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Authors

Henry, Alexander J
Holler, Jordan T
Lui, Jason
[et al.](#)

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Do patients with Peyronie's disease perceive penile curvature in adults and children differently than the general population?

Alexander J. Henry, MD¹, Jordan T. Holler, MD², Jason Lui, MD², Benjamin N. Breyer, MD, MAS², Matthew Ziegelmann, MD³, Tal Cohen, MD³, Ryan P. Smith, MD¹, Clinton Yeaman, MD¹, Andrew J. Winkelman, MD¹, Carlos Villanueva, MD⁴, Nora G. Kern, MD^{1,*}

¹Department of Urology, University of Virginia, Charlottesville, VA, 22908, United States

²Department of Urology and Department of Epidemiology and Biostatistics, University of California San Francisco, San Francisco, CA, 94143, United States

³Department of Urology, Mayo Clinic, Rochester, MN, 55905, United States

⁴Department of Urology, Phoenix Children's Hospital, Phoenix, AZ, 033302, United States

*Corresponding author: Department of Urology, University of Virginia, PO Box 800422, Charlottesville, VA 22908. Email: Ngl2z@uvahealth.org

Abstract

Background: As perception of penile curvature varies widely, we sought to understand how adults perceive curvature and how these opinions compare with those of patients with curvature, specifically Peyronie's disease (PD).

Aim: To investigate the perspectives of curvature correction from adults with and without PD, as well as differences within demographics.

Methods: A cross-sectional survey was administered to adult patients and nonpatient companions in general urology clinics at 3 institutions across the United States. Men, women, and nonbinary participants were recruited. Patients were grouped as having PD vs andrology conditions without PD vs general urology conditions plus companions. The survey consisted of unlabeled 2-dimensional images of penis models with varying degrees of curvature. Participants selected images that they would want surgically corrected for themselves and their children. Univariable and multivariable analyses were performed to identify demographic variables associated with willingness to correct.

Outcomes: Our main outcome was to detect differences in threshold to correct curvature between those with and without PD.

Results: Participants were grouped as follows: PD (n = 141), andrology (n = 132), and general (n = 302). Respectively, 12.8%, 18.9%, and 19.9% chose not to surgically correct any degree of curvature ($P = .17$). For those who chose surgical correction, the mean threshold for correction was 49.7°, 51.0°, and 51.0° ($P = .48$); for their children, the decision not to correct any degree of curvature was 21.3%, 25.4%, and 29.3% ($P = .34$), which was significantly higher than correction for themselves ($P < .001$). The mean threshold for their children's correction was 47.7°, 53.3°, and 49.4° for the PD, andrology, and general groups ($P = .53$), with thresholds no different vs themselves ($P = .93$). On multivariable analysis, no differences were seen in demographics within the PD and andrology groups. In the general group, participants aged 45 to 54 years and those who identified as LGBTQ (lesbian, gay, bisexual, transgender, queer) had a higher threshold for correction as compared with their counterparts when factoring other demographic variables (63.2° vs 48.8°, $P = .001$; 62.1° vs 50.4°, $P = .05$).

Clinical Implications: With changing times and viewpoints, this study stresses the importance of shared decision making and balancing risks and benefits to correction of penile curvature.

Strengths and Limitations: Strengths include the broad population surveyed. Limitations include the use of artificial models.

Conclusion: No significant differences were seen in the decision to surgically correct curvature between participants with and without PD, with participants being less likely to choose surgical correction for their children.

Keywords: Peyronie's; curvature; pediatric; threshold; surgery.

Introduction

Particularly for children in the United States, the field of genital surgery has been undergoing a culture shift over the last few decades. For example, the rates of circumcision and gender-affirming surgery for children with intersex conditions are decreasing.¹ While multiple factors likely play a role, a primary force in this trend is the growing idea that the individuals being operated on should be involved in the decision-making process, which is not possible for young children and infants. Penile curvature surgery is another example that falls into this category. The estimated incidence of congenital curvature is 0.6% to 10%.^{2–4} Parents and guardians may be unsure if, how, or when to proceed with correction and so look to the pediatric urologist for guidance and expert opinion. These decisions are complex, as exemplified by a study that

demonstrated a high level of adults' dissatisfaction with the function and aesthetics of their hypospadias repairs performed as children.⁵

Penile curvature is not just a condition treated by pediatric urologists. Congenital penile curvature may present in childhood, adolescence, or adulthood after onset of pubertal erections. In contrast to congenital curvature, Peyronie's disease (PD) is a wound-healing disorder characterized variably by penile pain, shortening or size change, and acquired/secondary-onset penile curvature.⁶ The PD prevalence in adult men in the United States is estimated at 0.5% to 9% based on study methodology.^{7,8} Treatment is typically initiated by symptom severity—specifically, the degree of curvature or its effect on sexual function.⁶ Historically, curvature $>30^\circ$ has been used to describe moderate severity

in adult patients and has served as a threshold for pursuing intervention.⁹ This threshold for intervention has been the recommendation for pediatric urologists, as demonstrated in a recent survey to the Societies for Pediatric Urology where the average threshold for surgical correction of curvature was 30°. ¹⁰ This has been found in other pediatric urology studies.^{2,3} From a clinical standpoint, the degree of curvature that has a meaningful impact on psychological well-being and/or sexual function (ie, intercourse) is highly variable. In our experience anecdotally, some couples are able to successfully engage in penetrative sexual intercourse in the face of $\geq 60^\circ$ penile curvature, and some patients are psychologically devastated by new-onset curvature $\leq 10^\circ$.

While it is easier to make recommendations when sexual function is impaired, it is more difficult to make these recommendations theoretically for prepubertal children and infants. Outside of functional concerns, aesthetics plays a role in surgical management, and the line between function and cosmesis can get blurry when making this decision for a minor. We sought to determine how modern-day adults perceive penile curvature and the need for surgical intervention in themselves or their children. Our primary study aim was to compare the perspectives of patients with and without PD. Our secondary aim was to investigate demographic differences based on the perceived need for intervention. We hypothesized that, generally, adults will have a higher threshold for surgical correction of curvature than the historical 30° benchmark, while patients with PD will have a lower threshold, closer to the 30° benchmark.

Methods

We convened a multi-institutional group of investigators with expertise in adult sexual dysfunction or pediatric urology. For this cross-sectional study, all institutions obtained institutional review board approval with data use agreements among them. To understand the adult population's perspectives, all participants were recruited in adult urology clinics at 3 geographically spaced institutions in the United States. Recruitment took place between August 2020 and October 2022. Three specific populations were surveyed for the current project. The first population was those adult patients (>18 years of age) undergoing evaluation or treatment for PD. The second was adult patients presenting for other andrology/sexual health concerns (erectile dysfunction, ejaculatory dysfunction, hypogonadism/low libido). The third was adult patients and their nonpatient partners/caretakers entering a general urology clinic waiting room. This included patients identifying as men, women, and/or gender nonbinary. Informed consent was obtained, as regulated by the institutional review board office.

Patients who agreed to participate were asked to complete a survey. Basic demographic information was obtained: age, gender, relationship status, region of origin, sexual orientation, and health care occupation status. Reason for the urologic visit was not obtained for general patients. The survey also included multiple unlabeled 2-dimensional images of penis models with varying degrees of arc-type penile curvature (range, 10°-90°) (Appendix 1). Respondents were asked to identify/select any, all, or none of the images that they would want surgically corrected for themselves or their partners, assuming that surgery had minimal risks but included a low risk of erectile function and penile shortening. Respondents

were then asked to complete the same survey under the assumption that the surgical correction was for their children or presumed children. For our primary aim, an average threshold for correction was assessed by the selected images. This threshold was compared among 3 groups: those with PD, those with andrology/sexual health concerns other than PD (andrology), and those with general urologic conditions or their companions (general).

Incomplete surveys were excluded. Data were reported as mean (SD) based on parametric distribution. A *t*-test was used for comparison of means and a chi-square test for comparison of categorical variables. For a secondary outcome, univariable and multivariable analyses were performed to identify demographic variables associated with willingness to consider correction. Variables in the multivariable analysis were gender, age, relationship status, sexual orientation, and health care employment status, and modeling was performed via forward selection. To assess the opinion of participants with and without PD, these tests were rerun comparing the PD group with the andrology and general groups combined. All demographic information other than region was included in the logistic regression models. All statistical tests were performed with SAS (version 9.4 TS 1 M6; SAS Institute). Significance was defined as $P < .05$.

Results

Demographics

Participants were grouped as follows: PD ($n = 141$), andrology ($n = 132$), and general ($n = 302$). Region of origin was similar among the groups, with the most common regions being the Mid-Atlantic, North Central, and West for all 3 groups, corresponding to the locations of the 3 recruiting institutions (Table 1). Participants in all groups primarily identified as men, with 99% in the PD group, 95% in the andrology group, and 64% in the general group. Most participants were ≥ 55 years old (73% in the PD group, 58% in the andrology group, and 58% in the general group). Most participants were married (74%, 65%, and 64%, respectively). Eight percent of the PD group, 9% of the andrology group, and 7% of the general group reported being LGBTQ (lesbian, gay, bisexual, transgender, queer). Finally, 90% of the PD group, 87% of the andrology group, and 80% of the general group did not work in health care.

Surgical correction preferences

With respect to one's own penis (or partner's), 12.8% of the PD group, 18.9% of the andrology group, and 19.9% of the general group chose not to surgically correct any degree of curvature, with no differences seen among groups ($P = .17$). Also, no significant differences were found in the threshold to correct among the 3 groups. For those who chose to surgically correct, the mean threshold for correction was 49.7°, 51.0°, and 51.0° for PD, andrology, and general, respectively ($P = .48$; Table 2).

Overall 21.3% of the PD group, 25.4% of the andrology group, and 29.3% of the general group chose not to correct any degree of curvature for their children ($P = .34$). Participants were significantly more likely to forego any curvature correction for their children as compared with their own penises ($P < .001$). Participants' mean threshold for correction of their children's penile curvature was 47.7°, 53.3°, and 49.4° for PD, andrology, and general, respectively ($P = .53$;

Table 1. Demographics of adult population.

	Participants, No. (%)		
	PD	Andrology	General
Region			
Northeast	6 (4)	6 (5)	30 (10)
Mid-Atlantic	33 (23)	34 (26)	46 (15)
Southeast	9 (6)	12 (9)	26 (9)
South Central	4 (3)	3 (2)	7 (2)
North Central	33 (23)	26 (20)	86 (29)
West	53 (38)	48 (36)	95 (31)
Outside USA/other	2 (1)	3 (1)	9 (3)
Gender			
Other than man	2 (1)	7 (5)	109 (36)
Man	139 (99)	125 (95)	193 (64)
Age, y			
18-24	4 (3)	2 (2)	10 (3)
25-34	3 (2)	19 (14)	42 (14)
35-44	7 (6)	20 (15)	37 (12)
45-54	20 (16)	11 (8)	36 (12)
55-64	49 (40)	32 (24)	75 (25)
≥65	40 (33)	48 (36)	101 (33)
Relationship status			
Single	14 (10)	19 (14)	57 (19)
In a relationship	20 (14)	17 (13)	29 (10)
Married	105 (74)	86 (65)	193 (64)
Divorced	2 (2)	10 (8)	20 (7)
Sexual orientation			
Heterosexual	130 (92)	120 (91)	280 (93)
LGBTQ	9 (8)	12 (9)	22 (7)
Works in health care			
No	126 (90)	115 (87)	242 (80)
Yes	15 (10)	17 (13)	60 (19)

Abbreviation: LGBTQ, lesbian, gay, bisexual, transgender, queer; PD, Peyronie's disease.

Table 2. Mean degree of penile curvature correction for self and child.

Penile curvature correction	Degree of correction, mean (SD)
For self	
PD	49.7 (17.8)
Andrology	51.0 (15.7)
General	51.0 (19.8)
For child	
PD	47.7 (15.0)
Andrology	53.3 (17.4)
General	49.3 (20.8)

Abbreviation: PD, Peyronie's disease.

Table 2). There was no significant difference in mean degree of correction for child vs self ($P = .93$).

Between patients with PD and without (andrology plus general), there was no significant difference in the minimum degree of threshold for curvature correction ($P = .48$). There was also no significant difference in the likelihood of foregoing surgical correction between participants with and without PD ($P = .06$).

Impact of demographics on correction preferences

Within the PD group, none of the demographic factors had a significant impact on willingness to correct penile curvature (Table 3). In the andrology group, participants aged 25 to 34 years had a higher threshold for penile curvature correction as compared with other age groups on univariable analysis (60.0° vs 50.3° , $P = .03$), although this was not significant on multivariable analysis. The general group demonstrated a

significant difference in willingness to undergo penile curvature correction on univariable analysis based on age groups and sexual orientation (Table 3). Participants aged 45 to 54 years had a higher threshold for penile curvature correction when compared with other age groups (63.2° vs 48.8° , $P = .0002$), while those aged ≥ 65 years had a lower threshold (47.1° , $P = .04$). Those who identified as LGBTQ also had a higher threshold for correction than those identifying as heterosexual (62.1° vs 50.4° , $P = .03$). Ages 45 to 54 years and sexual orientation differences remained statistically significant predictors on multivariable analysis when accounting for demographic factors ($P = .001$ and $P = .05$, respectively).

Discussion

The intent of our study was to understand thresholds for pursuing correction of penile curvature in the modern era in the United States. Our study demonstrated that, while 30° has been a classic threshold for intervention of penile curvature, the average threshold for our entire cohort was 50° . This was true for patients with and without PD or other types of sexual dysfunction. Demographics did not seem to change decision making for patients in the PD or andrology group, but a higher threshold was seen for those aged 45 to 54 years and LGBTQ participants in the general group. Interestingly, survey respondents reported a similar threshold for correction of penile curvature in children but were less likely to report a willingness to consider surgical intervention altogether. Specifically, $>20\%$ of respondents did not choose surgical correction for curvature in their children regardless of curve severity.

In the absence of a personal history of penile curvature, survey respondents from the andrology and general cohorts in our study were in essence giving their opinions based on aesthetics and anticipated/perceived functional limitations. We expected that surveying a population with actual curvature would afford a better understanding of the actual influence of varying degrees of curvature on penile function. It was interesting that, contrary to our speculations, we found that patients with PD have similar opinions on correction as those without a history of curvature. Undoubtedly, there is a certain degree of curvature that causes impairment to sexual function and emotional distress for adult men. Smith et al reported that 81% of patients with PD have emotional difficulties and 54% experience relationship distress as a result of the condition.¹¹ The threshold of curvature that causes impairment likely varies for each individual, and directionality/plaque location also may play a role.¹² Walsh et al noted that despite including demographic, medical, and sexual function variables, the only predictor of sexual disability in patients with PD was penile curvature $>60^\circ$. Curvature between 30° and 60° was not a significant variable, even on univariable modeling.¹³ Alternatively, Menon et al reported that men with self-reported penile curvature had more difficulty with intercourse due to their curvature, more unhealthy mental days, and increased dissatisfaction with penile self-perception when compared with those without reported curvature; this held true even for the mildest of curvature cases, at 20° .¹⁴ Here, we found that 50° was closer to the threshold for when patients with PD would consider surgical correction. We surveyed patients without PD (andrology group) separately given the presumption that they would also have a unique perspective vs the general population; however, again, no differences were seen.

Table 3. Demographics and univariable analysis for all groups.

Group	Minimum degree of correction, mean (95% CI)	<i>P</i> value ^a
PD		
Gender		.18
Other than man	35 (−28.5, 98.5)	
Man	49.9 (47.1, 52.7)	
Age, y		
18-24	45.0 (24.4, 65.5)	.54
25-34	60.0 (35.1, 84.8)	.25
35-44	48.6 (31.3, 65.8)	.85
45-54	47.5 (40.2, 54.8)	.50
55-64	51.6 (47.6, 55.7)	.26
≥65	48.3 (42.6, 53.9)	.48
Relationship status		.77
Single	35.6 (21.6, 49.5)	
In a relationship	47.7 (42.2, 53.3)	
Married	51.6 (48.4, 54.8)	
Divorced	40.0 (−87.1, 167)	
Sexual orientation		.23
Heterosexual	50.2 (47.4, 52.9)	
LGBTQ	44 (28.8, 59.2)	
Works in health care		.33
No	49.2 (46.1, 52.2)	
Yes	53.3 (45.9, 60.8)	
Andrology		
Gender		.47
Other than man	55.7 (38.1, 73.3)	
Man	50.7 (47.2, 54.2)	
Age, y		
18-24	30 (−224.1, 284.1)	.09
25-34	60.0 (52.7, 67.3)	.03
35-44	55.9 (47.9, 63.8)	.22
45-54	51.1 (32.5, 69.7)	.98
55-64	48.3 (42.2, 54.4)	.33
≥65	47.9 (41.4, 54.4)	.22
Relationship status		.63
Single	53.8 (43.5, 64.2)	
In a relationship	52.8 (45.9, 59.8)	
Married	51.4 (47.2, 55.5)	
Divorced	38.6 (13.3, 63.9)	
Sexual orientation		.85
Heterosexual	50.9 (47.4, 54.5)	
LGBTQ	52.0 (37.7, 66.2)	
Works in health care		.58
No	51.4 (47.7, 55.0)	
Yes	48.5 (36.9, 60.0)	
General		
Gender		.93
Other than man	51.2 (46.7, 55.6)	
Man	50.9 (47.9, 54.0)	
Age, y		
18-24	54.4 (36.4, 72.5)	.60
25-34	49.7 (43.7, 55.7)	.67
35-44	52.7 (45.5, 59.9)	.59
45-54	63.2 (56.7, 69.7)	.0002
55-64	48.8 (44.0, 53.6)	.32
≥65	47.1 (42.4, 51.9)	.04
Relationship status		.88
Single	56.9 (50.9, 62.8)	
In a relationship	60 (51.6, 68.4)	
Married	49.1 (46.1, 52.0)	
Divorced	41.9 (28.6, 55.1)	
Sexual orientation		.03
Heterosexual	50.4 (47.8, 52.9)	
LGBTQ	62.1 (49.7, 74.6)	
Works in health care		.91
No	51.0 (48.1, 53.8)	
Yes	51.3 (46.0, 56.6)	

Abbreviations: LGBTQ, lesbian, gay, bisexual, transgender, queer; PD, Peyronie's disease. ^aBold indicates *P* < .05.

We did see some trends such that participants in the general group who identified as LGBTQ had a higher threshold for correction, around 60°, as did the participants aged 45 to 54 years. These findings are noteworthy, but the underlying reasons for these differences are unclear.

There has been a shift in the way that urologists approach elective surgery involving genitalia, especially for nonconsenting minors. One of the greatest challenges for a pediatric urologist is to make sound recommendations to parents in settings where future outcomes with observation alone are unclear. Penile curvature with functional implications falls in this category, as pediatric providers likely will never know if sexual impairment occurs as patients enter adulthood. With this in mind, the impetus for this study was, in part, based on speculation that patient- and parent-perceived bother with penile curvature is not as significant as that perceived by the treating surgeon.

In a recent survey to pediatric urologists, the median degree that urologists would recommend surgical correction for curvature was 30°. When this same group of surveyed urologists was shown the exact penis models as those used in our survey herein, only 24% reported that they would correct the 30° modeled penis. In contrast, for the 50° modeled penis, 77% of providers recommended surgical correction. Thus, the responding pediatric urologists underestimated curvature severity on the arc-type curvature models.¹⁰ This study highlights that these pediatric urologists actually have views similar to those of the participants in our survey, where the average threshold for curvature correction was roughly 50° as well. Studies have revealed that clinicians and patients alike can over- and underestimate penile curvature. Liguori et al found that 42% of patients with congenital penile curvature underestimated their curvature.¹⁵ In the adult urology realm, these findings emphasize the utility of performing an objective curvature assessment of the erect penis prior to invasive treatment⁶; for pediatric cases, erection testing typically occurs at the time of surgical repair. Hence, the importance of accurate curvature assessment cannot be more emphasized, as it aids in counseling. One other important finding from our study was that for all groups, although the threshold to correct was similar between adult and child, the rate of nonsurgery was uniformly higher for children. This finding may also influence counseling that a pediatric urologist provides to parents of children with penile curvature.

There are limitations to our study. First, we simplified the clinical scenario tremendously to achieve our intended goal of understanding adults' perspectives of penile curvature strictly from an aesthetic standpoint. We did not provide detailed information on the risks/benefits of surgery or other therapeutic options and did not inquire about comorbidities, sexual function, insurance or education status, financial considerations, and so on. We recognize that the decision to pursue surgical correction of penile curvature is much more complex for patients with PD and should factor in the aforementioned. We admit that gathering religious or societal beliefs may have been helpful for the intent of our study, but this information was not obtained. In regard to the models, for the current study we used 2-dimensional models of crescent or arc-type curvatures (banana like) instead of hinge-type curvatures (where 2 straight segments are angled at a hinge). This was purposeful, as our intention was to simulate congenital penile curvature, which tends to be more broad based as opposed to PD curvature, which may occur at a more

abrupt angle (sometimes referred to as “hinge type”).¹⁶ It is possible that the higher threshold to operate could be related to arc-type curvatures, which may be perceived as milder than hinge-type curves.

Next, we recognize that by showing various images of penis models, we are asking the participants without PD to make decisions based on perceived functional limitations or aesthetics alone, whereas the decision to proceed with surgical management in someone with actual PD is based on objective experience. We hoped that by including patients with PD, they would have a better perspective on the functional impacts of the condition and show a similar vantage point using the penis models. We also simplified the scenario by using 2-dimensional penis models, which are not the most realistic when compared with a real penis with curvature. Future work could focus on using 3-dimensional photography or actual models of the erect penis.¹⁷ This would allow us to consider other aspects of penile deformity (eg, indentation/hourglass) that may influence the decision to pursue invasive treatments.

Ideally, our aim was to solicit participation from people in the public, but due to regulatory constraints, our best compromise was to solicit anyone who walked in the urology clinic space. We included companions of the urologic patients; however, we did not collect information on medical conditions, so we do not know which participant was a patient vs a companion. Although patients without a penis will never experience penile curvature, we felt that it was important to consider their views, given that they may be partners with someone with curvature and thus have their own perspectives on the functional issues (eg, pain with intercourse) and aesthetics of penile curvature. Interestingly, we did note that patients identifying as women or nonbinary had views on curvature that were similar to those identifying as men. Furthermore, recruitment was achieved at 3 institutions (West Coast, Midwest, and East Coast) in an attempt to capture a representative cohort across the United States. We recognize that the results may be skewed by this and could be improved with increasing institution recruitment at other parts of the country. Finally, we recognize that the results of this study may be applicable to only an American population and not elsewhere due to societal views.

Despite these limitations, we feel that the results are overall generalizable. In a compelling article entitled “Cosmetic or Aesthetic?” Brown writes, “Beauty is in the eye of the beholder, and that eye is very much dictated by what it has previously been exposed to.”¹⁸ Whereas 30° may have been the threshold for moderate disease 40 years ago,⁹ this may not be the threshold in the current era, especially when decisions are being made for infants and nonconsenting children. The findings emphasize the importance of shared decision making and expert counseling when dealing with patients who present with penile curvature. With no clear benchmark in degree of curvature driving selection for correction, physicians need to have a thorough understanding of the functional impact of curvature, as well as an empathetic ear to best guide patients toward a satisfactory treatment plan.

Conclusion

No significant differences were seen in the decision to surgically correct penile curvature when comparing the perspectives of participants with PD, those with various other andrology/sexual health concerns, and a cohort of patients

seen in a general urology clinic for nonsexual dysfunction conditions. The overall average threshold for correction was 51°, which is higher than the historical perceived degree of threshold reported by pediatric urologists. Survey participants were less likely to consider surgical correction for penile curvature for their children while maintaining similar thresholds for correction. With our changing times and viewpoints, this study stresses the importance of shared decision making and balancing risks and benefits to correction of penile curvature.

Author contributions

A.J.H.: data curation, writing—original draft, writing—review and editing. J.T.H.: data curation. J.L.: data curation. B.N.B.: data curation, resources, writing—review and editing. M.Z.: data curation, resources, writing—review and editing. T.C.: data curation. R.P.S.: data curation, resources, writing—review and editing. C.Y.: formal analysis, writing—review and editing. A.J.W.: data curation. C.V.: data curation, resources, writing—review and editing. N.G.K.: conceptualization, data curation, investigation, methodology, project administration, resources, supervision, validation, visualization, writing—original draft, writing—review and editing.

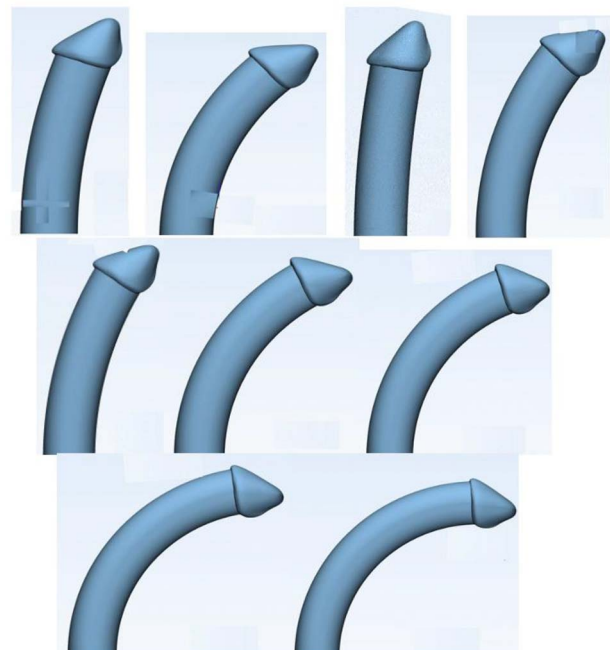
Supplementary material

Supplementary material is available at *The Journal of Sexual Medicine* online.

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Conflicts of interest: None.



Appendix 1. Degrees of penile curvature from top to bottom, left to right (not included in the administered survey): 20°, 50°, 10°, 40°, 30°, 60°, 70°, 80°, 90°.

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