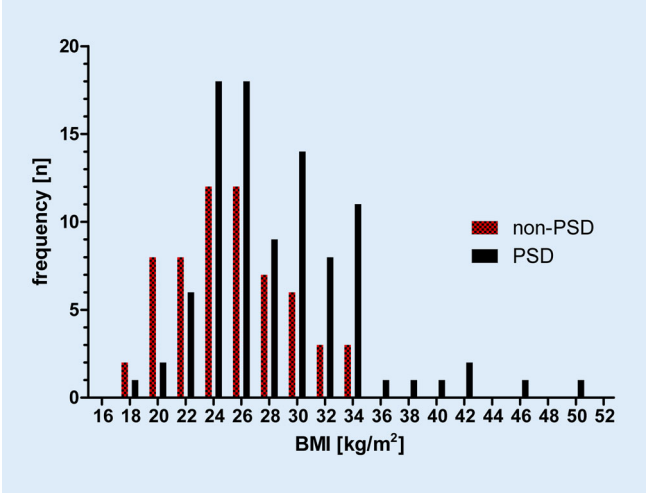

Fig. 4 ▲ Body mass index (*BMI*) histogram of pilonidal sinus disease (*PSD*) patients (*red*) and non-PSD participants (*black*); their BMI is statistically different ($p = 0.0002$; t-test). (Copyright: D. Doll, St. Marienhospital Vechta)

spectively, demonstrating the differentiation between PSD and non-PSD groups.

The BMI histogram for the 155 patients who underwent optical measurements is presented in ◘ **Fig. 2**, clearly differentiating between PSD and non-PSD groups. The distinction is notable due to a larger number of patients with a BMI above 24 kg/m^2 ($p = 0.0002$; t-test).

Glabellar height exhibited significant differences between PSD and non-PSD groups. Among PSD patients, glabellar height measured 7.8 ± 3.7 mm in men and 7.7 ± 3.6 mm in women. In contrast, non-PSD men displayed glabellar cushions of 8.9 ± 2.7 mm, while non-PSD women exhibited cushions measuring 10.5 ± 4.4 mm. Consequently, pilonidal disease was associated with a lower glabellar cushion height of 7.8 ± 3.7 mm, whereas non-PSD participants had a glabellar cushion height of 9.7 ± 3.8 mm ($p = 0.0021$; t-test, ◘ **Fig. 5**).

Women demonstrated higher glabellar cushion heights at 9.4 ± 4.4 mm, in contrast to men at 8.1 ± 3.4 mm. The length of the glabellar cushion, which is the distance from the intergluteal fold opening to the most ventral lumbar point, did not exhibit significant differences between men and women (39.76 ± 12.04 mm vs. 40.97 ± 10.22 mm). Similarly, there were no statistically significant differences in glabellar length between the PSD and non-PSD groups (40.77 ± 12.57 mm vs. 39.21 ± 9.51 mm; $p = 0.40$).

Interestingly, the steepness of the cranial part of the glabellar cushion displayed no significant variations between PSD and non-PSD patients ($p = 0.2$). Furthermore, our efforts to correlate glabellar cushion height with BMI revealed that BMI does not appear to influence glabellar cushion height. The slope of the correlation line, as depicted in ◘ **Fig. 6**, was statistically indistinguishable from zero ($p = 0.7$; t-test). Therefore, despite increased bodyweight in PSD patients, glabellar cushion height seems unaffected within this studied cohort.

Glabellar cushion height does not seem to decrease with age (◘ **Fig. 7**), unlike intergluteal fold depth [16]. This trend parallels the declining incidence of PSD with increasing age [11].

As a result, it appears that glabellar cushion height remains consistent with age among PSD patients. Conversely, in the non-PSD group, glabellar height increases, mirroring the diminishing incidence of PSD.

Discussion

This study marks the first endeavor to delineate the anatomical trajectory of cut hair fragments from the neck down to the intergluteal opening, a site commonly harboring pilonidal injections and hair nests. Leveraging a novel optical scanning tool commonly used for high-end industrial product quality control and building scanning, we successfully employed the 3D volume scanning technique on the region spanning from the thoracolumbar area to the intergluteal fold. This innovative approach allows for measurement without the risk of soft tissue displacements of unknown magnitude that may arise when using mechanical measuring devices.

Our findings underscore the significance of glabellar cushion size, as it is smaller in PSD patients and remains so throughout their lives, rendering them susceptible to further disease despite intermittent surgical intervention. Notably, females enjoy protection against PSD due to their larger cushion height, a factor correlated with the lower incidence of the disease among women both nationally and globally [17–19]. This protection may be an additional consequence of the reduced axial hair force exhibited in women, contributing to their resilience against PSD [20].

Gluteal depth has recently been studied in a larger cohort, revealing no discernible differences in intergluteal fold depth between PSD and non-PSD groups [16]. Akinci [12] highlighted that the maximal depth is consistently near the anus, an area with a notably low incidence of pilonidal disease. With intergluteal fold anatomy appearing to play a lesser role, why do flap procedures yield remarkably low recurrence rates in PSD? How do these procedures alter the anatomy above and within the intergluteal region?

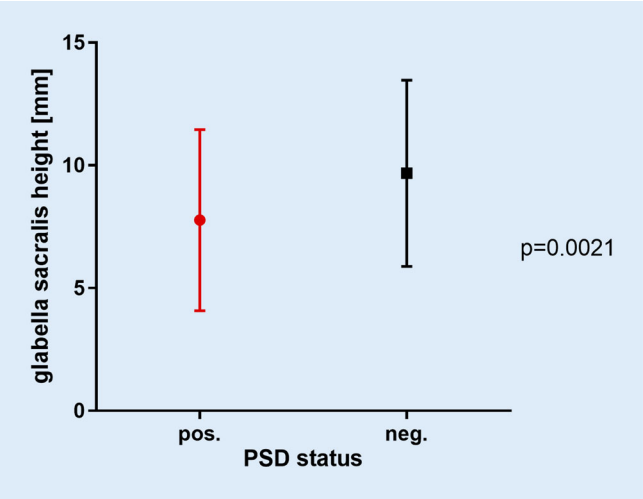

Fig. 5 ▲ Glabellar height in patients with and without pilonidal sinus disease (*PSD*; $p = 0.0021$; t-test). (Copyright: D. Doll, St. Marienhospital Vechta)

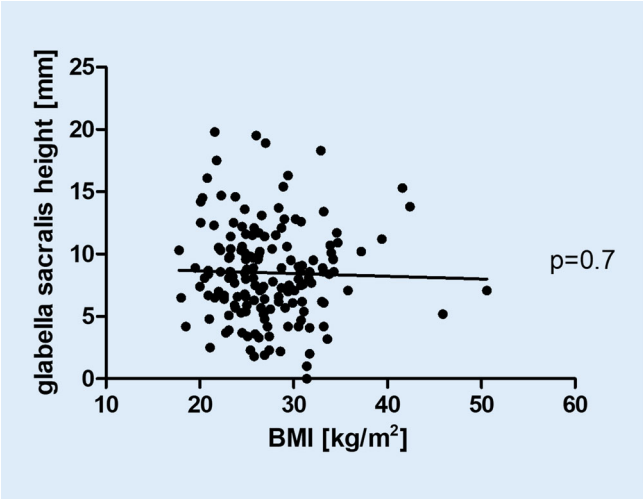

Fig. 6 ▲ Body mass index (*BMI*) and height of the glabellar cushion. The slope of the linear regression does not differ from zero ($p = 0.70$; t-test). (Copyright: D. Doll, St. Marienhospital Vechta)

Interestingly, flap procedures deliberately aim to avoid the intergluteal fold, as wound healing issues are more prevalent when the wound approaches the midline in that region [21]. Irrespective of the flap technique employed, whether it be an advancement (e.g., Karydakis, Bascom) or rotation (Limberg, Dufourmentel) flap, all are executed in the region of the glabella sacralis—cranially to the intergluteal fold's opening. These procedures shift healthy paramedian tissue into the midline. This may explain why flap procedures, regardless of their technique, demonstrate the lowest recurrence rates achievable today [13].

Our study demonstrates significant disparities in the height of the soft tissues covering the glabella sacralis between genders, with lower heights in PSD patients. Mechanistically, this makes it easier for hair to slide down and avoid being obstructed by a soft tissue cushion. Intriguingly, females display larger and higher glabellar cushions, aligning with the lower incidence of PSD observed in women [18, 19]. While PSD is undeniably a multifactorial condition, factors like reduced sweating [22], positive family history [23], and stiffer hair (higher axial hair force) put men at a disadvantage as compared to women [20]. Contributing skin resilience factors, as suggested by Karydakis, are still unexplored [24]. Obviously, anatomical shape variations have their part in this disease as well, as we have found.

The potential role of BMI in fostering PSD has long been debated, yet no concrete evidence has been presented yet. The Minnesota study, encompassing 31,497 students, failed to reveal any correlation (cited from Cowan to Dwight, derived from Franckowiak's thesis as referenced by Obedman [25, 26]). Recent research similarly found no correlation between BMI and intergluteal fold depth (IGFD) in a German cohort of 200 patients [16]. Additionally, Balik's comparison of obese PSD and non-PSD patients, measuring fat pad thickness at the sacrococcygeal junction, unveiled no discrepancies [27]. This suggests that obesity does not necessarily influence anatomical soft tissue changes at this junction.

Several aspects of our study setup warrant discussion. An upright position for measurements ensures that tissues remain undistorted. The alternative, a prone position, could introduce more physiological distortion. However, it remains unknown whether PSD development occurs during sitting, sleeping, or in an upright posture. Although gluteal muscle movement while walking might facilitate hair insertion into the skin, the exact posture's role remains uncertain. Page's 1969 study highlighted that hair movement into the sinus is promoted by walking when the orientation of the hair scale is appropriate [28].

Additionally, spinal column posture is of interest. While lumbar lordosis measurement was not studied in the current investigation, it might be valuable to ascertain whether hyperlordosis predisposes to increased hair loss and a reduced PSD risk. Hair slides downward when there is intimate skin contact, and detachment may redirect hair away from the midline. These data are present within our study and require further analysis.

These considerations, however, do not significantly alter our findings. The glabella sacralis is indeed found to be covered with a thicker protective soft tissue cushion in non-PSD participants, while PSD patients lack this protective cover, rendering them susceptible to the disease.

Limitations

Acknowledging certain limitations is crucial. Initially, as the inaugural study of its kind, our findings lack comparative precedent. While larger cohorts might yield divergent outcomes, our approach remains representative; inclusion was consecutive and reflective of real-world practice. Furthermore, our measurement methodology, employing an upright stance, deviates from the prone position used in most research. However, this aligns with everyday anatomical posture and offers a more natural perspective of the anatomy.

Our study's single-center nature may limit broader applicability. Embracing a multicenter approach could enhance

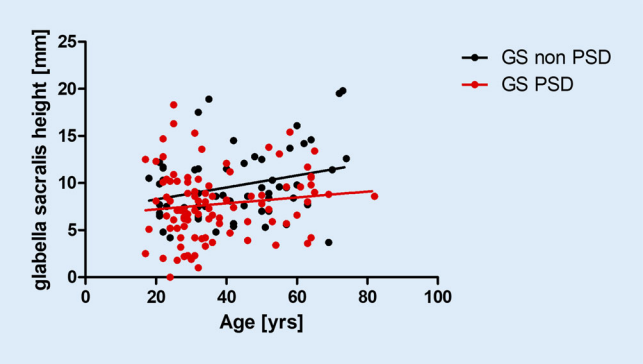

Fig. 7 ▲ Glabella sacralis (*GS*) cushion height and age, shown for pilonidal sinus disease (PSD; *red*) and non-PSD (*black*) groups. While the *red line* does not differ significantly from zero, glabellar height increases with age ($p = 0.0034$; t-test). (Copyright: D. Doll, St. Marienhospital Vechta)

the generalizability of our findings to more diverse populations.

Our research predominantly scrutinized glabellar cushion morphology and its potential repercussions. However, multifaceted factors such as genetic predisposition, hormonal or ethnic differences, lifestyle, and environmental influences could contribute to PSD risk and recurrence. Prospective studies could untangle this complexity through comprehensive multifactorial models.

The rather large variation in age in the PSD and the control groups does not reflect the typical young male PSD patient. There was one case encountered of an 82-year-old patient with PSD and several patients were in the age group over 60, also not matching the typical patient age and leading to the wide age range in the PSD group and the control group.

Notwithstanding these considerations, our study firmly underscores the paramount role of anatomical factors in PSD pathogenesis and recurrence. Acknowledging these constraints, further collaborative research and longitudinal inquiries are vital for refining our comprehension. This, in turn, can illuminate clinical strategies for the prevention and management of this intricate ailment.

Conclusion

In summary, our study has unveiled a significantly greater glabellar cushion in non-PSD individuals, and, notably, this cushion tends to be larger in females compared to males. This aligns with the fact that in females, pilonidal disease is four times less common than in males [18, 19].

Despite the lack of disparity in intergluteal fold depth between the PSD and non-PSD groups [16], the surgical community has been intrigued by the observed reduction in recurrence rates associated with flap and cleft lift procedures. The current findings suggest that it is not the intergluteal fold itself, but the region above it—the glabellar region—that serves as the gatekeeper for hair entry into the intergluteal fold. Therefore, elevating and fortifying the glabellar region, rather than focusing solely on the intergluteal fold, holds potential for preventing future recurrences. In families with a strong history of pilonidal disease, considering additional elevation of the glabellar cushion through techniques like fat injection or filler may offer a promising preventive measure in the future.

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Declarations

Conflict of interest. D. Doll, H. Ernst, L.-P. Hall, M. Orth, M. Braun-Münker, and M. Maak declare that they have no competing interests. There are no relevant or minor financial relationships between relatives or next of kin and external companies.

The analysis performed in this study did not contain any interventions that could potentially cause harm to human participants. Nevertheless, ethical approval was given by the Ethics Committee of the County Ethics Chamber of the Saarland University Homburg/Saar 59/22 from 11 of July 2022 (chair: Prof. Dr. Grundmann) and by the Ethics Committee Hannover GRAE/151/2022 from 19 of August 2022 (head: Prof. Dr. Creutzig).

References

1. Mayo H (1833) Observations on injuries and diseases of the rectum. London: Burgess & Hill
2. Bosche F, Luedi MM, van der Zypen D, Moersdorf P, Krapohl B, Doll D (2018) The hair in the sinus: sharp-ended rootless head hair fragments can be found in large amounts in pilonidal sinus nests. World J Surg 42(2):567–573
3. Doll D, Bosche FD, Stauffer VK, Sinicina I, Hoffmann S, Van der Zypen D et al (2017) Strength of occipital hair as an explanation for pilonidal sinus disease caused by intruding hair. Dis Colon Rectum 60(9):979–986
4. Doll D, Bosche F, Hauser A, Moersdorf P, Sinicina I, Grunwald J et al (2018) The presence of occipital hair in the pilonidal sinus cavity—a triple approach to proof. IJCD 33(5):567–576

5. Bosche FD (2017) Physikalische und morphologische Haarcharakteristika von Pilonidalsinuspatienten und ihren Vergleichsprobanden. Dissertation, zur Erlangung des Grades eines Doktors der Medizin. Homburg / Saar: Universität des Saarlandes
6. Gosselink M, Ctercteko G. The role of hair in the pathogenesis of pilonidal disease. ESCP Teachings—Pilonidal Sinus [Internet]. 2017 2018; 12. Available from: https://www.escp.eu.com/news/focus-on/pilonidal-disease/1550-the-role-of-hair-in-the-pathogenesis-of-pilonidal-disease-martijn-gosselink-and-grahame-ctercteko.
7. Gosselink MP, Jenkins L, Toh JWT, Cvejic M, Kettle E, Boadle RA et al (2017) Scanning electron microscope imaging of pilonidal disease. Tech Coloproctol 21(11):905–906
8. Doll D, Wilhelm D, Ommer A, Albers K, Mordhorst H, Iesalnieks I et al (2019) Immediate cut hair translocation to the intergluteal fold in the hairdressers shop—another link to pilonidal sinus disease. Pilonidal Sinus J 5(1):23–32
9. Yildiz T, Elmas B, Yucak A, Turgut H, Ilce Z (2017) Risk Factors for Pilonidal Sinus Disease in Teenagers. Indian J Pediatr 84:134–138
10. Harlak A, Mentes O, Kilic S, Coskun K, Duman K, Yilmaz F (2010) Sacrococcygeal pilonidal disease: analysis of previously proposed risk factors. Clinics 65(2):125–131
11. Doll D, Luedi MM, Wieferich K, van der Zypen D, Maak M, Glanemann M (2015) Stop insulting the patient: neither incidence nor recurrence in pilonidal sinus disease is linked to personal hygiene. PSJ 1(1):11–19
12. Akinci OF, Kurt M, Terzi A, Atak I, Subasi IE, Akbilgic O (2009) Natal cleft deeper in patients with pilonidal sinus: implications for choice of surgical procedure. Dis Colon Rectum 52(5:1000–1002
13. Stauffer VK, Luedi M, Kauf P, Schmid M, Diekmann M, Wieferich K et al (2018) Common surgical procedures in pilonidal sinus disease: a meta-analysis, merged data analysis, and comprehensive study on recurrence. Sci Rep 8(1):1–28
14. Bascom J, Bascom T. Failed pilonidal surgery: new paradigm and new operation leading to cures. Arch Surg. 2002;137(10):1146–50; discussion 51.
15. Eryilmaz R, Şahin M, Alimoğlu O, Yildiz MK (2003) Predisposing factors in chronic pilonidal sinus development. Turkish. J Surg 19(1):49–53
16. Maak M, Moersdorf P, Bari L, Scharonow M, Orth M, Doll D (2024) A single-center prospective comparison of natal cleft depth of 200 patients with and without pilonidal sinus disease. In submission
17. Oetzmann von Sochaczewski C, Godeke J (2021) Pilonidal sinus disease on the rise: a one-third incidence increase in inpatients in 13 years with substantial regional variation in Germany. Int J Colorectal Dis 36(10):2135–2145
18. Luedi MM, Schober P, Stauffer VK, Diekmann M, Andereggen L, Doll D (2021) Gender-specific prevalence of pilonidal sinus disease over time: A systematic review and meta-analysis. ANZ J Surg 91(7–8:1582–1587
19. Luedi MM, Schober P, Stauffer VK, Diekmann M, Doll D (2020) Global Gender Differences in Pilonidal Sinus Disease: A Random-Effects Meta-Analysis. World J Surg 44(11):3702–3709
20. Dettmer M, Schumacher F, Matevossian E, Wilhelm D, Luedi M, Doll D (2021) Gender differences in axial hair strength may explain gender related incidence variation in Pilonidal Sinus patients. Pilonidal Sinus. Journal 7(1):11–20
21. Kaplan M, Ozcan O, Bilgic E, Kaplan ET, Kaplan T, Kaplan FC (2017) Distal scar-to-midline distance in pilonidal Limberg flap surgery is a recurrence promoting factor: A multicenter, case-control study. Am J Surg 214(5):811–819
22. Doll D, Brengelmann I, Schober P, Ommer A, Bosche F, Papalois AE et al (2021) Rethinking the causes of pilonidal sinus disease: a matched cohort study. Sci Rep 11(1):1–7
23. Doll D, Matevossian E, Wietelmann K, Evers T, Kriner M, Petersen S (2009) Family history of pilonidal sinus predisposes to earlier onset of disease and a 50 % long-term recurrence rate. Dis Colon Rectum 52(9):1610–1615
24. Karydakis GE (1992) Easy and successful treatment of pilonidal sinus after explanation of its causative process. ANZ J Surg 62(5):385–389
25. Dwight RW, Maloy JK (1953) Pilonidal sinus; experience with 449 cases. N Engl J Med 249(23:926–930
26. Obedman M, Vaticon D. Pilonidal sinus: a high-incidence disease among adolescents. etiology, hair, recurrence, incidence mdx3 increasee over time. 1993;6(1):21–36.
27. Balik O, Balik AA, Polat KY, Aydinli B, Kantarci M, Aliagaoglu C et al (2006) The importance of local subcutaneous fat thickness in pilonidal disease. Dis Colon Rectum 49(11):1755–1757
28. Page BH (1969) The entry of hair into a pilonidal sinus. Br J Surg 56(1):32

Zusammenfassung

Ein höheres glabelläres Weichteilkissen geht mit einer geringeren Inzidenz von Steißbeinfisteln einher. Eine 3-D-Analyse

Hintergrund: Es gibt immer mehr Hinweise darauf, dass okzipitale Haarfragmente mit der Entstehung der Steißbeinfistel („pilonidal sinus disease", PSD) in Verbindung gebracht werden. Anatomische Variationen in der Form des Rückenkamms zwischen Hinterhaupt und oberer Gesäßfalte können entscheidend für die Abwärtsbewegung der Haare in die Glabella-sacralis-Region sein.
Ziel: Ziel dieser Studie ist es, die Form und Höhe des Glabellakissens und dessen möglichen Einfluss auf die Entwicklung von PSD zu untersuchen.
Patienten und Methoden: Die Autoren haben eine Methode entwickelt, um die Form des thorakolumbalen Übergangs bis hinunter zur intraglutäalen Falte mithilfe eines 3-D-Scanners mit strukturiertem Licht zu erfassen. Die Oberflächenkontur der Weichteile dieser Region wurde vermessen. Es wurden Algorithmen entwickelt, um die Breite und Form des Kanals zwischen dem Erector trunci sowie die Höhe des Glabellakissens zu extrahieren. In die Untersuchung wurden 155 Personen einbezogen, 94 PSD-Patienten und 61 Nicht-PSD-Patienten.
Ergebnisse: Die Glabellahöhe unterscheidet sich signifikant zwischen der PSD- und der Nicht-PSD-Kohorte. Insgesamt war eine PSD mit einem Glabellakissen von 7,8 ± 3,7 mm assoziiert, während Nicht-PSD-Patienten ein Glabellakissen von 9,7 ± 3,8 mm aufwiesen ($p = 0{,}0021$). Bei männlichen PSD-Patienten betrug die Glabellahöhe 7,8 ± 3,7 mm (Mittelwert ± SD), während sie bei weiblichen PSD-Patienten 7,7 ± 3,6 mm betrug. Umgekehrt hatten männliche Nicht-PSD-Patienten eine Glabellakissenhöhe von 8,9 ± 2,7 mm und weibliche Nicht-PSD-Patienten eine Glabellakissenhöhe von 10,5 ± 4,4 mm.
Schlussfolgerung: Eine höhere Glabellaregion ist mit einer geringeren Inzidenz von Steißbeinfisteln assoziiert. Daher könnte eine Anhebung und Stärkung der Glabellaregion vorteilhaft sein, um ein Wiederauftreten zu verhindern.

Schlüsselwörter
Rezidiv · Lumbosakralregion · Body-Mass-Index · Behaarung · Chirurgische Lappen