

Appendix 5

Online supplementary evidence for section 9 Penile size abnormalities and dysmorphophobia

Table S9.1: Summary of papers reporting objective penile measurements

Authors	Year	Patients, n	Age, years	Flaccid length, cm	Stretched length, cm	Erect length, cm	Flaccid circumference, cm	Erect circumference, cm,
Loeb [1]	1899	50; Caucasian	(17 – 35)	9.41	NA	NA	NA	NA
Ajmani et al. [2]	1985	320; African - Nigeria	(17-23)	8.19 ±0.94	NA	NA	8.83 ±0.02	NA
Schonfeld et al. [3]	1942	54; Caucasian - USA	(20 – 25)	NA	13.02	NA	NA	NA
Kinsey et al. [4]	1948	2770; Caucasian	(20 – 59)	9.7	16.74	NA	NA	NA
Bondil et al. [5]	1992	905; Caucasian - France	53.18 ±18.19	10.74 ±1.84	16.74 ±2.29	NA	NA	NA
Richters et al. [6]	1995	156; Caucasian - Australia	NA	NA	NA	15.99	NA	NA
Wessels et al. [7]	1996	80; Caucasian - USA	54 ±14.37	8.85 ±2.38	12.45 ±2.71	12.89 ±2.91	9.71 ±1.71	12.30 ±1.31
Smith et al. [8]	1998	184; Caucasian - Australia	NA	NA	NA	15.71 ±2.31	NA	NA
Bogaert et al. [9]	1999	3417; Caucasian - USA	30.45 ±11.27	9.83 ±1.80	NA	15.60 ±1.88	NA	NA
Ponchietti et al. [10]	2001	3300; Caucasian - Italy	(17 - 19)	9 (5-12)	12.5 (8 - 16.5)	NA	10 ±0.75	NA
Schneider et al. [11]	2001	111; Caucasian - Germany	18.24 ±0.43	8.60 ±1.50	NA	14.48 ±1.99	NA	NA
Spyropoulos et al. [12]	2002	52;	25.9 ±4.4	7.76 ±1.3	12.18 ±1.7	NA	8.68 ±1.12	NA

		Caucasian - Greece						
Awwad et al. [13]	2005	271; Arab - Jordan	44.6 ±16.3	9.3 ±1.9	13.5 ±2.3	NA	8.9 ±1.5	NA
Mehraban et al. [14]	2007	1500; Arab - Iran	29.61 ±5.50	NA	11.58 ±1.45	NA	8.66 ±1.01	NA
Promodu et al. [15]	2007	301; Indian	31.58 ±6.38	8.21 ±1.44	10.88 ±1.42	12.93 ±1.63	9.14 ±1.02	11.49 ±1.04
Aslan et al. [16]	2011	1132; Arab - Turkish	20.3 ±0.9	9.3 ±1.3	13.7 ±1.6	NA	NA	NA
Choi et al. [17]	2011	144; oriental – Korea	57.3 ±16.5	7.7 ±1.7	11.7 ±1.9	NA	NA	NA
Shalaby et al. [18]	2014	2000; African - Egypt	31.6 ± 4.2	NA	13.84 ±1.35	NA	NA	NA
Veale et al. [19]	2014	15521; Caucasian - UK	NA	9.16 ±1.57	13.24 ±1.89	13.12 ±1.66	9.31 ±0.90	11.66 ±1.10
Habous et al. [20]	2015	778; Arab - Saudi Arabia	43.7 (20–82)	NA	NA	14.34 ±1.86	NA	11.50 ±1.74
Hussein et al. [21]	2017	223; Arab - Iraq	41.3 ±15	9.8 ±2.0	12.6 ±1.9	NA	NA	NA
Alves Barboza et al. [22]	2018	Tot 627 - Brazil African 167; Caucasian 283	53.6 ±15 53.8 ±13.8 53.7 ±15.5	NA NA NA	NA 16.5 ±1.7 15.8 ±1.6	NA NA NA	NA NA NA	NA NA NA
Di Mauro et al. [23]	2021	4685; Caucasian - Italy	19 ±6.2	9.47 ±2.69	16.78 ±2.55	NA	9.59 ±3.08	12.03 ±3.82
Nguyen Hoai et al. [24]	2021	14597; Asian - Vietnam	33.1 ±10.7	9.03 (5.10- 13.20)	14.67 (8.30- 19.90)	NA	8.39 (5.34- 11.3)	NA
Takure [25]	2021	271; African - Nigeria	57.3 ±16.4	10.3 ±2.4	13.7 ±2.5	NA	NA	NA

Sole et al. [26]	2022	800; Caucasian - Argentina	54.2 ±17.6	11.4 ±2	15.2 ±2.2	NA	10.1 ±1.3	NA
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Measurements are expressed as median/mean, (IQR)/±SD

Table S9.2: Summary of studies reporting clinical characteristics of patients with AABP

Study	Year	n	Age, yr	BMI	DM (%)	HT (%)	Smoking habits (%)	History of penile cancer (%)	History of LS (%)	Underlying issues requiring surgery (%)
Ngaage et al. [27]	2021	15	53 ±15.7	37.4 ±4.3	7 (54%)	NR	0	6 (46%)	NR	Urinary or sexual difficulties 9 (60.0%)
Kara et al. [28]	2021	13	22.4 ±4.8	26 ±6.2	7%	7%	NR	0	NR	Cosmetic issues 13 (100%), self-esteem/psychological well-being 13 (100%), urinary or sexual difficulties 13 (100%)
Zhang et al. [29]	2020	26	33 ±5.7	29 ±5.4	NR	NR	NR	NA	NR	-
Monn et al. [30]	2020	67	54.76 ±12.7	40.4 ±6.7	20 (47.6%)	NR	NR	NA	NR	Urinary difficulties 50 (74.6%), pain 21(31.3%), sexual difficulties 52 (77.6%)
Gao et al. [31]	2020	32	32.5 (26-38)	-	NR	NR	NR	NR	NR	Cosmetic issues 32 (100%)
Erpelding et al. [32]	2019	16	54 (44-62)	47.7 (25.5-53.3)	9 (56%)	NR	4 (25%)	NR	2 (12.5%)	-

Hesse et al. [33]	2019	27	56 ±15	49 ±14	12 (44%)	16 (59%)	NR	NR	NR	Pain 12 (44%), sexual difficulties 8 (30%), difficulty in ambulating 9 (33%)
Zhang et al. [34]	2019	15	33.2 ±4.6	28.9 ±5.3	NR	NR	NR	0	NR	-
Monn et al. [35]	2019	13	43.4 ±15.3	42.0 ±7.3	6 (46.2%)	NR	4 (30.8%)	NR	NR	-
Aube et al. [36]	2019	24	61.5 (54–67)	38.1 (33.6 – 43.7)	NR	NR	13 (54.2%)	NR	17 (70.8%)	Personal hygiene 19 (79.2%), urinary difficulties 14 (58.3%), sexual difficulties 19 (79.2%)
Cocci et al. [37]	2019	47	51.8 ±18.4	30 ±2.3	16 (34%)	18 (38.29%)	NR	NR	10 (10.63%)	Sexual difficulties 13 (27.66%), urinary difficulties 13 (27.66%), combination of urinary and sexual difficulties 12 (25.54%)
Pariser et al. [38]	2018	64	53 (42-63)	45 (38-53)	32 (50%)	NR	16 (25%)	0	NR	-
Theisen et al. [39]	2018	16	48.5	44.7	9 (56%)	9 (56%)	NR	NR	12 (78%)	-
Fuller et al. [40]	2017	12	-	45.4 ±13.8	NR	NR	NR	NR	NR	-

Voznensky et al. [41]	2017	14	50 ±10.5	55 ±13.7	NR	NR	NR	NR	NR	-
Hampson et al. [42]	2017	42	-	-	48%	67%	NR	1	33%	Personal hygiene (67%); urinary or sexual difficulties (52%)
Ghanem et al. [43]	2017	10	29.4 ±6.1	26.5 ±3.7	NR	NR	NR	NR	NR	-
Tausch et al. [44]	2016	56	-	39 (22-63)	NR	NR	NR	NR	NR	-
Westerman et al. [45]	2015	15	51 (26-75)	42.6 (29.8-53.9)	8 (53.3%)	NR	NR	0	13 (87%)	Cosmetic issues 11 (100%), urinary difficulties 6 (40%), sexual difficulties 3 (20%)
Rybak et al. [46]	2014	11	54.2 ±44.7	49.2 (42.4-64.5)	NR	NR	NR	0	0	-
Shaeer et al. [47]	2009	64	(22-54)	-	NR	NR	NR	0	0	Cosmetic issues 64 (100%)

Measurements are expressed as median/mean, (IQR)/±SD.

BMI = body mass index; DM = diabetes mellitus; HT = hypertension; LS = lichen sclerosis.

Table S9.3: Surgical interventions to manage adult acquired buried penis [48]

Study	Year	n	Type of intervention (%)	Classification of intervention* (%)
Ngaage et al. [27]	2021	15	3 (20%) abdominoplasty, 5 (33%) panniculectomy, 11 (73%) monsplasty, 3 (20) shaft reconstruction with scrotal flap, 7 (47%) STSG	7 category II, 5 category IV, 3 category V

Kara et al. [28]	2021	13	13 (100%) circumcision, penile liberation and STSG	13 category II
Zhang et al. [29]	2020	26	26 (100%) suprapubic liposuction and a modified Devine's technique.	26 category IV
Monn et al. [30]	2020	67	53 (79.1%) STSG, 19 (28.4%) ligament fixation, 38 (56.7%) pubic lipectomy, 10 (14.9%) pubic liposuction, 17 (25.4%) abdominal panniculectomy, 16 (23.9%) urethroplasty	-
Gao et al. [31]	2020	32	32 (100%) suprapubic liposuction, suspensory ligament release and preputioplasty.	32 category IV
Aube et al. [36]	2019	24	17 (70.8%) STSG, 17 (70.8%) penopubic ligament fixation, 17 (70.8%) pubic lipectomy, 9 (37.5%) abdominal panniculectomy, 3 (12.5%) pubic liposuction	-
Cocci et al. [37]	2019	47	(27.66%) circumcision, (19.14%) scrotoplasty, (4.25%) V-Y plasty of the pre-pubic region, (12.76%) thin STSG, (36.17%) thick STSG, (57.44%) suprapubic fat pad excision, (25.53%) abdominoplasty, (36.17%) division of suspensory ligament	-
Erpelding et al. [32]	2019	16	2 (12.5%) penile liberation and STSG, 1 (6.2%) penile liberation, STSG, eschutcheonectomy and urethroplasty, 1 (6.2%) penile liberation, STSG and urethroplasty, 4 (25%) penile liberation, STSG, eschutcheonectomy and urethroplasty, 4 (25%) penile liberation, STSG, eschutcheonectomy and scrotoplasty, 4 (25%) penile liberation, STSG, eschutcheonectomy.	4 category II, 12 category IV
Hesse et al. [33]	2019	27	27 (100%) Penile liberation, STSG, panniculectomy, abdominoplasty and monsoplasty	-
Zhang et al. [34]	2019	15	15 (100%) suprapubic liposuction, penile suspensory ligament release and insertion of folded acellular dermal matrix between corpora cavernosa and pubis symphysis	15 category IV

Monn et al. [35]	2019	13	6 (46.2%) penile liberation, full thickness graft to the penis using the escutcheon tissue as a graft source, 7 (53.8%) penile liberation, panniculectomy, full thickness graft to the penis using the escutcheon tissue as a graft source	6 category IV, 7 category V
Pariser et al. [38]	2018	64	3 (5%) penile unburying with local skin flap, 17 (27%) skin graft to the shaft, 7 (11%) scrotal surgery (scrotoectomy or scrotoplasty), 33 (52%) escutcheonectomy, 4 (6%) abdominal panniculectomy.	3 category I, 17 category II, 7 category III, 33 category IV, 4 category V
Theisen et al. [39]	2018	16	16 (100%) escutcheonectomy, scrotoectomy, and penile split- thickness skin graft.	16 category IV
Fuller et al. [40]	2017	12	12 (100%) escutcheonectomy, scrotoplasty and penile STSG.	12 category IV
Voznesensky et al. [41]	2017	12	11 (92%) debridement of penile skin and STSG to penis, 12 (100%) escutcheonectomy, 10 (83%) abdominoplasty, 7 (59%) scrotoplasty, 12 (100%) securing the supra-penile dermis to the pubic dermal or periosteal tissue	12 category IV/V
Hampson et al. [42]	2017	42	42 (100%) limited suprapubic panniculectomy, radical excision of penile shaft skin and reconstruction with STSG and scrotoplasty if needed	42 category IV
Ghanem et al. [43]	2017	10	10 suprapubic liposuction	10 category IV
Tausch et al. [44]	2016	56	25 (45%) phalloplasty with or without a scrotal flap (if significant abdominal component panniculectomy to remove the excess suprapubic fat), 12 (21%) penile shaft reconstruction with STSG, 19 (34%) penile shaft reconstruction with STSG following excision of the involved tissues with any necessary adjunctive procedures.	-
Westerman et al. [45]	2015	15	15 (100%) phalloplasty with ventral slit scrotal flap	15 category II
Rybak et al. [46]	2014	11	11 (100%) penile release, 10 (90.9%) STSG	1 category I, 10 category II

Shaeer et al. [47]	2009	64	64 (100%) adhesiolysis, suprapubic and lateral lipectomy, anchoring the penoscrotal and penopubic junctions, and skin coverage by a local flap.	64 category IV
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Table S9.4: Surgical and functional outcomes of adult acquired buried penis repair [48]

Study	Year	Overall post-operative complications	Recurrence of burying	Sexual outcomes	Urinary outcomes	Cosmetic outcomes
Ngaage et al. [27]	2021	6 (44%)	2 (13%)	Spontaneous erections in 5 (83%)	7 (78%) voiding in standing position	-
Kara et al. [28]	2021	4 (30%)	-	Increase in IIEF & SSS	-	All patients were pleased with cosmetic outcome
Zhang et al. [29]	2020	21 (80.8%)	-	-	-	Most patients had positive feedback toward their result of the operation, with the mean grade of 4.5±0.7. 17 patients (65%) who were very satisfied with the outcome. Six patients (23%) were satisfied with the outcome. Three patients (12%) were neither satisfied nor dissatisfied with the outcome. None of the patients were dissatisfied nor very dissatisfied with the outcome
Monn et al. [30]	2020	24 (57.1%)	-	33 (49.3%) patients with erection post-operatively	-	Satisfied 25 (37.3%); unsatisfied 9 (13.4%); neutral 33 (49.3%)
Gao et al. [31]	2020	-	-	Increase in IIEF	-	-

Aube et al. [36]	2019	15 (62.5%)	-	Good postoperative erection	-	Patients' satisfaction in case of a successful procedure was: 16 patients (76.2%) satisfied of the procedure, 5 patients (23.8%) neutral/not responding and no patients (0%) dissatisfied
Erpelding et al. [32]	2019	3 (18.7%)	-	-	-	-
Hesse et al. [33]	2019	15 (55.5%)	-	-	-	Nearly all patients (96%) reported early satisfaction with the procedure
Zhang et al. [34]	2019	11 (73.3%)	-	No difficulty in sexual intercourses	None of patients reported difficulty in urination	10 patients (66.7%) were very satisfied with the outcome, 4 patients (26.6%) were satisfied with the outcome, 1 patient (6.7%) was neither satisfied nor dissatisfied with the outcome, and no patient was dissatisfied with the appearance and function

Cocci et al.[37]	2019	7 (14.9%)	-	Increase in IIEF of 3 points, vaginal penetration became possible in 97.87% of patients, erectile function improved in 42.55%, 48.93% needed to take PDE5i to enhance their nocturnal erections, improvement in penile erogenous sensation was recorded in 6.38%	-	-
Monn et al. [35]	2019	5 (38.4%)	-	-	-	All patients reported subjective satisfaction with the cosmesis of their surgical outcome
Pariser et al. [38]	2018	42 (65%)	-	-	-	-
Theisen et al. [39]	2018	2 (10.5%)	1 (5.2%)	Significant improvement in 10 of 13 questions (77%)	Significant improvement in 10 of 12 questions (83%)	
Fuller et al. [40]	2017	0 (0%)	-	-	-	-

Voznesensky et al. [41]	2017	9 (75%)	9 (75%)	Improvement or the same degree of sexual activity (75%).	Improvement in urination (92%)	-
Ghanem et al. [43]	2017	-	-	-	-	3 (30%) of the patients were very satisfied with the result, 5 (50%) patients were satisfied, 1 patient (10%) was neither satisfied nor dissatisfied, and 1 (10%) patient was dissatisfied. No patients were very dissatisfied.
Tausch et al. [44]	2016	-	-	-	-	-

Table S9.5: Suspensory ligament release [49]

Author (year)	Year	n	Study design	Age, years	Follow up, months	Stretched penile length gain, cm
Littara et al. [50]	2019	21	Retrospective	38.08 ±1.1	12	1.1
Zhang et al. [34]	2019	15	Retrospective	33.2 ±4.6	3	4.3 ±1.6
Li et al. [51]	2006	27	Retrospective	NR	16	1.1 ±1.1
Spyropoulos et al. [52]	2005	11	Retrospective	25-25	Not reported	1.6 (1–2.3)

Measurements are expressed as median/mean, (IQR)/±SD.

Table S9.6: Published data on evaluation of Hyaluronic acid injection therapy on penile girth enhancement

Author	Year	n	Study design	Age, years	Follow-up, months	Girth gain, cm	Complications, n (%)
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Zhang et al. [53]	2022	38	Retrospective	31.2 ± 6.7	12	2.44 ± 1.14	3 (7.9)
Ahn et al. [54]	2021	32	Multi-centre RCT	20-65	5-6	2.27 ± 1.26	2 (6.3)
Quan et al. [55]	2021	230	Retrospective	30.34 ± 5.23	6	1.80 ± 0.83	10 (4.3)
Yang et al. [56]	2020	39	Multi-centre RT	19-65	5-6	2.1 ± 1.0	2 (5.13)
Yang et al. [57]	2020	33	Multi-centre RT	20-66	18	1.41 ± 1.48	3 (9.1)
Yang et al. [58]	2019	36	Multi-centre RT	20-65	11-12	1.69 ± 1.53	1 (2.78)
Kwak et al. [59]	2011	50	Retrospective	42.5 (27-61)	18	3.78 ± 0.35	0 (0)
Summary		N/A	N/A	19-66	5-18	1.40 – 3.78	0-9.1

Measurements are expressed as median/mean, (IQR)/±SD.

Table S9.7: Published data on evaluation of autologous fat injection on penile girth enhancement

Author (year)	Year	n	Study design	Age (years)	Follow up (months)	Girth gain (cm)	Complications, n (%)
Littara et al. [50]	2019	334	Retrospective	36	12	2.76	49 (14.67)
Salem et al. [60]	2019	15	Prospective	33 (23-45)	6	2-3.5	N/A
Kang et al. [61]	2012	52	Retrospective	42.1	6	2.18-2.28	1 (1.92)
Panfilov et al. [62]	2006	60	Retrospective	33.8	12	2.65	3 (5)
Summary	N/A	N/A	N/A	33-42.1	6-12	2-3.5	1.92-14.67

Measurements are expressed as median/mean, (IQR)/±SD.

Table S9.8: Published data on evaluation of grafting techniques on penile girth enhancement

Author (year)	Year	n	Study design	Technique	Age, years	Follow up, months	Girth gain, cm	Complications, n (%)
Elist et al. [63]	2018	400	Retrospective	Subcutaneous silicone implant	35 (22-68)	48	4.9	86 (21.5)
Zhang et al. [64]	2016	30	Retrospective	Dermal graft	23.7 (19-35)	13	1.5	1 (3.3)
Xu et al. [65]	2016	23	Retrospective	SLR + skin advancement + dermal fat graft	23 (18-33)	6	1.67	7 (30.43)
Tealab et al. [66]	2013	18	Retrospective	Acellular collagen matrix graft	24 (19-38)	12	2.3	8 (44.44)
Mertziatis et al. [67]	2013	82	Retrospective	SLR + skin advancement + Dermal fat graft	24	12	2.2	25 (31.64)
Spyropoulos et al. [52]	2005	4	Retrospective	SLR + Dermal fat graft	32	14	2.3	No major complication
Alei et al. [68]	2012	69	Retrospective	Porcine dermal acellular matrix graft	28.2 (19-59)	12	Flaccid: 3.2; Erect: 2.4	19 (27.5)
Austoni et al. [69]	2002	39	Retrospective	Corporal venous graft	24-47	9	Flaccid: no change, Erect: 2.9	1 (2.56)
Summary	N/A	N/A	N/A	N/A	18-68	6-48	0-4.9	0-44.44%

Table S9.9: Published data on evaluation of implantation of biodegradable scaffolds

Author	Year	Study design	n	Age (years)	Follow up (months)	Girth gain (cm)	Complications, n (%)
Djordjevic et al. [70]	2018	Retrospective	21	28 (22-37)	38 (13-66)	Flaccid: 1.1 ±0.4 Erect: 1±0.3	2 (9.52)

Jin et al. [71]	2011	Multi-centre non-controlled	69	33±9.14	6	Flaccid: 4.01; Erect: 4.02	6 (8.69)
Perovic et al. [72]	2006	Multi-centre prospective non-controlled	84	28.77±6.61	24.67	Flaccid: 3.35; Erect: 2.47	8 (9.52)
Summary	N/A	N/A	N/A	18-60	6-60	1-4.02	8.69-9.52%

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