REVIEW PAPER

FUNCTIONAL UROLOGY

Complications and functional outcomes of endoscopic enucleation of the prostate: a systematic review and meta-analysis of randomised-controlled studies

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Karl H. Pang University College London Hospitals NHS Foundation Trust Institute of Andrology 16-18 Westmoreland Street London W1G8PH, UK karlpang@doctors.org.uk Introduction There are several endoscopic enucleation procedures (EEP) using different energy sources: holmium laser enucleation of the prostate (HoLEP), thulium laser enucleation of the prostate (ThuLEP), Greenlight[®] (GreenVEP) and diode (DiLEP) lasers, and plasma kinetic enucleation of the prostate (PKEP). The comparative outcomes among these EEPs are unclear. We aimed to compare the peri-operative and post-operative outcomes, complications and functional outcomes among different EEPs. Material and methods A systematic review and meta-analysis was performed according to the Pre-

ferred Reporting Items for Systematic Reviews and Meta-analyses (PRISMA) checklist. Only randomisedcontrolled trials (RCT) comparing EEPs were included. The risk of bias was assessed using the Cochrane tool for RCTs.

Results The search identified 1153 articles and 12 RCTs were included. The number of RCTs for each comparison was, HoLEP vs ThuLEP; n = 3, HoLEP vs PKEP; n = 3, PKEP vs DiLEP; n = 3, HoLEP vs GreenVEP; n = 1, HoLEP vs DiLEP; n = 1, ThuLEP vs PKEP; n = 1. Operative time was shorter and blood loss was lower with ThuLEP compared with HoLEP, whereas operative time was shorter for HoLEP compared with PKEP. Blood loss was lower with HoLEP and DiLEP compared with PKEP. There were no Clavien-Dindo IV–V complications, and the incidence of Clavien-Dindo I complications was lower with ThuLEP compared with HoLEP. No significant differences were detected among EEPs regarding urinary retention, stress urinary incontinence, bladder neck contracture or urethral stricture. Lower International Prostate Symptom Score (IPSS) and higher quality of life (QoL) scores were in favour of ThuLEP compared with HoLEP at 1 month. **Conclusions** EEP improves symptoms and uroflowmetry parameters with a low incidence of high-grade complications. ThuLEP was associated with shorter operative time, lower blood loss, and lower incidence of low-grade complications compared with HoLEP.

Key Words: benign prostate enlargement \circ enucleation \circ laser \circ holmium \circ thulium

INTRODUCTION

Benign prostate hyperplasia (BPH) may induce lower urinary tract symptoms (LUTS) and compli-

cations, such as urinary retention and renal failure. Many options are available to manage BPH, including medical drug and surgical treatment, and radiological embolization [1]. Refinements in technology

This is an Open Access article distributed under the terms of the Creative Commons Attribution-NonCommercial-ShareAlike 4.0 International (CC BY-NC-SA 4.0). License (http://creativecommons.org/licenses/by-nc-sa/4.0/). and technique aim to improve efficacy and functional outcomes and reduce peri- and post-operative complications. Historically, transurethral resection of the prostate (TURP) has been the gold standard for prostate sizes ≤80 cc, and open prostatectomy for larger prostates. Endoscopic enucleation of the prostate (EEP) has been used to overcome size limitations, and to avoid the morbidity associated with open surgery. Available laser options to perform EEP include: holmium laser enucleation of the prostate (HoLEP), thulium (ThuLEP/ThuVEP/ThuVAP), greenlight (GreenVEP/GreenLEP) and diode (Di-LEP). Plasma kinetic enucleation of the prostate (PKEP), or bipolar enucleation (BipoLEP) represent important alternatives when lasers are not available for clinical use [1–3]. Researchers have compared all energy sources with TURP in randomized-controlled trials (RCTs) and meta-analyses [4–7], however, the European Association of Urology (EAU) guidelines concluded that EEP with holmium, thulium and diode demonstrate similar efficacy and safety profile compared with TURP [1].

There are not many RCTs comparing different enucleation techniques, therefore, the optimum approach is yet to be defined. Surgical RCTs are uncommon because they are difficult to conduct, especially the randomisation step. The most studied technique is HoLEP versus ThuLEP, and a recent meta-analysis concluded that both procedures offer comparable improvement in symptoms, but ThuLEP is associated with less blood loss and incidence of transient urinary incontinence [8].

With the lack of evidence in comparing individual enucleation techniques, the aim of our systematic review is to evaluate the efficacy, incidence of complications and functional outcomes among various enucleation methods.

Evidence acquisition

Search strategy

The systematic review was registered on the PROS-PERO database (CRD42022306747) and performed in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-analyses (PRISMA, Appendix 1) checklist [9]. We searched the Medline, Cochrane and Embase databases on 07-Feb-2022 (Appendix 4), and filtered for English articles, humans, and randomised studies, with no date restrictions.

Study eligibility

A population (P), intervention (I), comparator (C), outcome (O), and study design (S) (PICOS) frame-

work defined the study eligibility. We included studies if they fulfilled, (P): men undergoing EEP for BPH; (I): any enucleation method, e.g. using holmium, thulium, greenlight or diode laser, or plasma kinetic; (C) any of the 'intervention' methods listed above; (O) peri- and post-operative outcomes and complications functional outcomes [maximum flow rate (Qmax)], post-void residual (PVR), the International Prostate Symptom Score (IPSS), quality of life (QoL) and International Index of Erectile Function (IIEF) questionnaires; (S) RCTs only. We excluded case reports, conference abstracts, reviews, letters, commentaries, and editorials.

Two reviewers (KHP and GO) screened articles, and reference lists of included manuscripts for eligibility. Disagreement during study inclusion was resolved by a judgement of one of the senior authors (CSB, TT).

Risk of bias assessment

The risk of bias (RoB) assessment of included studies was performed (KHP and GO) using the Cochrane RoB tool for RCTs [10].

Data extraction and analysis

Data extracted (GO and KHP) included, the number of patients, EEP technique, baseline characteristics [age, prostate size, prostate-specific antigen (PSA) level, IPSS, Qmax and PVR, and IIEF], operative time, length of stay, catheter duration, blood loss, post-operative complications (urinary retention/incontinence, urethral stricture, retrograde ejaculation), Clavien-Dindo (CD) grade [11], post-operative Qmax and PVR, IPSS and IIEF scores, and follow-up duration.

We performed a qualitative synthesis and metaanalyses using Review Manager 5.4.1 (The Cochrane Collaboration, Oxford, UK). We used the inverse variance weighted mean difference (WMD) with 95% confidence intervals (95% CI) as a summary measure for continuous variables. If studies reported the median and interquartile ranges (IQR), we estimated the mean and standard deviation (SD) based on formulas by Hozo et al. [12]. For dichotomous outcomes, we calculated odds ratio (OR) according to Mantel-Haenszel (MH) test, as an effect measure with 95% CI. We considered a p-value <0.05 as statistically significant. Pooled estimates were calculated using the random-effect model for all outcome variables. We quantified study heterogeneity with the Chi-squared and I² statistics.

characteristics
patient
L. Baseline
Table 1

р Д	p-va- lue	0.642	RR	RR	0.1	RR	0.64	0.27	R	RR	0.5	R	0.35	etic EP; st-void
IIEF nean/S dian/IC	EEP2	16.5 ±4.63	R	RR	17.48 ±5.34	RR	17.59 ±1.70	45.8 ±17 (IIEF- 15)	R	R	17.1 ±2.7	RR	9 (6–18)	ma kine /R – po:
u) me	EEP1	20 ±4.56	NR	NR	19.84 ±4.82	RR	17.46 ±1.70	55.6 ±15.4 (IIEF- 15)	R	R	17.5 ±2.6	RR	8 (5–19)	o – plas rate; P\
, <u>ଚ</u>	p-va- lue	0.962	0.24	0.37	0.23	0.64	0.31	0.4	0.76	0.53	0.13	0.28	0.98	EP; PKEF m flow
VR, ml iean/Sl	EEP2	100 ±52.69	115.5 ± 130.54	165.5 ±46.2	159.41 ±63.16	168.5 ±55.8	121.35 66.13	172 ±137	92.1 ±127.5	95.19 ±49.03	162.8 ±41.7	52.60 ±49.47	59.5 ±28.8	ulium E naximu
μĔ	EEP1	105 ±37.94	90.4 ± 120.44	172.7 ±39.4	135.37 ±46.83	160 ±52.8	132.44 ±71.01	146 ±105	85. ±98.2	88.87 ±44.83	147.5 ±47.2	66.57 ±64.64	63.4 ±36.4	.EP – th nax – n
S, , S B, S	p-va- lue	0.181	0.15	0.37	0.88	0.45	0.65	0.5	0.981	0.62	0.23	0.78	0.11	e; ThuL life; Qr
าax, ml nean/Sl dian/IC	EEP2	9.6 ±1.55	7.9 ±8.05	6.6 ±2.3	2.5 (0–10)	3.9 ±3.3	7.10 ±2.46	8±3	6.7 ±3.7	7.14 ±3.13	6.8 ±2.8	7.91 ±2.22	6.9 ±5.0	prostat Iality of
ng (T) an	EEP1	12.1 ±1.95	8.2 ±6.71	7.1 ±2.8	0 (0- 13.9)	3.3 ±3.4	7.28 ±2.37	7.5 ±1.3	6.7 ±3.9	7.48 ±3.66	7.6 ±3.1	7.77 ±2.10	5.4 ±5.1	of the oL – qu
, and a second	p-va- lue	0.889	NR	0.65	0.387	0.65	0.85	0.4	0.073	0.48	0.66	0.35	0.2	core; Q
QoL nean/Sl dian/IC	EEP2	4 ±0.25	RR	5 (4–6)	5 (4–6)	4.43 ±0.5	4.66 ±0.80	4 ±1.1	3.7 ±0.8	4.43 ±0.61	4.8 ±0.9	4.40 ±0.84	5 (4–6)	er enuc ptom S
n) me	EEP1	4 ±0.25	NR	5 (4–6)	5 (3–6)	4.37 ±0.49	4.69 ±0.84	3.8 ±1.2	3.9 ±0.7	4.35 ±0.62	4.9 ±1.1	4.58 ±0.81	5 (5–6)	ium las ate Sym
/SD)	p-va- lue	0.809	0.16	0.13	0.92	0.85	0.43	0.6	0.32	0.69	0.59	0.83	0.9	– holm I Prosta
(mean,	EEP 2	20 ±2.25	18.2 ±7.31	22.8 ±3.7	25.35 ±4.17	28.9 ±2.1	22.20 ±3.60	23 ±4.8	23.4 ±5.5	24.13 ±4.08	22.4 ±5.3	23.50 ±4.89	23.1 ±6.1	HoLEP nationa
IPSS	EEP1	22 ±2.75	17.9 ±6.95	23.9 ±3.9	25.24 ±4.87	28.8 ±2.1	22.63 ±3.15	22.4 ±5.6	24.2 ±4.0	23.82 ±4.65	21.8 ±4.5	23.73 ±4.60	22.8 ±7.0	ostate; – Inter
	p-va- lue	0.698	0.31	0.63	0.379	0.007	0.74	0.88	0.1	0.29	0.45	0.64	0.7	if the pi en; IPSS
PSA ng/ml)	EEP2	4.14 ±1.08	3.2 ±4.14	4.96 ±1.40	6.2 (1- 18.75)	6.2 ±3.2	3.63 ±1.92	5.3 ±12.6	2.7 ±1.2	2.49 ±1.18	5.6 ±3.2	2.79 ±1.25	4.4 (2.3– 8.2	ation o c antige
	EEP1	4.14 ±1.55	2.9 ±5.25	5.09 ±1.49	6.5 (0.71– 33)	7.6 ±2.5	3.74 ±2.17	5.6 ±4.4	2.2 ±1.8	2.70 ±1.03	6.2 ±3.8	2.67 ±1.17	5.2 (2.0– 11.2)	c enucle -specifi
,, mL/ SD, DR)	p-va- lue	0.826	0.17	0.37	0.073	0.09	0.46	0.49	0.193	0.57	0.24	0.58	0.98	oscopic rostate
ate size mean/ dian/lo	EEP2	82.5 ±6.31	90.2 ±42.7	91.8 ±6.9	102 (80– 243)	125.00 ±26.93	61.23 ±20.99	83.3 ±27.8	83.0 ±34.8	67.05 ±16.28	98.6 ±21.6	68.72 ±22.28	59.5 ±28.8	P – end PSA – p
Prosta cc (me	EEP1	77.5 ±16.13	86.3 ±46.7	93.0 ±7.2	125 (80– 270)	135.19 ±34.84	63.71 ±21.63	87.1 ±28.1	75.6 ±28.9	69.02 ±22.29	93.3 ±18.5	65.79 ±24.63	63.4 ±36.4	ses; EE iation;
<u>د ر</u>	p-va- lue	0.207	3 0.12	0.17	0.71	0.0	0.67	60.0	0.95	0.11	0.28	NR	0.14	a-analy ard dev
ge, yeal Iean/Sl	EEP2	74 ±1.9	67.1 ±17.83	72.7 ±3.1	67. 48 ±6.46	67.72 ±6.48	70.28 ±8.16	74.1 ±.8	71.7 ±8.7	70.03 ±7.84	75.4 ±8.4	NR	67.3 ±7.7	nd Met - stand
Ă,	EEP1	71.5 ±2	69.5 ±15.54	71.8 ±3.9	66.81 ±7.77	66.17 ±7.22	70.95 ±7.50	71 ±9.3	71.6 ±9.8	67.66 ±8.99	73.6 ±6.2	RR	69.4 ±7.5	views a EP; SD
alysed,	EEP2	48	115	58, 53 (18 m)	31	23	80,79 80,79 72 (24 m), 64 (36 m)	53	8	66	40	40	57	matic Re – diode
ents an n (%)	EEP1	46	121	58, 54 (18 m)	33	54	80, 80 (12 m), 69 (24 m), 62 (36 m)	20	63	61	40	40	57	or Syster 2; DiLEP
No. pati	Overall	94	236	116, 107 (18 m)	64	107	160, 159 (12 m), 141 (24 m), 126 (36 m)	103	126	127	80	80	114	tems f. sation Ef مامن م د r
ention m	EEP2 (Thu- LEP	Thu- LEP	Thu- LEP	PKEP	PKEP	РКЕР	Gre- enVEP	DiLEP	PKEP	DiLEP	DiLEP	DiLEP	Reporting Seporting Apporting
Intervi ari	EEP1	Holep	Holep	Holep	Holep	Holep	НоГЕР	HOLEP	HOLEP	Thu- LEP	PKEP	PKEP	PKEP	Ferred F Teenligh
. Year		2018	i 2021	2020	2020	2021	2021	2015	2019	2016	2016	2013	2018	A – Pref /EP – gr
Author		Beckel et al. [13]	Bozzin et al. [14]	Zhang et al. [17]	Habib et al. [18]	Higazy et al. [19]	Wei et al. [20]	Elshal et al. [24]	He et al. [15]	Feng et al. [16]	Wu et al. [21]	Xu et al. [22]	Zou et al. [23]	PRISM. Green ^v

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Evidence synthesis

The initial search identified 1153 articles, overall, 12 RCTs [13–24] were included for analysis (PRISMA diagram, Figure 1). In total, 1,406 patients were included: HoLEP, n = 505; PKEK, n = 366; ThuLEP, n = 284 (vaporisation n = 48); DiLEP, n = 200; Green-VEP, n = 53. Baseline characteristics of the patients, including age, prostate size, PSA level, IPSS scores, Qmax and PVR, and IIEF scores, are presented in Table 1. The prostate size was comparable and are detailed in Table 1. Appendix 2 summarises the study inclusion and exclusion criteria, and EEP characteristics. We performed meta-analyses when more than one RCT compared the same outcome: 1) HoLEP with ThuLEP [13, 14, 17]; 2) HoLEP with PKEP [18, 19, 20], and; 3) PKEP with DiLEP [21, 22] (Figure 2). Only one RCT compared HoLEP with GreenVEP [24], HoLEP with DiLEP [15] or, ThuLEP with PKEP [16], therefore, meta-analyses comparing these techniques were impossible, and we performed a descriptive analysis.

Peri- and post-operative parameters

Operative time

The mean operative time (mins) was HoLEP, 65–114; PKEP, 38.8–98.7; ThuLEP, 63.7–71.4; DiLEP, 33.7–113.5, and; GreenVEP, 103 (Table 2).

The operative time (Figure 2a) was significantly shorter in the ThuLEP group compared to HoLEP (WMD, 10.3; 95% CI, 3.95–16.3; p = 0.001), and longer in the PKEP group compared to HoLEP §(WMD, -12.1; 95% CI, -15.7–-8.44; p < 0.001).

There were no significant differences in operative time in the single RCTs that compared HoLEP with GreenVEP, HoLEP with DiLEP or, ThuLEP with PKEP (Table 2).

Enucleation weight

The mean enucleation weight (grams) across all studies was HoLEP, 48–105; PKEP, 37.2–99.9; Thu-LEP, 41.3–66.5; DiLEP, 33.7–65.8 and; GreenVEP, 11.6 (Table 2). However, when comparing HoLEP versus ThuLEP, the enucleation weight was 48–65 grams and 48.8–66.5 grams respectively (Table 2).

In meta-analyses, there were no significant differences about the weight of tissue removed between techniques (Figure 2b).

Haemoglobin decrease

The decrease in haemoglobin (g/dL) was with Ho-LEP, 0.5–2.8; PKEP, 0.36–1.6; ThuLEP, 0.5–2.6; Di-



Figure 1. *PRISMA 2020 flow chart for the current systematic review.*

PRISMA – Preferred Reporting Items for Systematic Reviews and Meta-analyses; n – number of patients

LEP, 0.3–0.9 and; GreenVEP, 0.7. Other peri- and post-operative parameters are detailed in Table 1. In meta-analyses, haemoglobin decrease was lower with ThuLEP compared with HoLEP (WMD, 0.8; 95% CI, 0.08–1.5; p = 0.03); higher with HoLEP compared with PKEP (WMD, -0.2; 95% CI, -0.23– -0.1; p < 0.001) and; lower with DiLEP compared with PKEP (WMD, 0.32; 95% CI, 0.06–0.59; p = 0.02) (Figure 2c). There was no significance between comparable EEPs about the transfusion rate (Figure 1).

Catheter duration and length of stay

The urinary catheter time was between 1–3 days for all enucleation methods (Table 2). Catheter duration was significantly shorter in with HoLEP compared with PKEP (WMD, -0.43; 95% CI, -0.79– -0.07; p = 0.02) (Figure 2e).

Data from the single RCTs showed that ThuLEP was associated with shorter catheter duration (mean, 1.85 days) when compared with PKEP (mean, 2.3 days; p = 0.04) (Table 2).

The mean LOS (days) was HoLEP, 2–5.8; PKEP, 0.95–5.3; ThuLEP, 2–2.6; DiLEP, 3.6-6.2 and; Green-VEP, 1.5 (Table 2). HoLEP was associated with

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Table

	n/SD)	p-value	0.809	0.316	0.5	0.066	0.01	<0.001	0.055	0.418	0.1	<0.01	0.103	0.06
	'ays (mea	EEP2	2 ±0.25	2.2 ±4.05	2 ±0.25	0.95 ±0.3	1.49 ±0.6	3.94 ±0.68	1.5 ±1.3	6.2±2.7	3.02 ±1.45	3.6 ±1.5	4.95 ±0.95	4 ±0.5
	LOS, d	EEP1	2 ±0.25	2.8 ±3.89	2 ±0.25	0.84 ±0.09	1 ±0.24	3.59 ±0.58	1.1±0.7	5.8±2.3	2.64 ±1.08	4.8 ±1.8	5.30 ±0.93	4 ±0.25
	n, days)	p-value	0.966	0.45	0.694	0.019	0.02	0.01	0.055	0.33	0.042	<0.01	0.00	0.77
	er duratio mean/SD	EEP2	2 ±0.25	1.9 ±2.81	2 ±0.25	1.17 ±0.87	1.79 ±1.6	3.54 ±0.69	2.3 ±3.8	2.23 ±0.44	2.28 ±1.34	1.2 ±0.4	1.15 ±0.33	1.86 ±0.2
	Cathete (I	EEP1	2 ±0.25	2.0 ±3.55	2 ±0.25	0.72 ±0.17	1 ±0.23	3.27 ±0.62	1.2 ±1	2.3 ±0.39	1.85 ±0.94	1.6 ±0.7	1.94 ±0.36	1.97 ±0.2
	g/dl)	p-value	0.97	0.005	0.15	ц.	0.96	0.03	6.0	0.007	0.037	<0.01	0.002	0.82
	ecrease, mean/SD	EEP2	1.6 ±0.31	0.45 ±1.78	0.7 ±0.1	1 ±0.7	1.1 ± 0.1	1.13 ±0.51	0.74 ±1.1	0.4. ±0.23	0.99 ±0.52	0.8±0.3	0.93 ±1.02	0.33 ±0.66
	nb dH	EEP1	1.7 ±0.475	2.77 ±1.23	0.8 ±0.1	0.9 ±0.85	0.9 ±0.1	0.96 ±0.52	0.74 ±0.82	0.51 ±0.22	0.80 ±0.49	1.1 ±0.5	1.61 ±0.85	0.36 ±0.75
	weight, /SD)	p-value	0.421	0.321	0.23	0.88	0.36	0.44	0.00	0.34	0.43	0.39	0.49	0.84
	ed tissue 1s (mean,	EEP2	58 ±13.44	48.84 ±18.23	66.5 ±5.8	78 ±37	99.91 ±21.69	51.61 ±18.62	11.6 ±20	60.4 ±34.2	39.47 ±11.66	65.8 ±15.6	51.30 ±21.09	33.7 ±8.5
	Enucleat gran	EEP1	48 ±13.75	51.13 ±23.14	65.0 ±7.6	79 ±44	105 ±34.20	53.93 ±19.29	48 ±22	55.2 ±27.3	41.29 ±14.33	62.3 ±20.2	47.93 ±22.69	37.2 ±10.9
	e, mins)	p-value	≤0.004	NR	<0.001	NR	0.029	0.19	NR	0.054	NR	NR	0.12	0.38
	ation time mean/SD	EEP2	27.03 ±4,02	NR	56.4 ±8.4	NR	61.98 ±10.85	49.71 ±18.32	NR	40.7 ±10.9	NR	NR	18.55 ±3.68	37.8 ±16.9
	Enuclea (EEP1	40 ±5.09	NR	61.2 ±5.4	NR	57.96 ±7.74	53.68 ±19.33	NR	44.7 ±12.2	NR	NR	17.18 ±4.08	35.1 ±15.6
	, mins)	p-value	0.275	0.245	<0.001	0.003	<0.001	<0.01	0.1	0.091	0.72	0.02	0.00	0.43
mes	tion time, mean/SD	EEP2	50 ±8.5	63.69 ±41.44	71.4 ±6.4	93.58 ±31.47	94.72 ±12.15	78.21 ±27.78	103 ±35	62.9 ±18.2	69.21 ±19.80	113.5 ±25.4	33.73 ±6.96	41.4 ±18.1
e outco	Opera (I	EEP1	65 ±9.25	71.66 ±38.70	78.4 ±8.0	71.54 ±25.25	83.43 ±6.92	66.56 ±22.59	114 ±35	68.7 ±19.7	67.90 ±20.88	98.7 ±31.5	50.28 ±6.24	38.8 ±16.9
perativ	tion arm	EEP2	ThuLEP	ThuLEP	ThuLEP	PKEP	PKEP	PKEP	Gre- enVEP	DiLEP	PKEP	DiLEP	DiLEP	Dilep
d post-c	Intervent	EEP1	HOLEP	HOLEP	HOLEP	HOLEP	HOLEP	HOLEP	HOLEP	HOLEP	ThuLEP	PKEP	PKEP	PKEP
Peri- anı	Year		2018	2021	2020	2020	2021	2021	2015	2019	2016	2016	2013	2018
Table 2. /	Author		Becker et al. [13]	Bozzini et al. [14]	Zhang et al. [17]	Habib et al. [18]	Higazy et al. [19]	Wei et al. [20]	Elshal et al. [24]	He et al. [15]	Feng et al. [16]	Wu et al. [21]	Xu et al. [22]	Zou et al. [23]

Hb – haemoglobin; LOS – length of stay

Author	Year	Interv ar	ention 'm	Clav	vien-Din n (%)	do I,	Urina	ry reten [.] n (%)	tion,	Clavie	en-Dindc n (%)	μ,	Clavier	Dindo ה n (%)	IIIa,	Clavier	n (%)	,dIII	Urge in o	icontine verall	ence	Stress i C	ncontine verall	ence
		EEP1	EEP2	EEP1	EEP2	p-value	EEP1	EEP2 F	o-value	EEP1	EEP2 p	-value	EEP1	EEP2 p	-value	EEP1	EEP2 p	-value	EEP1 1	EEP2 p	-value	EEP1	EEP2 p	-value
Becker et al. [13]	2018	HOLEP	ThuLEP	9 (19,6)	4 (8,3)	NR	3 (6.5)	1 (2.1)	0.254	2 (4.3) û	1 (2.1)	NR	2 (4.3)	(0) 0	R	3 (6.5)	l (2.1)	NR 4	(8.7) 1	(2.1) (0.149	8 (17.4) (9 (18.8)	0.491
Bozzini et al. [14]	2021	HOLEP	ThuLEP	14 (11.6)	7 (6.08)	RN	13 (10.7)	7 (6.1)	0.04	8 (6.6) 2	2 (1.7)	NR	RR	NR	R	1 (0.08)	1 0.08)	0.4	10 (8.2) ⁸	(6.9)	0.2	9 (7.4) 2	2 (1.7)	0.03
Zhang et al. [17]	2020	HOLEP	ThuLEP	8 (13.8)	2 (3.4)	RR	1 (1.7)	(0) 0	NR	1 (1.7) ŝ	3 (5.2)	0.62	(0) 0	(0) 0	I	2 (3.4)	2 (3.4)	-	NR	NR	ЯN	5 (8.6) 2	2 (3.4)	0.44
Habib et al. [18]	2020	HOLEP	PKEP	(0) 0	1 (3.2)	RR	0 (0)	(0) 0	I	1 (3) 3	3 (9.7)	NR	NR	NR	NR	1 (3)	0 (0)		NR	NR	RR	3 (9.1)	5 16.1)	0.47
Higazy et al. [19]	2021	HOLEP	PKEP	1 (1.9)	2 (3.7)	NR	0 (0)	(0) 0	T	3 (5.6) 5	5 (9.4)	NR	(0) 0	(0) 0	1	1 (1.9)	l (1.9)	1	NR	NR	RR	5 (9.3)	5 (9.4)	0.74
Wei et al. [20]	2021	HOLEP	PKEP	(0) 0	4 (5)	NR	4 (2.5)	(0) 0	0.04	NR	NR	NR	NR	NR	NR	2 (3.2)	t (6.3)	NR 6	(7.5) 7	(8.8)	0.77	3 (3.8) 2	2 (2.5)	NR
Elshal et al. [24]	2015	HOLEP	Gre- enVEP	7 (14)	10 (18.9)	RR	1 (2)	3 (5.7)	0.6	0 (0)	5 (9.4)	NR	NR	NR	NR	3 (6)	t (7.5)	NR D	(10) 6	(9.4)	0.22	7 (14) 3	3 (5.7)	NR
He et al. [15]	2019	HOLEP	DiLEP	1 (1.6)	1 (1.6)	RR	1 (1.6)	1 (1.6)	1	4 (6.3) 🤅	3 (4.8)	NR	(0) 0	(0) 0	1	1 (1.6)	3 (4.8)	NR	NR	RR	ЯN	5 (7.9)	4(6.3) (0.729
Feng et al. [16]	2016	ThuLEP	PKEP	1 (1.6)	2 (3)	R	1 (1.6)	1 (1.5)	96.0	1 (1.6) 🤅	3 (4.5)	NR	NR	NR	NR	1 (1.6)	2 (3)	NR	NR	NR	RR	3 (4.9)	3 (4.5) (0.921
Wu et al. [21]	2016	PKEP	Dilep	4 (10)	2 (5)	NR	3 (7.5)	2 (5)	0.64	1 (2.5)	(0) 0	NR	NR	NR	R	3 (7.5)	l (2.5)	NR (15 37.5) (7 17.5)	0.05	5 (12.5) ⁻	4 (10)	0.72
Xu et al. [22]	2013	PKEP	Dilep	1 (2.5)	2 (5)	RR	0 (0)	(0) 0	I	(0) 0	(0) 0	ı.	NR	NR	NR	(0) 0	(0) 0	-	4 (35) (5 12.5)	0.02	4 (10) 3	3 (7.5) (0.692
Zou et al. [23]	2018	PKEP	Dilep	1 (1.8)	2 (3.0)	NR	1 (1.8)	2 (3.0)	1	5 (8.8)	3 (5.3)	NR	NR	NR	NR	l (1.8)	3 (5.3)	NR	NR	NR	NR	5 (8.8)	5 (8.8)	1
EEP – endosc GreenVEP – £	opic enur greenlight	cleation ɕ t vaporisa	orocedure ition EP; C	ss; HoLEP JiLEP – di	' – holmit iode EP	um laser	enucleati	ion of the	: prostat	e; ThuLEF	o – thuliu	m laser (enucleati	on of the	e prostat	e; PKEP -	- plasma	kinetic e	nucleatic	on of the	e prostat	.é		

Table 3. Post-operative complications

a shorter LOS when compared with PKEP (WMD -0.31; 95% CI, -0.53--0.09; p = 0.006) (Figure 2f).

Complications according to Clavien-Dindo

Complications following different forms of EEP are shown in Table 3. The incidence of CD-I, CD-II, CD-IIIb was HoLEP, n = 140 (27.7%), n = 19 (4.5%), n = 14 (2.8%); PKEP, n = 18 (4.9%), n = 17 (5.9%),

n = 11 (3%); ThuLEP, n = 4 (4.9%), n = 7 (2.5%), n = 5 (1.8%); DiLEP, n = 7 (3.5%), n = 9 (4.5%), n = 7 (3.5%); GreenVEP, n = 10 (18.9%), n = 5 (9.4%), n = 4 (7.5%) respectively. CD-IIIa occurred in two (0.9\%) of HoLEP patients, CD-IIIa did not occur in the other EEP groups. There were no encountered CD-IV-V complications.

There were lower cases of CD-I with ThuLEP compared with HoLEP (OR, 2.45; 95% CI, 1.28-5.03;



Figure 2. *Meta-analysis of outcomes. Peri-operative and post-operative outcomes:* **a)** *operation time (mins),* **b)** *enucleated weight (grams).*

HoLEP – holmium laser enucleation of the prostate; ThuLEP – thulium laser enucleation of the prostate; SD – standard deviation; Cl – confidence interval; PKEP – plasma kinetic enucleation of the prostate; DiLEP – diode laser enucleation of the prostate





p = 0.007) (Figure 3a). No other statistical significance was found in meta-analyses with regards to CD-I, CD-II and CD-IIIb when comparing other techniques (Figure 3a–c).

Specific complications

Specific complications, including urinary retention, urinary incontinence, bladder neck contracture, and urethral stricture, are summarised in Table 3 and Appendix 3. Figure 4a-e illustrates meta-analyses, and the only significance identified was the higher incidence of urge urinary incontinence (UUI) with PKEP than DiLEP (OR, 3.22; 95% CI, 1.50–6.94; p = 0.003 (Figure 4c).

Functional outcomes

International Prostate Symptom Score and quality of life

Table 4 summarises IPSS scores at 1, 3, 6 and 12 months. Men who underwent ThuLEP had a lower IPSS score compared to HoLEP at 1 month (WMD,



Figure 2. Meta-analysis of outcomes. Peri-operative and post-operative outcomes: **e)** catheter duration (days), **f)** length of hospital stay (days)

HoLEP – holmium laser enucleation of the prostate; ThuLEP – thulium laser enucleation of the prostate; SD – standard deviation; Cl – confidence interval; PKEP – plasma kinetic enucleation of the prostate; DiLEP – diode laser enucleation of the prostate

1.4; 95% CI, 0.44–2.37; p = 0.004) and 3 months (WMD, 1.0; 95% CI, 0.85–1.15; p < 0.001), however, IPSS scores were similar at 6 and 12 months post-operatively. No other significant differences were identified (Figure 5a).

QoL score was lower in the ThuLEP group compared with HoLEP at 1 months (WMD, 1.0; 95% CI, 0.87–1.13; p <0.001), but this was not significant at 6 or 12 months (Figure 5b).

Maximum flow rate and peri- and post-operative

Qmax and PVR, among different techniques, are shown in Table 4. There were no significant differences



Figure 3. Meta-analysis of outcomes. Complications according to the Clavien-Dindo classification: a) Clavien-Dindo I, b) Clavien-Dindo II.

HoLEP – holmium laser enucleation of the prostate; ThuLEP – thulium laser enucleation of the prostate; SD – standard deviation; Cl – confidence interval; PKEP – plasma kinetic enucleation of the prostate; DiLEP – diode laser enucleation of the prostate



Figure 3. Meta-analysis of outcomes. Complications according to the Clavien-Dindo classification: c) Clavien-Dindo IIIb. HoLEP – holmium laser enucleation of the prostate; ThuLEP – thulium laser enucleation of the prostate; SD – standard deviation; Cl – confidence interval; PKEP – plasma kinetic enucleation of the prostate; DiLEP – diode laser enucleation of the prostate

when comparing HoLEP with ThuLEP, or PKEP with DiLEP. However, at 1 month, patients who had HoLEP had a higher Qmax than those who had PKEP (WMD, 1.17; 95% CI, 0.28–2.05; p = 0.01), but this was not significant at 12 months post-operatively (Figure 5c). Qmax was significantly lower with GreenVEP when compared with HoLEP at 3 and 6 months (Table 4).

PVR was lower in the HoLEP group versus Thu-LEP at 3 months (WMD, -2,85; 95% CI, -4.90– -0.79; p = 0.007), but this was not significant at 6 or 12 months (Figure 5d).

Index of Erectile Function

Meta-analyses were only possible to compare PKEP with DiLEP, and HoLEP with PKEP, and there was no statistical significance regarding post-operative IIEF scores (Table 4 and Figure 5e).

Risk of bias assessment

We performed the RoB assessment of the included studies using the Cochrane RoB tool. Figure 6 demonstrates the results, and the domain with the highest RoB was blinding of participants and personnel. We decided to judge all studies in which the authors performed only patient blinding as non-blinded studies. The allocation concealment domain had an 'unclear' RoB in 75% of the studies. The randomisation domain had a low RoB in 92% of the studies.

DISCUSSION

Herein, to our knowledge, we report the first systematic review and meta-analysis of published RCTs comparing various EEP techniques to treat symptomatic benign prostate enlargement. Overall, study heterogeneity was high, which is a commonly observed issue in prior publications of studies on EEPs [5, 6]. EEPs appear to offer similar efficacy and safety to TURP, but overcome the limitations over larger prostates and provide an alternative to the more invasive open prostatectomy [1, 25, 26].

In contrary to the meta-analysis comparing ThuLEP and HoLEP by Hartung et al. [8], we excluded one RCT (Zhang et al., [27]) in our analyses due to the high study heterogeneity and bias. Our results seem more homogenous when compared to the functional results of the mentioned study.



Figure 4. Meta-analysis of outcomes. Specific complications: a) urinary retention, b) stress urinary incontinence. HoLEP – holmium laser enucleation of the prostate; ThuLEP – thulium laser enucleation of the prostate; SD – standard deviation; Cl – confidence interval; PKEP – plasma kinetic enucleation of the prostate; DiLEP – diode laser enucleation of the prostate



Figure 4. Meta-analysis of outcomes. Specific complications: c) urge urinary incontinence, d) bladder neck contracture. HoLEP – holmium laser enucleation of the prostate; ThuLEP – thulium laser enucleation of the prostate; SD – standard deviation; Cl – confidence interval; PKEP – plasma kinetic enucleation of the prostate; DiLEP – diode laser enucleation of the prostate

Principle findings

The most studied EEP was HoLEP. There were at least one RCT comparing HoLEP with ThuLEP (n = 3), PKEP (n = 3), GreenVEP (n = 1) or DilEP (n = 1). The least studied was GreenVEP; our search did not identify any RCTs on GreenVEP compared with ThuLEP, PKEP, or DiLEP. Without 2-arm RCTs comparing all possible EEP combinations, or RCTs comparing all EEPs, it is impossible to draw conclusions on which EEP is superior.

Our analyses showed that ThuLEP was associated with the shortest operative time compared with Ho-LEP. Enucleated tissue weight was similar in most comparisons, except that one RCT showed that the enucleation weight was lower with GreenVEP compared with HoLEP [24]. Regarding haemoglobin drop, all methods were associated with less blood loss than PKEP, and ThuLEP and DiLEP were associated with less blood loss than HoLEP. Catheter duration and LOS were longest with PKEP.

There were significant variations in reporting of complications among studies, and some did not use the CD classification. However, EEP is generally a safe procedure, there were no CD IV-V complications, and CD-IIIb occurred in up to 7.5% of cases. Regarding specific complications, meta-analyses did not identify any significant differences with regards to the incidence of urinary retention, urinary incontinence, bladder neck contracture, and urethral stricture among the EEPs studied, except that DiLEP was associated with less UUI compared with PKEP. Although not statistically significant, the incidence of transfusion, urinary retention, urge and SUI were

lower with ThuLEP compared with HoLEP. This observation may be associated with the deeper penetration



Figure 4. Meta-analysis of outcomes. Specific complications: e) urethral stricture.

HoLEP – holmium laser enucleation of the prostate; ThuLEP – thulium laser enucleation of the prostate; SD – standard deviation; Cl – confidence interval; PKEP – plasma kinetic enucleation of the prostate; DiLEP – diode laser enucleation of the prostate

1 month									
monun									
	ŀ	IOLEP		Т	huLE	P		Mean Difference	Mean Difference
Study or Subgroup	Mean	SD	Total	Mean	SD	Total	Weight	IV, Random, 95% CI	IV, Random, 95% Cl
Becker 2018	11	2.25	46	9	2	48	40.5%	2.00 [1.14, 2.86]	
Zhang 2020	7	0.25	58	6	0.3	58	59.5%	1.00 [0.90, 1.10]	•
Total (95% CI)			104			106	100.0%	1.40 [0.44, 2.37]	
Total (95% CI) Heterogeneity: Tau ² =	= 0.40; 0	Chi ² =	104 5.10. d	df = 1 (P = 0	106 .02); l ²	100.0% = 80%	1.40 [0.44, 2.37]	
Total (95% CI) Heterogeneity: Tau ² = Test for overall effect	= 0.40; 0 : Z = 2.8	Chi ² = 86 (P =	104 5.10, d = 0.004	df = 1 (}	P = 0	106 .02); l ²	100.0% = 80%	1.40 [0.44, 2.37]	-2 -1 0 1 2 HoLEP ThuLEP
Total (95% CI) Heterogeneity: Tau ² = Test for overall effect:	= 0.40; 0 : Z = 2.8 H	Chi ² = 36 (P = 10LEP	104 5.10, d = 0.004	df = 1 () P	P = 0 KEP	106 .02); I ²	100.0% = 80%	1.40 [0.44, 2.37] Mean Difference	-2 -1 0 1 2 HoLEP ThuLEP Mean Difference
Total (95% CI) Heterogeneity: Tau ² = Test for overall effect: Study or Subgroup	= 0.40; (: Z = 2.8 H Mean	Chi ² = 36 (P = 10LEP SD	104 5.10, d = 0.004 Total	df = 1 () 4) P Mean	P = 0 KEP SD	106 .02); I ² Total	100.0% = 80% Weight	1.40 [0.44, 2.37] Mean Difference IV, Random, 95% CI	-2 -1 0 1 2 HoLEP ThuLEP Mean Difference IV, Random, 95% CI
Total (95% CI) Heterogeneity: Tau ² = Test for overall effect: Study or Subgroup Higazy 2021	= 0.40; 0 : Z = 2.8 H <u>Mean</u> 4.6	Chi ² = 36 (P = 10LEP 5D 0.7	104 5.10, d = 0.004 Total 54	df = 1 (} P <u>Mean</u> 4.8	P = 0 KEP SD 0.6	106 .02); I ² Total 53	100.0% = 80% Weight 88.6%	1.40 [0.44, 2.37] Mean Difference IV, Random, 95% CI -0.20 [-0.45, 0.05]	HoLEP ThuLEP Mean Difference IV, Random, 95% CI
Total (95% CI) Heterogeneity: Tau ² = Test for overall effect: Study or Subgroup Higazy 2021 Wei 2021	= 0.40; 0 : Z = 2.8 <u>Hean</u> 4.6 10.7	Chi ² = 86 (P = 10LEP 5D 0.7 1.9	104 5.10, d = 0.004 Total 54 80	df = 1 () P Mean 4.8 10.6	P = 0 KEP SD 0.6 2.5	106 .02); I ² Total 53 80	100.0% = 80% Weight 88.6% 11.4%	1.40 [0.44, 2.37] Mean Difference IV, Random, 95% CI -0.20 [-0.45, 0.05] 0.10 [-0.59, 0.79]	-2 -1 0 1 2 HoLEP ThuLEP Mean Difference IV, Random, 95% Cl

Figure 5. Meta-analysis of outcomes. Functional outcomes: a) IPSS.

HoLEP – holmium laser enucleation of the prostate; ThuLEP – thulium laser enucleation of the prostate; SD – standard deviation; Cl – confidence interval; PKEP – plasma kinetic enucleation of the prostate; DiLEP – diode laser enucleation of the prostate

a)



Figure 5. Meta-analysis of outcomes. Functional outcomes: a) IPSS.

HoLEP – holmium laser enucleation of the prostate; ThuLEP – thulium laser enucleation of the prostate; SD – standard deviation; Cl – confidence interval; PKEP – plasma kinetic enucleation of the prostate; DiLEP – diode laser enucleation of the prostate

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tudy or Subgroup	HoLEP Mean SD	Total Me	ThuLEP an SD	Total	Weight	Mean Difference IV, Random. 95% CI	Mean Difference IV, Random. 95% Cl
ecker 2018	3 0.75	46	2 0.5	48	23.6%	1.00 [0.74, 1.26]	
hang 2020	3 0.25	58	2 0.5	58	76.4%	1.00 [0.86, 1.14]	
otal (95% CI)	0.00 5112	104		106	100.0%	1.00 [0.87, 1.13]	
leterogeneity: Tau" =	= 0.00; Chr = 0	0.00, df = 0.0001	1 (P = 1.0))0); I-	= 0%	-	-1 -0.5 0 0.5 1
est for overall effect:	Z = 15.59 (P	< 0.00001)				HoLEP ThuLEP
months							
	PKEP		Dilep			Mean Difference	Mean Difference
study or Subgroup	Mean SD	Total Mea	n SD T	otal	Weight	IV, Random, 95% CI	IV, Random, 95% CI
Vu 2016	1.6 1	40 1.	8 1.2	40	62.7%	-0.20 [-0.68, 0.28]	
(u 2013	1.9 2	40 1.6	5 0.7	40	37.3%	0.25 [-0.41, 0.91]	
Fotal (95% CI)		80		80	100.0%	-0.03 [-0.46, 0.39]	-
leterogeneity: Tau ² =	= 0.01; Chi ² =	1.17, df =	1 (P = 0.	.28); I ²	= 14%	-	-1 -0.5 0 0.5 1
est for overall effect	:: Z = 0.15 (P =	= 0.88)					PKEP DILEP
months							
	Holep		ThuLEP			Mean Difference	Mean Difference
Study or Subgroup	Mean SD	Total Me	an SD	Total	Weight	IV, Random, 95% Cl	IV, Random, 95% CI
Becker 2018	1 0.5	46	1 0.25	48	24.2%	0.00 [-0.16, 0.16]	<u>+</u>
Zhang 2020	1 0.25	58	1 0.25	58	75.8%	0.00 [-0.09, 0.09]	-
Fotal (95% CI)		104		106	100.0%	0.00 [-0.08, 0.08]	+
Heterogeneity: Tau ² =	= 0.00; Chi ² = 0	0.00, df =	1 (P = 1.0)	0); I ² =	= 0%		-05-025 0 025 05
est for overall effect	: Z = 0.00 (P =	1.00)					HOLEP ThuLEP
	PKEP		DiLEP			Mean Difference	Mean Difference
study or Subgroup	Mean SD	Total Mea	n SD	Total	Weight	IV, Random, 95% CI	IV, Random, 95% CI
Vu 2016	1.4 0.8	40 1.	6 1.1	40	26.4%	-0.20 [-0.62, 0.22]	
(u 2013	1.55 0.6	40 1.	5 0.55	40	73.6%	0.05 [-0.20, 0.30]	
(u 2013 F otal (95% CI)	1.55 0.6	40 1. 80	5 0.55	40 80	73.6%	0.05 [-0.20, 0.30] - 0.02 [-0.23. 0.20]	
(u 2013 F otal (95% CI) łeterogeneity: Tau ² =	1.55 0.6	40 1. 80 1.00, df =	5 0.55 1 (P = 0.3	40 80 32); I ²	73.6% 100.0% = 0%	0.05 [-0.20, 0.30] -0.02 [-0.23, 0.20]	
Ku 2013 F otal (95% CI) Heterogeneity: Tau ² = Fest for overall effect:	1.55 0.6 = 0.00; Chi ² = : Z = 0.14 (P =	40 1. 80 1.00, df = (0.89)	5 0.55 1 (P = 0.3	40 80 32); I ²	73.6% 100.0% = 0%	0.05 [-0.20, 0.30] - 0.02 [-0.23, 0.20] -	-1 -0.5 0 0.5 1 PKEP DILEP
(u 2013 F otal (95% CI) Heterogeneity: Tau ² = Fest for overall effect:	1.55 0.6 = 0.00; Chi ² = : Z = 0.14 (P =	40 1. 80 1.00, df = : 0.89)	5 0.55 1 (P = 0.3	40 80 32); I ²	73.6% 100.0% = 0%	0.05 [-0.20, 0.30] -0.02 [-0.23, 0.20] -	-1 -0.5 0 0.5 1 PKEP DILEP
(u 2013 Fotal (95% CI) Heterogeneity: Tau ² = Fest for overall effect 2 months	1.55 0.6 = 0.00; Chi ² = : Z = 0.14 (P =	40 1. 80 1.00, df = (0.89)	5 0.55 1 (P = 0.3	40 80 32); I ²	73.6% 100.0% = 0%	0.05 [-0.20, 0.30] - 0.02 [-0.23, 0.20] -	-1 -0.5 0 0.5 1 PKEP DILEP
(u 2013 Fotal (95% CI) Heterogeneity: Tau ² = Test for overall effect 2 months	1.55 0.6 = 0.00; Chi ² = : Z = 0.14 (P = HoLEP	40 1. 80 1.00, df = : 0.89)	5 0.55 1 (P = 0.3 ThuLEP	40 80 32); I ²	73.6% 100.0% = 0%	0.05 [-0.20, 0.30] -0.02 [-0.23, 0.20] - Mean Difference	-1 -0.5 0 0.5 1 PKEP DILEP
(u 2013 Fotal (95% CI) Heterogeneity: Tau ² = Fest for overall effect: Months Hundright 2021	1.55 0.6 = 0.00; Chi ² = : Z = 0.14 (P = HoLEP Mean SD	40 1. 80 1.00, df = 0.89) Total Me 131 43	5 0.55 1 (P = 0.3 ThuLEP an SD	40 80 32); I ² Total	73.6% 100.0% = 0% Weight	0.05 [-0.20, 0.30] -0.02 [-0.23, 0.20] -0.02 [-0.23, 0.20] - 	-1 -0.5 0 0.5 1 PKEP DILEP Mean Difference IV, Random, 95% CI
(u 2013 Fotal (95% CI) Heterogeneity: Tau ² = Fest for overall effect: 2 months Study or Subgroup 3022ini 2021 2hang 2020	1.55 0.6 = 0.00; Chi ² = : Z = 0.14 (P = <u>HoLEP</u> <u>Mean SD</u> 45.6 11.6 1 0.25	40 1. 80 1.00, df = 0.89) Total Me 121 43 58	5 0.55 1 (P = 0.3 ThuLEP an SD 5.6 12.5 1 0.25	40 80 32); I ² <u>Total</u> 115 58	73.6% 100.0% = 0% Weight 19.1% 80.9%	0.05 [-0.20, 0.30] -0.02 [-0.23, 0.20] Mean Difference IV, Random, 95% CI 5 2.00 [-1.08, 5.08] 5 0.00 [-0.09, 0.09]	-1 -0.5 0 0.5 1 PKEP DiLEP Mean Difference IV, Random, 95% CI
(u 2013 Fotal (95% CI) Heterogeneity: Tau ² = Fest for overall effect 2 months Study or Subgroup Bozzini 2021 Zhang 2020 Fotal (95% CI)	1.55 0.6 = 0.00; Chi ² = : Z = 0.14 (P = <u>HoLEP</u> <u>Mean SD</u> 45.6 11.6 1 0.25	40 1. 80 1.00, df = 0.89) Total Me 121 43 58 170	5 0.55 1 (P = 0.3 ThuLEP an SD 3.6 12.5 1 0.25	40 80 32); I ² Total 115 58	73.6% 100.0% = 0% <u>Weight</u> 19.1% 80.9% 100.0%	Mean Difference IV, Random, 95% CI 2.00 [-0.8, 5.08] 0.00 [-0.09, 0.09]	-1 -0.5 0 0.5 1 PKEP DiLEP Mean Difference IV, Random, 95% CI
(u 2013 Fotal (95% CI) Heterogeneity: Tau ² = Fest for overall effect 2 months Study or Subgroup Sozzini 2021 Zhang 2020 Fotal (95% CI) Heterogeneity: Tau ² =	1.55 0.6 = 0.00; Chi ² = : Z = 0.14 (P = <u>HoLEP</u> <u>Mean SD</u> 45.6 11.6 1 0.25 = 0.76; Chi ² =	40 1. 80 1.00, df = 0.89) Total Me 121 43 58 179 1.62, df =	5 0.55 1 (P = 0.: ThuLEP an SD :.6 12.5 1 0.25 1 (P = 0.2	40 80 32); I ² Total 115 58 173 20): I ²	73.6% 100.0% = 0% Weight 19.1% 80.9% 100.0% = 38%	0.05 [-0.20, 0.30] -0.02 [-0.23, 0.20] Mean Difference IV, Random, 95% CI 2.00 [-1.08, 5.08] 0.00 [-0.09, 0.09] 0.38 [-1.16, 1.93]	-1 -0.5 0 0.5 1 PKEP DILEP Mean Difference IV, Random, 95% CI
(u 2013 Fotal (95% CI) Heterogeneity: Tau ² = Fest for overall effect 2 months Study or Subgroup Bozzini 2021 Zhang 2020 Fotal (95% CI) Heterogeneity: Tau ² = Fest for overall effect	1.55 0.6 = 0.00; Chi ² = : Z = 0.14 (P = <u>HoLEP</u> <u>Mean SD</u> 45.6 11.6 1 0.25 = 0.76; Chi ² = : Z = 0.49 (P =	40 1. 80 1.00, df = 10.89 Total Me 121 43 58 179 1.62, df = 0.63)	5 0.55 1 (P = 0.3 ThuLEP an SD .6 12.5 1 0.25 1 (P = 0.2	40 80 32); I ² Total 115 58 173 20); I ²	73.6% 100.0% = 0% Weight 19.1% 80.9% 100.0% = 38%	0.05 [-0.20, 0.30] -0.02 [-0.23, 0.20] Mean Difference (V, Random, 95% CI 2.00 [-1.08, 5.08] 0.00 [-0.09, 0.09] 0.38 [-1.16, 1.93]	Mean Difference IV, Random, 95% CI
(u 2013 Fotal (95% CI) Heterogeneity: Tau ² = Fest for overall effect: 2 months Study or Subgroup Bozzini 2021 Zhang 2020 Fotal (95% CI) Heterogeneity: Tau ² = Fest for overall effect	1.55 0.6 = 0.00; Chi ² = : Z = 0.14 (P = <u>HoLEP</u> <u>Mean</u> <u>SD</u> 45.6 11.6 1 0.25 = 0.76; Chi ² = : Z = 0.49 (P =	40 1. 80 1.00, df = 0.89) Total Me 121 43 58 179 1.62, df = 0.63)	5 0.55 1 (P = 0.3 ThuLEP an SD 1 0.25 1 (P = 0.2 P(SC)	40 80 32); I ² Total 115 58 173 20); I ²	73.6% 100.0% = 0% Weight 19.1% 80.9% 100.0% = 38%	0.05 [-0.20, 0.30] -0.02 [-0.23, 0.20] Mean Difference IV, Random, 95% CI 2.00 [-1.08, 5.08] 0.00 [-0.09, 0.09] 0.38 [-1.16, 1.93]	Mean Difference IV, Random, 95% CI
(u 2013 Fotal (95% CI) Heterogeneity: Tau ² = Fest for overall effect: 2 months Study or Subgroup Bozzini 2021 Zhang 2020 Fotal (95% CI) Heterogeneity: Tau ² = Fest for overall effect Study or Subgroup	1.55 0.6 = 0.00; Chi ² = : Z = 0.14 (P = <u>HoLEP</u> <u>45.6</u> 11.6 1 0.25 = 0.76; Chi ² = : Z = 0.49 (P = <u>HoLEP</u> <u>HoLEP</u>	40 1. 80 1.00, df = 0.89) Total Me 121 43 58 179 1.62, df = 0.63) Total Mea	5 0.55 1 (P = 0.3 ThuLEP an SD 1 0.25 1 (P = 0.2 PKEP n SD	40 80 32); I ² Total 115 58 173 20); I ² Total	73.6% 100.0% = 0% Weight 19.1% 80.9% 100.0% = 38% Weight	0.05 [-0.20, 0.30] -0.02 [-0.23, 0.20] Mean Difference IV, Random, 95% CI 2.00 [-1.08, 5.08] 0.00 [-0.09, 0.09] 0.38 [-1.16, 1.93] Mean Difference IV, Random, 95% CI	Mean Difference IV, Random, 95% CI HoLEP ThULEP Mean Difference IV. Random, 95% CI
Ku 2013 Fotal (95% CI) Heterogeneity: Tau ² = Fest for overall effect: 2 months Study or Subgroup Bozzini 2021 Zhang 2020 Fotal (95% CI) Heterogeneity: Tau ² = Fest for overall effect Study or Subgroup Habib 2020	1.55 0.6 = 0.00; Chi ² = : Z = 0.14 (P = <u>HoLEP</u> <u>45.6</u> 11.6 1 0.25 = 0.76; Chi ² = : Z = 0.49 (P = <u>HoLEP</u> <u>Mean SD</u> <u>2 0.5</u>	40 1. 80 1.00, df = 0.89) Total Mee 121 43 58 179 1.62, df = 0.63) Total Mea 31	5 0.55 1 (P = 0.3 ThuLEP an 5D 1 0.25 1 0.25 1 (P = 0.2 PKEP n SD 2 0.75	40 80 32); 1 ² Total 115 58 173 20); 1 ² Total 33	73.6% 100.0% = 0% Weight 19.1% 80.9% 100.0% = 38% Weight 20.9%	0.05 [-0.20, 0.30] -0.02 [-0.23, 0.20] Mean Difference [V, Random, 95% CI 5 2.00 [-1.08, 5.08] 5 0.00 [-0.09, 0.09] 5 0.38 [-1.16, 1.93] Mean Difference [V, Random, 95% CI 0.00 [-0.31, 0.31]	Mean Difference IV, Random, 95% CI -4 -2 0 2 4 HoLEP ThuLEP Mean Difference IV, Random, 95% CI
(u 2013 Fotal (95% CI) Heterogeneity: Tau ² = Fest for overall effect 2 months Study or Subgroup Bozzini 2021 Zhang 2020 Fotal (95% CI) Heterogeneity: Tau ² = Fest for overall effect Study or Subgroup Habib 2020 Higazy 2021	1.55 0.6 = 0.00; $Chi^2 =$: Z = 0.14 (P = <u>HoLEP</u> 45.6 11.6 1 0.25 = 0.76; $Chi^2 =$: Z = 0.49 (P = <u>HoLEP</u> <u>Mean SD</u> 2 0.5 1.4 0.5	40 1. 80 1.00, df = 0.89) Total Mee 121 43 58 179 1.62, df = 0.63) Total Mea 31 54 1.	5 0.55 1 (P = 0.3 ThuLEP an 5D 1 0.25 1 (P = 0.2 PKEP n 5D 2 0.75 3 0.5	40 80 322); ² Total 115 58 173 20); ² Total 33 53	73.6% 100.0% = 0% Weight 19.1% 80.9% 100.0% = 38% Weight 20.9% 56.1%	0.05 [-0.20, 0.30] -0.02 [-0.23, 0.20] Mean Difference [V, Random, 95% CI 5 2.00 [-1.08, 5.08] 5 0.00 [-0.09, 0.09] 5 0.38 [-1.16, 1.93] Mean Difference [V, Random, 95% CI 0.00 [-0.31, 0.31] 0.10 [-0.09, 0.23]	Mean Difference IV, Random, 95% CI HoLEP ThULEP Mean Difference IV, Random, 95% CI
(u 2013 Fotal (95% CI) Heterogeneity: Tau ² = Fest for overall effect: 2 months Study or Subgroup Bozzini 2021 Zhang 2020 Fotal (95% CI) Heterogeneity: Tau ² = Fest for overall effect Study or Subgroup Habib 2020 Higazy 2021 Nei 2021	1.55 0.6 = 0.00; $Chi^2 =$: Z = 0.14 (P = <u>HoLEP</u> 45.6 11.6 1 0.25 = 0.76; $Chi^2 =$: Z = 0.49 (P = <u>HoLEP</u> <u>Mean</u> <u>SD</u> 2 0.5 1.4 0.5 1.7 0.9	40 1. 80 1.00, df = 0.89) Total Mee 121 43 58 179 1.62, df = 0.63) Total Mea 31 54 1. 80 1.	5 0.55 1 ($P = 0.3$ ThuLEP an SD 1 0.25 1 ($P = 0.2$ PKEP n SD 2 0.75 3 0.5 6 1	40 80 322); I ² Total 115 58 173 173 173 58 173 173 175 58 173 175 58 173 175 176 176 177 177 177 177 177 177 177 177 177 177 177 177 177 177 177 177 177 177 177 177 177 177 177 177 177 177 177 177 177 177 177 177 177 177 177 177 177 177 177 177 177 177 177 177 177 177 177 177 177 177 177 177 177 177 177 177 177 177 177 177 177 177 177 177 177 177 177 177 177 177 177 177 177 177 177 177 177 177 177 177 177 177 177 177 177 177 177 177 177 177 177 177 177 177 177 177 177 177 177 177 177 177 177 177 177 177 177 177 177 177 177 177 177 177 177 177 177 177 177 177 177 177 177 177 177 177 177 177 177 177 177 177 177 177 177 177 177 177 177 177 177 177 177 177 177 177 177 177 177 177 177 177 177 177 177 177 177 177 177 177 177 177 177 177 177 177 177 177 177 177 177 177 177 177 177 177 177 177 177 177 177 177 177 177 177 177 177 177 177 177 177 177 177 177 177 177 177 177 177 177 177 177 177 177 177 177 177 177 177 177 177 177 177 177 177 177 177 177 177 177 177 177 177 177 177 177 177 177 177 177 177 177 177 177 177 177 177 177 177 177 177 177 177 177 177 177 177 177 177 177 177 177 177 177 177 177 177 177 177 177 177 177 177 177 177 177 177 177 177 177 177 177	73.6% 100.0% = 0% Weight 19.1% 80.9% 100.0% = 38% Weight 20.9% 56.1% 23.0%	0.05 [-0.20, 0.30] -0.02 [-0.23, 0.20] Mean Difference [V, Random, 95% CI 5 2.00 [-1.08, 5.08] 5 0.00 [-0.09, 0.09] 5 0.38 [-1.16, 1.93] Mean Difference [V, Random, 95% CI 0.00 [-0.31, 0.31] 0.10 [-0.09, 0.29] 0.10 [-0.20, 0.40]	Mean Difference IV, Random, 95% CI -4 -2 0 2 4 HoLEP ThuLEP Mean Difference IV, Random, 95% CI
(u 2013 Fotal (95% CI) Heterogeneity: Tau ² = Fest for overall effect: 2 months Study or Subgroup Bozzini 2021 Zhang 2020 Fotal (95% CI) Heterogeneity: Tau ² = Fest for overall effect Study or Subgroup Habib 2020 Higazy 2021 Wei 2021 Fotal (95% CI)	1.55 0.6 = 0.00; $Chi^2 =$: Z = 0.14 (P = <u>HoLEP</u> <u>Mean</u> <u>SD</u> 45.6 11.6 1 0.25 = 0.76; $Chi^2 =$: Z = 0.49 (P = <u>HoLEP</u> <u>Mean</u> <u>SD</u> 2 0.5 1.4 0.5 1.7 0.9	40 1. 80 1.00, df = 0.89) Total Mee 121 43 58 179 1.62, df = 0.63) Total Mea 31 54 1. 80 1. 165	5 0.55 1 (P = 0.3 ThuLEP an SD 1 0.25 1 (P = 0.2 PKEP n SD 2 0.75 3 0.5 6 1	40 80 32); I ² Total 115 58 173 20); I ² Total 33 53 79 165	73.6% 100.0% = 0% Weight 19.1% 80.9% 100.0% Weight 20.9% 56.1% 23.0% 100.0%	0.05 [-0.20, 0.30] -0.02 [-0.23, 0.20] Mean Difference IV, Random, 95% CI 2.00 [-1.08, 5.08] 0.00 [-0.09, 0.09] 0.38 [-1.16, 1.93] Mean Difference IV, Random, 95% CI 0.00 [-0.31, 0.31] 0.10 [-0.09, 0.29] 0.10 [-0.20, 0.40] 0.08 [-0.06, 0.22]	Mean Difference IV, Random, 95% CI HoLEP ThULEP Mean Difference IV, Random, 95% CI
(u 2013 Fotal (95% CI) Heterogeneity: Tau ² = Fest for overall effect: 2 months Study or Subgroup Bozzini 2021 Zhang 2020 Fotal (95% CI) Heterogeneity: Tau ² = Fest for overall effect Study or Subgroup Habib 2020 Higazy 2021 Wei 2021 Fotal (95% CI) Heterogeneity: Tau ² =	1.55 0.6 = 0.00; $Chi^2 =$: Z = 0.14 (P = <u>HoLEP</u> <u>Mean SD</u> 45.6 11.6 1 0.25 = 0.76; $Chi^2 =$: Z = 0.49 (P = <u>HoLEP</u> <u>Mean SD</u> 2 0.5 1.4 0.5 1.7 0.9 = 0.00; $Chi^2 =$	40 1. 80 1.00, df = 0.89) Total Mee 121 43 58 179 1.62, df = 0.63) Total Mea 31 54 1. 80 1. 165 0.32, df =	5 0.55 1 ($P = 0.3$ ThuLEP an SD 1 0.25 1 ($P = 0.2$ PKEP n SD 2 0.75 3 0.5 6 1 2 ($P = 0.3$	40 80 32); I ² Total 115 58 173 20); I ² Total 33 53 79 165 85); I ²	73.6% 100.0% = 0% Weight 19.1% 80.9% 100.0% = 38% Weight 20.9% 56.1% 23.0% 100.0% = 0%	0.05 [-0.20, 0.30] -0.02 [-0.23, 0.20] Mean Difference IV, Random, 95% CI 2.00 [-1.08, 5.08] 0.00 [-0.09, 0.09] 0.38 [-1.16, 1.93] Mean Difference IV, Random, 95% CI 0.00 [-0.31, 0.31] 0.10 [-0.09, 0.29] 0.10 [-0.20, 0.40] 0.08 [-0.06, 0.22]	Mean Difference IV, Random, 95% CI HoLEP Mean Difference IV, Random, 95% CI
Ku 2013 Fotal (95% CI) Heterogeneity: Tau ² = Fest for overall effect: 2 months Study or Subgroup Bozzini 2021 Chang 2020 Fotal (95% CI) Heterogeneity: Tau ² = Fest for overall effect Study or Subgroup Habib 2020 Higazy 2021 Wei 2021 Fotal (95% CI) Heterogeneity: Tau ² = Fest for overall effect	1.55 0.6 = 0.00; $Chi^2 =$: $Z = 0.14$ (P = <u>HoLEP</u> <u>Mean SD</u> 45.6 11.6 1 0.25 = 0.76; $Chi^2 =$: $Z = 0.49$ (P = <u>HoLEP</u> <u>Mean SD</u> 2 0.5 1.4 0.5 1.7 0.9 = 0.00; $Chi^2 =$: $Z = 1.09$ (P =	40 1. 80 1.00, df = 0.89) Total Mee 121 43 58 179 1.62, df = 0.63) Total Mea 31 54 1. 80 1. 165 0.32, df = 0.27)	5 0.55 1 ($P = 0.3$ ThuLEP an SD .6 12.5 1 0.25 1 ($P = 0.2$ PKEP n SD 2 0.75 3 0.5 6 1 2 ($P = 0.3$	40 80 32); I ² Total 115 58 173 20); I ² Total 33 53 79 165 85); I ²	73.6% 100.0% = 0% Weight 19.1% 80.9% 100.0% = 38% Weight 20.9% 56.1% 23.0% 100.0% = 0%	0.05 [-0.20, 0.30] -0.02 [-0.23, 0.20] Mean Difference IV, Random, 95% CI 2.00 [-1.08, 5.08] 0.00 [-0.09, 0.09] 0.38 [-1.16, 1.93] Mean Difference IV, Random, 95% CI 0.00 [-0.31, 0.31] 0.10 [-0.09, 0.29] 0.10 [-0.20, 0.40] 0.08 [-0.06, 0.22]	Mean Difference IV, Random, 95% CI HoLEP Mean Difference IV, Random, 95% CI Mean Difference IV, Random, 95% CI
Ku 2013 Fotal (95% CI) Heterogeneity: Tau ² = Fest for overall effect: 2 months Study or Subgroup 302zini 2021 Zhang 2020 Fotal (95% CI) Heterogeneity: Tau ² = Fest for overall effect Study or Subgroup Habib 2020 Higazy 2021 Wei 2021 Fotal (95% CI) Heterogeneity: Tau ² = Fest for overall effect	1.55 0.6 = 0.00; $Chi^2 =$: $Z = 0.14$ (P = <u>HoLEP</u> <u>Mean SD</u> 45.6 11.6 1 0.25 = 0.76; $Chi^2 =$: $Z = 0.49$ (P = <u>HoLEP</u> <u>Mean SD</u> 2 0.5 1.4 0.5 1.7 0.9 = 0.00; $Chi^2 =$: $Z = 1.09$ (P =	40 1. 80 1.00, df = 0.89) Total Me 121 43 58 179 1.62, df = 0.63) Total Mea 31 54 1. 80 1. 165 0.32, df = 0.27)	5 0.55 1 ($P = 0.3$ ThuLEP an SD .6 12.5 1 0.25 1 ($P = 0.2$ PKEP n SD 2 0.75 3 0.5 6 1 2 ($P = 0.3$.6 12 .6 12.5 .6 12.5 .6 12.5 .7 10.25 .6 12.5 .6 12.5 .5 12.	40 80 32); I ² Total 115 58 173 20); I ² Total 33 53 79 165 85); I ²	73.6% 100.0% = 0% Weight 19.1% 80.9% 100.0% = 38% Weight 20.9% 56.1% 23.0% 100.0% = 0%	0.05 [-0.20, 0.30] -0.02 [-0.23, 0.20] Mean Difference IV, Random, 95% CI 2.00 [-1.08, 5.08] 0.00 [-0.09, 0.09] 0.38 [-1.16, 1.93] Mean Difference IV, Random, 95% CI 0.00 [-0.31, 0.31] 0.10 [-0.20, 0.40] 0.08 [-0.06, 0.22] Mean Difference	Mean Difference IV, Random, 95% CI HoLEP ThuLEP Mean Difference IV, Random, 95% CI Mean Difference IV, Random, 95% CI
(u 2013 Fotal (95% CI) Heterogeneity: Tau ² = Fest for overall effect: 2 months Study or Subgroup 302zini 2021 Zhang 2020 Fotal (95% CI) Heterogeneity: Tau ² = Fest for overall effect Study or Subgroup Habib 2020 Higazy 2021 Wei 2021 Fotal (95% CI) Heterogeneity: Tau ² = Fest for overall effect Study or Subgroup	1.55 0.6 = 0.00; $Chi^2 =$: $Z = 0.14$ (P = HoLEP Mean SD 45.6 11.6 1 0.25 = 0.76; $Chi^2 =$: $Z = 0.49$ (P = HoLEP Mean SD 2 0.5 1.4 0.5 1.7 0.9 = 0.00; $Chi^2 =$: $Z = 1.09$ (P =	40 1. 80 1.00, df = 0.89) Total Mee 121 43 58 179 1.62, df = 0.63) Total Mee 31 54 1. 80 1. 165 0.32, df = 0.27) Total Mee	5 0.55 1 (P = 0.3 ThuLEP an SD .6 12.5 1 0.25 1 (P = 0.2 PKEP n SD 2 0.75 3 0.5 6 1 2 (P = 0.3 DILEP n SD	40 80 32); I ² Total 115 58 173 20); I ² Total 33 53 79 165 85); I ² Total	73.6% 100.0% = 0% Weight 19.1% 80.9% 100.0% = 38% Weight 20.9% 56.1% 23.0% 100.0% = 0% Weight	0.05 [-0.20, 0.30] -0.02 [-0.23, 0.20] Mean Difference IV, Random, 95% CI 2.00 [-1.08, 5.08] 0.00 [-0.09, 0.09] 0.38 [-1.16, 1.93] Mean Difference IV, Random, 95% CI 0.00 [-0.31, 0.31] 0.10 [-0.20, 0.40] 0.08 [-0.06, 0.22] Mean Difference IV, Random, 95% CI	Mean Difference IV, Random, 95% CI Mean Difference IV, Random, 95% CI Mean Difference IV, Random, 95% CI Mean Difference IV, Random, 95% CI Mean Difference IV, Random, 95% CI
(u 2013 Fotal (95% CI) Heterogeneity: Tau ² = Fest for overall effect: 2 months Study or Subgroup Bozzini 2021 Zhang 2020 Fotal (95% CI) Heterogeneity: Tau ² = Fest for overall effect Study or Subgroup Habib 2020 Higazy 2021 Wei 2021 Fotal (95% CI) Heterogeneity: Tau ² = Fest for overall effect Study or Subgroup Mu 2016	1.55 0.6 = 0.00; $Chi^2 =$: Z = 0.14 (P = <u>HoLEP</u> <u>Mean SD</u> 45.6 11.6 1 0.25 = 0.76; $Chi^2 =$: Z = 0.49 (P = <u>HoLEP</u> <u>Mean SD</u> 2 0.5 1.4 0.5 1.7 0.9 = 0.00; $Chi^2 =$: Z = 1.09 (P = <u>PKEP</u> <u>Mean SD</u> 1.2 0.9	40 1. 80 1.00, df = 0.89) Total Mee 121 43 58 179 1.62, df = 0.63) Total Mea 31 54 1. 80 1. 165 0.32, df = 0.27) Total Mea 40 1	5 0.55 1 ($P = 0.3$ ThuLEP an SD 1000 = 0.25 1 ($P = 0.2$ PKEP n SD 2 0.75 3 0.5 6 1 2 ($P = 0.3$ DILEP n SD 3 1.1	40 80 32); I ² Total 1155 58 173 20); I ² Total 33 53 79 165 85); I ² Total 40	73.6% 100.0% = 0% Weight 19.1% 80.9% 100.0% = 38% Weight 20.9% 56.1% 23.0% 100.0% = 0% Weight 18.3%	0.05 [-0.20, 0.30] -0.02 [-0.23, 0.20] Mean Difference IV, Random, 95% CI 2.00 [-1.08, 5.08] 0.00 [-0.09, 0.09] 0.38 [-1.16, 1.93] Mean Difference IV, Random, 95% CI 0.00 [-0.31, 0.31] 0.10 [-0.20, 0.40] 0.08 [-0.06, 0.22] Mean Difference IV, Random, 95% CI -0.10 [-0.54, 0.34]	Mean Difference IV, Random, 95% CI Mean Difference IV, Random, 95% CI Mean Difference IV, Random, 95% CI Mean Difference IV, Random, 95% CI Mean Difference IV, Random, 95% CI
Ku 2013 Fotal (95% CI) Heterogeneity: Tau ² = Fest for overall effect: 2 months Study or Subgroup 302zini 2021 Zhang 2020 Fotal (95% CI) Heterogeneity: Tau ² = Fest for overall effect Study or Subgroup Habib 2020 Higazy 2021 Wei 2021 Fotal (95% CI) Heterogeneity: Tau ² = Fest for overall effect Study or Subgroup Wei 2021 Fotal (95% CI) Heterogeneity: Tau ² = Fest for overall effect Study or Subgroup Wu 2016 Ku 2013	1.55 0.6 = 0.00; $Chi^2 =$: Z = 0.14 (P = Mean SD 45.6 11.6 1 0.25 = 0.76; $Chi^2 =$: Z = 0.49 (P = HoLEP Mean SD 2 0.5 1.4 0.5 1.7 0.9 = 0.00; $Chi^2 =$: Z = 1.09 (P = Mean SD 1.2 0.9 1.2 0.9 1.2 0.5	40 1. 80 1.00, df = 0.89) Total Mee 121 43 58 179 1.62, df = 0.63) Total Mee 31 54 1. 80 1. 165 0.32, df = 0.27) Total Mee 40 1. 40 1. 41 4. 43 4. 43 4. 43 4. 43 4. 44 4. 4	5 0.55 1 ($P = 0.3$ ThuLEP an SD .6 12.5 1 0.25 1 ($P = 0.2$ PKEP n SD 2 0.75 3 0.5 6 1 2 ($P = 0.3$ DILEP in SD 3 1.1 2 0.45	40 80 32); I ² Total 115 58 173 20); I ² Total 33 53 79 165 8 5); I ² Total 40 40 40	73.6% 100.0% = 0% Weight 19.1% 80.9% 100.0% = 38% Weight 20.9% 56.1% 23.0% 100.0% = 0% Weight 18.3% 81.7%	0.05 [-0.20, 0.30] -0.02 [-0.23, 0.20] Mean Difference IV, Random, 95% CI 2.00 [-1.08, 5.08] 0.00 [-0.09, 0.09] 0.38 [-1.16, 1.93] Mean Difference IV, Random, 95% CI 0.00 [-0.31, 0.31] 0.10 [-0.20, 0.40] 0.08 [-0.06, 0.22] Mean Difference IV, Random, 95% CI -0.10 [-0.54, 0.34] 0.00 [-0.21, 0.21]	Mean Difference IV, Random, 95% CI Mean Difference IV, Random, 95% CI Mean Difference IV, Random, 95% CI Mean Difference IV, Random, 95% CI Mean Difference IV, Random, 95% CI
(u 2013 Fotal (95% CI) Heterogeneity: Tau ² = Fest for overall effect: 2 months Study or Subgroup 302zini 2021 Zhang 2020 Fotal (95% CI) Heterogeneity: Tau ² = Fest for overall effect Study or Subgroup Habib 2020 Higazy 2021 Nei 2021 Fotal (95% CI) Heterogeneity: Tau ² = Fest for overall effect Study or Subgroup Nu 2016 (u 2013 Fotal (95% CI)	1.55 0.6 = 0.00; $Chi^2 =$: $Z = 0.14$ (P = Mean SD 45.6 11.6 1 0.25 = 0.76; $Chi^2 =$: $Z = 0.49$ (P = HoLEP Mean SD 2 0.5 1.4 0.5 1.7 0.9 = 0.00; $Chi^2 =$: $Z = 1.09$ (P = Mean SD 1.2 0.9 1.2 0.5	40 1. 80 1.00, df = 0.89) Total Mee 121 43 58 179 1.62, df = 0.63) Total Mee 31 54 1. 80 1. 165 0.32, df = 0.27) Total Mee 40 1. 80	5 0.55 1 ($P = 0.3$ 1 ($P = 0.3$ 1 ($P = 0.2$ 1 ($P = 0.2$ 1 ($P = 0.2$ 1 ($P = 0.2$ 1 ($P = 0.3$ 2 0.75 3 0.5 6 1 2 0.75 3 0.5 6 1 2 0.75 3 0.5 6 1 2 0.75 3 0.5 6 1 2 0.45	40 80 32); I ² Total 115 58 173 20); I ² Total 33 53 79 165 8 5); I ² Total 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 	73.6% 100.0% = 0% Weight 19.1% 80.9% 100.0% = 38% Weight 20.9% 56.1% 23.0% 100.0% = 0% Weight 18.3% 81.7% 100.0%	Mean Difference IV, Random, 95% CI 2.00 [-1.08, 5.08] 0.00 [-0.09, 0.09] 0.38 [-1.16, 1.93] Mean Difference IV, Random, 95% CI 0.00 [-0.31, 0.31] 0.10 [-0.20, 0.40] 0.08 [-0.06, 0.22] Mean Difference IV, Random, 95% CI -0.10 [-0.54, 0.34] 0.00 [-0.21, 0.21] -0.02 [-0.21, 0.17]	Mean Difference IV, Random, 95% CI Mean Difference IV, Random, 95% CI
(u 2013 Fotal (95% CI) Heterogeneity: Tau ² = Fest for overall effect: 2 months Study or Subgroup Sozzini 2021 Chang 2020 Fotal (95% CI) Heterogeneity: Tau ² = Fest for overall effect Hudy or Subgroup Habib 2020 Higazy 2021 Vei 2021 Fotal (95% CI) Heterogeneity: Tau ² = Fest for overall effect Hudy or Subgroup Vu 2016 (u 2013 Fotal (95% CI) Heterogeneity: Tau ² =	1.55 0.6 = 0.00; $Chi^2 =$: Z = 0.14 (P = <u>HoLEP</u> <u>Mean SD</u> 45.6 11.6 1 0.25 = 0.76; $Chi^2 =$: Z = 0.49 (P = <u>HoLEP</u> <u>Mean SD</u> 2 0.5 1.4 0.5 1.7 0.9 = 0.00; $Chi^2 =$: Z = 1.09 (P = <u>Mean SD</u> 1.2 0.9 1.2 0.5 = 0.00; $Chi^2 =$	40 1. 80 1.00, df = 0.89) Total Mee 121 43 58 179 1.62, df = 0.63) Total Mea 31 54 1. 80 1. 165 0.32, df = 0.27) Total Mea 40 1. 40 1. 80 0.16, df =	5 0.55 1 ($P = 0.3$ ThuLEP an SD 6 12.5 1 0.25 1 ($P = 0.2$ PKEP n SD 2 0.75 3 0.5 6 1 2 ($P = 0.3$ DILEP n SD 3 1.1 2 0.45 1 ($P = 0.45$	40 80 32); I ² Total 1155 58 173 58 173 58 173 175 58 175 175 175 175 175 175 175 175 175 175 175 175 175 175 175 175 175 175 175 175 175 175 175 175 175 175 175 175 175 175 175 175 175 175 175 175 175 175 175 175 175 175 175 175 175 175 175 175 175 175 175 175 175 175 175 175 175 175 175 175 175 175 175 175 175 175 175 175 175 175 175 175 175 175 175 175 175 175 175 175 175 175 175 175 175 175 175 175 175 175 175 175 175 175 175 175 175 175 175 175 175 175 175 175 175 175 175 175 175 175 175 175 175 175 175 175 175 175 175 175 175 175 175 175 175 175 175 175 175 175 175 175 175 175 175 175 175 175 175 175 175 175 175 175 175 175 175 175 175 175 175 175 175 175 175 175 175 175 175 175 175 175 175 175 175 175 175 175 175 175 175 175 175 175 175 175 175 175 175 175 175 175 175 175 175 175 175 175 175 175 175 175 175 175 175 175 175 175 175 175 175 175 175 175 175 175 175 175 175 175 175 175 175 175 175 175 175 175 175 175 175 175 175 175 175 175 175 175 175 175 175 175 175 175 175 175 175 175 175 175 175 175 175 175 175 175 175 175 175 175 175 175 175 175 175 175 175 175 175 175 175 175 175 175 175 175 175 175 175 175 175 175 175 175 175 175 175 175 175 175 175	73.6% 100.0% = 0% Weight 19.1% 80.9% 100.0% = 38% Weight 20.9% 56.1% 23.0% 100.0% = 0% Weight 18.3% 81.7% 100.0% = 0%	Mean Difference IV, Random, 95% CI 0.00 [-0.02, 0.030] 0.038 [-1.16, 1.93] Mean Difference IV, Random, 95% CI 0.00 [-0.09, 0.09] 0.038 [-1.16, 1.93] Mean Difference IV, Random, 95% CI 0.00 [-0.20, 0.40] 0.08 [-0.06, 0.22] Mean Difference IV, Random, 95% CI -0.10 [-0.54, 0.34] 0.00 [-0.21, 0.21] -0.02 [-0.21, 0.17]	Mean Difference IV, Random, 95% CI -1 -0.5 0 0.5 1 PKEP DILEP Mean Difference IV, Random, 95% CI -0.5 -0.25 0 0.25 0.5 HOLEP PKEP Mean Difference IV, Random, 95% CI

Figure 5. Meta-analysis of outcomes. Functional outcomes: b) QoL.

HoLEP – holmium laser enucleation of the prostate; ThuLEP – thulium laser enucleation of the prostate; SD – standard deviation; Cl – confidence interval; PKEP – plasma kinetic enucleation of the prostate; DiLEP – diode laser enucleation of the prostate

c)

1 months

	HoLE	2	Thu	LEP		Mean Difference	Mean Difference
Study or Subgroup	Mean SE) Tota	Mean	SD Tota	l Weight	IV, Random, 95% CI	IV, Random, 95% CI
Becker 2018	21.3 2.4	5 46	22	8.1 4	8 62.0%	-0.70 [-1.83, 0.43]	
Zhang 2020	22.8 4.3	1 58	23.3	5.8 5	8 38.0%	-0.50 [-1.94, 0.94]	
Total (95% CI)		104	•	10	5 100.0%	-0.62 [-1.51, 0.26]	
Heterogeneity: Tau ² =	= 0.00; Chi ² =	.0.05,	df = 1 (P =	= 0.83);	$ ^2 = 0\%$		<u> </u>
Test for overall effect	t: Z = 1.38 (P	= 0.17))				-2 -1 0 1 2 Thui FP Hol FP
	Holep	,	PKE	P		Mean Difference	Mean Difference
Study or Subgroup	Mean SD	Total	Mean S	D Total	Weight	IV, Random, 95% CI	IV, Random, 95% Cl
Higazy 2021	24.8 2	54	23.2 1	.8 53	51.7%	1.60 [0.88, 2.32]	
Wei 2021	21.6 2.6	80	20.9 2	.5 80	48.3%	0.70 [-0.09, 1.49]	
Total (95% CI)		134		133	100.0%	1.17 [0.28, 2.05]	
Heterogeneity: Tau ²	= 0.26; Chi ² =	= 2.72,	df = 1 (P	= 0.10);	$l^2 = 63\%$		
Test for overall effect	t: $Z = 2.59$ (P	= 0.01	0)				
							THE HOLE
months							
	HoLEP		Thul	.EP		Mean Difference	Mean Difference
Study or Subgroup	Mean SD	Total	Mean S	D Tota	i Weight	IV, Random, 95% Cl	IV, Random, 95% Cl
Bozzini 2021	20.8 9.8	121	25.9 11	.1 115	47.4%	-5.10 [-7.78, -2.42]	
Zhang 2020	24.8 4.7	58	25.2 4	.4 50	52.6%	-0.40 [-2.06, 1.26]	
Total (95% CI)		179		173	100.0%	-2.63 [-7.23, 1.97]	
Heterogeneity: Tau ² =	= 9.76; Chi ² =	8.56, 0	df = 1 (P =	= 0.003);	$l^2 = 88\%$		
Test for overall effect:	: Z = 1.12 (P	= 0.26)					-10 -5 0 5 10 ThuLEP HoLEP
Study or Subarow	PKEP	Total	DiL	EP D. Total	Wolaht	Mean Difference	Mean Difference
Wu 2016	16 2 7 2	10(4)	175 C	6 40	29 GP	-1 20 [-4 25 1 95]	
V. 2010	22 9 4 5	40	23.1 4	3 40	28.0%	-0.20 [-2.13 1 73]	
XU ZU 1 5		.0			1 2. 170	0.20 [2.15, 1.75]	Т
Xu 2013	22.9 4.9						
Total (95% CI)	22.5 4.5	80		80	100.0%	-0.49 [-2.12, 1.14]	
Total (95% CI) Heterogeneity: Tau ² =	= 0.00; Chi ² =	80 = 0.30,	df = 1 (P	80 = 0.59);	100.0% $I^2 = 0\%$	-0.49 [-2.12, 1.14]	
Total (95% CI) Heterogeneity: Tau ² = Test for overall effect	= 0.00; Chi ² = t: Z = 0.58 (P	80 = 0.30, = 0.56	df = 1 (P)	80 = 0.59);	100.0% $I^2 = 0\%$	-0.49 [-2.12, 1.14] -	-4 -2 0 2 4 DiLEP PKEP
Total (95% CI) Heterogeneity: Tau ² = Test for overall effect	= 0.00; Chi ² = t: Z = 0.58 (P	80 = 0.30, = 0.56	df = 1 (P)	80 = 0.59);	100.0% $I^2 = 0\%$	-0.49 [-2.12, 1.14] -	-4 -2 0 2 4 Dilep pkep
Total (95% CI) Heterogeneity: Tau ² : Test for overall effect	= 0.00; Chi ² = t: Z = 0.58 (P	80 = 0.30, = 0.56	df = 1 (P)	80 = 0.59);	100.0% I ² = 0%	-0.49 [-2.12, 1.14] -	-4 -2 0 2 4 DILEP PKEP
Total (95% CI) Heterogeneity: Tau ² : Test for overall effect months	= 0.00; Chi ² = t: Z = 0.58 (P	80 = 0.30, = 0.56	df = 1 (P)	80 = 0.59);	100.0% I ² = 0%	-0.49 [-2.12, 1.14] -	-4 -2 0 2 4 Dilep pkep
Total (95% CI) Heterogeneity: Tau ² : Test for overall effect months	= 0.00; Chi ² = t: Z = 0.58 (P HoLEP	80 = 0.30, = 0.56	df = 1 (P) ThuL	80 = 0.59); EP	100.0% I ² = 0%	-0.49 [-2.12, 1.14] -	-4 -2 0 2 4 DiLEP PKEP
Total (95% CI) Heterogeneity: Tau ² : Test for overall effect months Study or Subgroup	= 0.00; Chi ² = t: Z = 0.58 (P HoLEP Mean SD	80 = 0.30, = 0.56	df = 1 (P) ThuL Mean Si	80 = 0.59); EP D Total	100.0% I ² = 0% Weight	-0.49 [-2.12, 1.14] - Mean Difference IV, Random, 95% CI	-4 -2 0 2 4 DiLEP PKEP Mean Difference IV, Random, 95% CI
Total (95% CI) Heterogeneity: Tau ² : Test for overall effect months Study or Subgroup Becker 2018	= 0.00; Chi ² = t: Z = 0.58 (P HoLEP <u>Mean SD</u> 25 5.6	80 = 0.30, = 0.56 <u>Total</u> 46	df = 1 (P) ThuL <u>Mean S</u> 25.9 4.	80 = 0.59); EP D Total 7 48	100.0% I ² = 0% Weight 42.0%	-0.49 [-2.12, 1.14] Mean Difference IV, Random, 95% CI -0.90 [-2.99, 1.19]	Mean Difference
Total (95% CI) Heterogeneity: Tau ² : Test for overall effect months Study or Subgroup Becker 2018 Zhang 2020	= 0.00; Chi ² = t: Z = 0.58 (P <u>HoLEP</u> <u>Mean SD</u> 25 5.6 26 4.5	80 = 0.30, = 0.56 <u>Total</u> 46 58	df = 1 (P) ThuL <u>Mean S</u> 25.9 4. 25.3 4.	80 = 0.59); EP D Total 7 48 7 58	100.0% I ² = 0% Weight 42.0% 58.0%	-0.49 [-2.12, 1.14] Mean Difference IV, Random, 95% CI -0.90 [-2.99, 1.19] 0.70 [-0.97, 2.37]	Mean Difference IV, Random, 95% CI
Total (95% CI) Heterogeneity: Tau ² : Test for overall effect months Study or Subgroup Becker 2018 Zhang 2020	= 0.00; Chi ² = t: Z = 0.58 (P <u>HoLEP</u> <u>Mean SD</u> 25 5.6 26 4.5	80 = 0.30, = 0.56 <u>Total</u> 46 58	df = 1 (P) ThuL <u>Mean S</u> 25.9 4. 25.3 4.	80 = 0.59); EP D Total 7 48 7 58	100.0% $I^2 = 0\%$ Weight 42.0% 58.0% 100.0%	-0.49 [-2.12, 1.14] Mean Difference IV, Random, 95% CI -0.90 [-2.99, 1.19] 0.70 [-0.97, 2.37]	Mean Difference IV, Random, 95% CI
Total (95% CI) Heterogeneity: Tau ² : Test for overall effect months Study or Subgroup Becker 2018 Zhang 2020 Total (95% CI)	= 0.00; Chi2 = t: Z = 0.58 (P)HolEPMean SD25 5.626 4.5	80 = 0.30, = 0.56 <u>Total</u> 46 58 104	df = 1 (P) ThuL Mean S 25.9 4. 25.3 4.	80 = 0.59); EP D Total 7 48 7 58 106	Weight 42.0% 58.0% 100.0%	-0.49 [-2.12, 1.14] Mean Difference IV, Random, 95% CI -0.90 [-2.99, 1.19] 0.70 [-0.97, 2.37] 0.03 [-1.52, 1.58]	Mean Difference IV, Random, 95% CI
Total (95% CI) Heterogeneity: Tau ² = Test for overall effect months Study or Subgroup Becker 2018 Zhang 2020 Total (95% CI) Heterogeneity: Tau ² = Test for overall effect?	= 0.00; Chi2 = 0.58 (P) $= 0.58 (P)$ $= 0.54 (P)$	80 = 0.30, = 0.56 <u>Total</u> 46 58 104 - 1.37, = 0.97	df = 1 (P) <u>Mean S</u> 25.9 4. 25.3 4. df = 1 (P	80 = 0.59); EP D Total 7 48 7 58 106 = 0.24);	100.0% l ² = 0% Weight 42.0% 58.0% 100.0% l ² = 27%	-0.49 [-2.12, 1.14] Mean Difference IV, Random, 95% CI -0.90 [-2.99, 1.19] 0.70 [-0.97, 2.37] 0.03 [-1.52, 1.58]	Mean Difference IV, Random, 95% CI
Total (95% CI) Heterogeneity: Tau ² : Test for overall effect months Study or Subgroup Becker 2018 Zhang 2020 Fotal (95% CI) Heterogeneity: Tau ² = Fest for overall effect:	= 0.00; Chi2 = t: Z = 0.58 (P)Mean SD25 5.626 4.5= 0.34; Chi2 =: Z = 0.04 (P)	80 = 0.30, = 0.56 <u>Total</u> 46 58 104 = 1.37, 6 = 0.97)	df = 1 (P) <u>Mean S</u> 25.9 4. 25.3 4. df = 1 (P	80 = 0.59); EP D Total 7 48 7 58 106 = 0.24);	$\frac{\text{Weight}}{42.0\%}$ $\frac{100.0\%}{58.0\%}$	-0.49 [-2.12, 1.14] Mean Difference IV, Random, 95% CI -0.90 [-2.99, 1.19] 0.70 [-0.97, 2.37] 0.03 [-1.52, 1.58]	Mean Difference IV, Random, 95% CI
Total (95% CI) Heterogeneity: Tau ² : Test for overall effect months Study or Subgroup Becker 2018 Zhang 2020 Total (95% CI) Heterogeneity: Tau ² = Test for overall effect:	= 0.00; Chi ² = t: Z = 0.58 (P <u>HoLEP</u> <u>Mean SD</u> 25 5.6 26 4.5 = 0.34; Chi ² = : Z = 0.04 (P <u>PKEP</u>	80 = 0.30, = 0.56 <u>Total</u> 46 58 104 = 1.37, e = 0.97)	df = 1 (P) <u>Mean S</u> 25.9 4. 25.3 4. df = 1 (P	80 = 0.59); EP D Total 7 48 7 58 106 = 0.24); EP	$\frac{ 100.0\% }{ 2 ^2} = 0\%$ $\frac{ Weight }{ 42.0\% }$ $\frac{ 42.0\% }{ 58.0\% }$ $ 100.0\% $ $ 2 ^2 = 2.7\%$	-0.49 [-2.12, 1.14] Mean Difference IV, Random, 95% CI -0.90 [-2.99, 1.19] 0.70 [-0.97, 2.37] 0.03 [-1.52, 1.58] - Mean Difference	-4 -2 0 2 4 DiLEP PKEP Mean Difference IV, Random, 95% CI
Total (95% CI) Heterogeneity: Tau ² : Test for overall effect months Study or Subgroup Becker 2018 Zhang 2020 Total (95% CI) Heterogeneity: Tau ² = Test for overall effect: Study or Subgroup	= 0.00; Chi ² = t: Z = 0.58 (P HoLEP Mean SD 25 5.6 26 4.5 = 0.34; Chi ² = : Z = 0.04 (P PKEP Mean SD	80 = 0.30, = 0.56 <u>Total</u> 46 58 104 = 0.97) Total	df = 1 (P) <u>Mean S</u> 25.9 4. 25.3 4. df = 1 (P <u>DiLl</u> Mean S	80 = 0.59); P D Total 7 48 7 58 106 = 0.24); P D Total	Weight 42.0% 58.0% 100.0% 1 ² = 2.7% Weight	-0.49 [-2.12, 1.14] Mean Difference IV, Random, 95% CI -0.90 [-2.99, 1.19] 0.70 [-0.97, 2.37] 0.03 [-1.52, 1.58] Mean Difference IV, Random, 95% CI	Mean Difference IV, Random, 95% CI
Total (95% CI) Heterogeneity: Tau ² : Test for overall effect months Study or Subgroup Becker 2018 Zhang 2020 Total (95% CI) Heterogeneity: Tau ² = Test for overall effect: Study or Subgroup Wu 2016	E22.9 4.3 = 0.00; Chi ² = t: Z = 0.58 (P Mean SD 25 5.6 26 4.5 = 0.34; Chi ² = : Z = 0.04 (P PKEP Mean SD 18.5 8.2	80 = 0.30, = 0.56 <u>Total</u> 46 58 104 1.37, = 0.97) <u>Total</u> 40	df = 1 (P) <u>Mean S</u> 25.9 4. 25.3 4. df = 1 (P <u>DiLt</u> <u>Mean S</u> 19.8 9.	80 = 0.59); D Total 7 48 7 58 106 = 0.24); EP D Total 3 40	Weight 42.0% 58.0% 100.0% 1 ² = 2.7% Weight 17.3%	-0.49 [-2.12, 1.14] Mean Difference IV, Random, 95% CI -0.90 [-2.99, 1.19] 0.70 [-0.97, 2.37] 0.03 [-1.52, 1.58] Mean Difference IV, Random, 95% CI -1.30 [-5.14, 2.54]	Mean Difference IV, Random, 95% CI
Total (95% CI) Heterogeneity: Tau ² : Test for overall effect months Study or Subgroup Becker 2018 Zhang 2020 Total (95% CI) Heterogeneity: Tau ² = Test for overall effect: Study or Subgroup Wu 2016 Xu 2013	HoLEP Mean SD 25 5.6 26 4.5 = 0.34; Chi ² = : Z = 0.04 (P Mean SD 18.5 8.2 23.1 4.3	80 = 0.30, = 0.56 Total 46 58 104 1.37, = 0.97) Total 40 40	df = 1 (P) <u>Mean Si</u> 25.9 4. 25.3 4. df = 1 (P) <u>DILI</u> <u>Mean S</u> 19.8 9. 23.3 3.	80 = 0.59); D Total 7 48 7 58 106 = 0.24); P Total 3 40 7 40	Weight 42.0% 58.0% 100.0% 1 ² = 2.7% Weight 17.3% 82.7%	-0.49 [-2.12, 1.14] Mean Difference IV, Random, 95% CI -0.90 [-2.99, 1.19] 0.70 [-0.97, 2.37] 0.03 [-1.52, 1.58] Mean Difference IV, Random, 95% CI -1.30 [-5.14, 2.54] -0.20 [-1.96, 1.56]	Mean Difference IV, Random, 95% CI -2 -1 0 1 2 ThuLEP HoLEP Mean Difference IV, Random, 95% CI
Total (95% CI) Heterogeneity: Tau ² : Test for overall effect months Study or Subgroup Becker 2018 Zhang 2020 Total (95% CI) Heterogeneity: Tau ² = Test for overall effect: Study or Subgroup Wu 2016 Xu 2013	= 0.00; Chi2 = $= 0.00; Chi2 =$ $t: Z = 0.58 (P$ $Mean SD$ $25 5.6$ $26 4.5$ $= 0.34; Chi2 =$ $: Z = 0.04 (P$ $PKEP$ $Mean SD$ $18.5 8.2$ $23.1 4.3$	80 = 0.30, = 0.56 Total 46 58 104 1.37, 6 = 0.97) Total 40 40	df = 1 (P) <u>Mean SJ</u> 25.9 4. 25.3 4. df = 1 (P <u>Dill Mean S</u> 19.8 9. 23.3 3.	80 = 0.59); EP D Total 7 48 7 58 106 = 0.24); EP D Total 3 40 7 40 7 40	100.0% l² = 0% Weight 42.0% 58.0% 100.0% l² = 27% Weight 17.3% 82.7%	-0.49 [-2.12, 1.14] Mean Difference IV, Random, 95% CI 0.90 [-2.99, 1.19] 0.70 [-0.97, 2.37] 0.03 [-1.52, 1.58] Mean Difference IV, Random, 95% CI -1.30 [-5.14, 2.54] -0.20 [-1.96, 1.56] 0.02 [-1.96, 0.55]	Mean Difference IV, Random, 95% CI
Total (95% CI) Heterogeneity: Tau ² : Test for overall effect months Study or Subgroup Becker 2018 Zhang 2020 Total (95% CI) Heterogeneity: Tau ² = Test for overall effect: Study or Subgroup Wu 2016 Xu 2013 Total (95% CI)	HoLEP $Mean SD$ $25 5.6$ $26 4.5$ $= 0.34; Chi2 =$ $Z = 0.04 (P$ REP $Mean SD$ $18.5 8.2$ $23.1 4.3$	80 = 0.30, = 0.56 Total 46 58 104 1.37, 0 = 0.97) Total 40 80 80	$df = 1 (P)$ $\frac{Mean S}{25.9 4.}$ $25.9 4.$ $25.3 4.$ $df = 1 (P)$ $\frac{Mean S}{19.8 9.}$ $23.3 3.$	80 = 0.59); EP D Total 7 48 7 58 106 = 0.24); EP D Total 3 40 7 40 0 0 000	Weight 42.0% 58.0% 100.0% 2 100.0% 100.0% 12 27% Weight 17.3% 82.7% 100.0%	-0.49 [-2.12, 1.14] Mean Difference IV, Random, 95% CI -0.90 [-2.99, 1.19] 0.70 [-0.97, 2.37] 0.03 [-1.52, 1.58] -0.03 [-1.52, 1.58] -1.30 [-5.14, 2.54] -0.20 [-1.96, 1.56] -0.39 [-1.99, 1.21]	Mean Difference IV, Random, 95% CI
Total (95% CI) Heterogeneity: Tau ² : Test for overall effect months Study or Subgroup Becker 2018 Zhang 2020 Total (95% CI) Heterogeneity: Tau ² = Test for overall effect: Study or Subgroup Wu 2016 Xu 2013 Total (95% CI) Heterogeneity: Tau ² =	HoLEP = 0.00; Chi2 = 0.00; Chi2 = 0.58 (P) $HoLEP = 0.58 (P)$ $25 5.6 = 0.34; Chi2 = 0.$	80 = 0.30, = 0.56 Total 46 58 104 = 0.97) Total 40 40 80 80 .26,	df = 1 (P) <u>Mean S</u> 25.9 4. 25.3 4. df = 1 (P <u>Dill</u> <u>Mean S</u> 19.8 9. 23.3 3. df = 1 (P	80 = 0.59); EP D Total 7 58 106 = 0.24); EP D Total 3 40 7 40 80 = 0.61);	$\begin{array}{r} \textbf{100.0\%} \\ \hline \textbf{Weight} \\ 42.0\% \\ 58.0\% \\ \hline \textbf{100.0\%} \\ l^2 = 27\% \\ \hline \textbf{Weight} \\ 17.3\% \\ 82.7\% \\ \hline \textbf{100.0\%} \\ l^2 = 0\% \end{array}$	-0.49 [-2.12, 1.14] Mean Difference IV, Random, 95% CI -0.90 [-2.99, 1.19] 0.70 [-0.97, 2.37] 0.03 [-1.52, 1.58] - Mean Difference IV, Random, 95% CI -1.30 [-5.14, 2.54] -0.20 [-1.96, 1.56] -0.39 [-1.99, 1.21]	Mean Difference IV, Random, 95% CI

Figure 5. Meta-analysis of outcomes. Functional outcomes: c) QoL.

HoLEP – holmium laser enucleation of the prostate; ThuLEP – thulium laser enucleation of the prostate; SD – standard deviation; Cl – confidence interval; PKEP – plasma kinetic enucleation of the prostate; DiLEP – diode laser enucleation of the prostate

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tudy or Subaroup	HOLEP Mean SD	Total	Mean SD	Total	Weight	IV. Random 95% CI	Wean Difference
lozzini 2021	19.4 12.6	121	26.1 7 8	115	49.1%	-6.70 [-9.364.04]	
hang 2020	26.6 4.9	58	25.5 4.5	58	50.9%	1.10 [-0.61, 2.81]	- -
Total (95% CI)		179		173	100.0%	-2.73 [-10.37, 4.91]	
leterogeneity: Tau ² =	29.12; Chi ² =	23.36	, df = 1 (P	< 0.000	01); $ ^2 =$	96%	-10 -5 0 5 10
lest for overall effect:	Z = 0.70 (P =	0.48)					ThuLEP HoLEP
	HoLEP		PKE	Р		Mean Difference	Mean Difference
study or Subgroup	Mean SE) Tota	l Mean S	D Tota	l Weigh	t IV, Random, 95% CI	IV, Random, 95% CI
labib 2020	25.6 11.25	5 33	25 9	1 3	L 2.59	6 0.60 [-4.40, 5.60]	
Vei 2021	23 1.9	80	23.25	2 7	50.19	6 -0.25 [-0.86, 0.36]	
Total (95% CI)		167	,	16	3 100.09	6 0.22 [-0.58, 1.02]	•
leterogeneity: Tau ² =	0.24; Chi ² =	4.32, d	f = 2 (P = 0)	.12); I ²	= 54%		— <u> </u>
Test for overall effect:	Z = 0.54 (P =	0.59)					PKEP HOLEP
	PKEP		DILEP			Mean Difference	Mean Difference
Study or Subgroup	Mean SD	Total	Mean SD	Total	Weight	IV, Random, 95% CI	IV, Random, 95% CI
Wu 2016	17 6.7	40	18.2 6.3	40	17.7%	-1.20 [-4.05, 1.65]	<u>-</u>
(u 2013	23.3 3.7	40	23.45 3.3	40	61.1%	-0.15 [-1.69, 1.39]	
200 2018	28.1 7.2	57	28 7	57	21.2%	0.10 [-2.51, 2.71]	
Total (95% CI)		137		137	100.0%	-0.28 [-1.48, 0.92]	+
leterogeneity: Tau ² =	= 0.00; Chi ² =	0.51, 0	df = 2 (P =	0.78); l ²	= 0%	-	
Test for overall effect	: Z = 0.46 (P =	= 0.64)					DILEP PKEP
)							
month							
monur				-		New Difference	New Difference
Study or Subgroup	HoLEP Mean SD	Tatal	ThuL		Weight	Mean Difference	Mean Difference
SLUDY OF SHITTEN		1012	Mean N	j jnia			IV. Random 95% (
Becker 2018	30 16.9	46	Mean S	5 48	47.9%	16.00 [9.53, 22.47]	
Becker 2018 Zhang 2020	30 16.9 15.9 5.05	46	Mean SI 14 1 15 6.	5 48 5 58	47.9%	16.00 [9.53, 22.47] 0.90 [-1.22, 3.02]	
Becker 2018 Zhang 2020	30 16.9 15.9 5.05	46 58	14 1 15 6.	5 48 5 58	47.9% 52.1%	16.00 [9.53, 22.47] 0.90 [-1.22, 3.02]	IV, Random, 95% CI
Becker 2018 Zhang 2020 Total (95% CI) Heterogeneity: Tau ² :	30 16.9 15.9 5.05	46 58 104 $2^2 = 18.5$	Mean SI 14 1 15 6.	$\frac{5}{5}$ $\frac{48}{5}$ $\frac{106}{106}$	47.9% 52.1% 100.0%	16.00 [9.53, 22.47] 0.90 [-1.22, 3.02] 8.13 [-6.66, 22.91]	
Becker 2018 Becker 2018 Zhang 2020 Total (95% CI) Heterogeneity: Tau ² Test for overall effect	30 16.9 15.9 5.05 = 107.97; Chit t: Z = 1.08 (P	46 58 104 $2^2 = 18.5$ = 0.28)	<u>Mean Si</u> 14 1 15 6. 90, df = 1 (5 48 5 58 106 P < 0.0	47.9% 52.1% 100.0% 001); I ² =	16.00 [9.53, 22.47] 0.90 [-1.22, 3.02] 8.13 [-6.66, 22.91] 95%	-20 -10 0 10 20 HoLEP ThuLEP
Becker 2018 Becker 2018 Zhang 2020 Total (95% CI) Heterogeneity: Tau ² Test for overall effect	30 16.9 15.9 5.05 = 107.97; Chi t: Z = 1.08 (P HoLEP	$\frac{1000}{46}$ 58 104 $2^2 = 18.3$ = 0.28)	Mean Si 14 1 15 6. 90, df = 1 (5 48 5 58 106 P < 0.0	47.9% 52.1% 100.0% 001); I ² =	 16.00 [9.53, 22.47] 0.90 [-1.22, 3.02] 8.13 [-6.66, 22.91] 95% Mean Difference 	-20 -10 0 10 20 HoLEP ThuLEP
Becker 2018 Becker 2018 Zhang 2020 Total (95% CI) Heterogeneity: Tau ² Test for overall effect Study or Subgroup	30 16.9 15.9 5.05 = 107.97; Chi t: Z = 1.08 (P HoLEP Mean SD	104a 46 58 104 $^2 = 18.2$ = 0.28 Total	Mean Si 14 1 15 6. 90, df = 1 (PKE Mean S	5 10(a) 5 48 5 58 106 P < 0.0 P	47.9% 52.1% 100.0% 001); I ² =	16.00 [9.53, 22.47] 0.90 [-1.22, 3.02] 8.13 [-6.66, 22.91] 95% Mean Difference IV, Random, 95% CI	-20 -10 0 10 20 HoLEP ThuLEP Mean Difference IV, Random, 95% CI
Becker 2018 Becker 2018 Zhang 2020 Total (95% CI) Heterogeneity: Tau ² Test for overall effect Study or Subgroup Higazy 2021	30 16.9 30 16.9 15.9 5.05 = 107.97; Chi t: Z = 1.08 (P HoLEP Mean SD 22.8 18.9	104 104	Mean Si 14 1 15 6. 90, df = 1 (PKE Mean S 27 17 27 17	5 48 5 48 5 58 106 P P 0.0 D Tota 6 53	47.9% 52.1% 100.0% 001); l ² =	Mean Difference IV, Random, 95% CI 8.13 [-6.66, 22.91] 95% Mean Difference IV, Random, 95% CI 6 -4.20 [-11.12, 2.72]	-20 -10 0 10 20 HoLEP ThuLEP Mean Difference IV, Random, 95% CI
Becker 2018 Becker 2018 Zhang 2020 Total (95% CI) Heterogeneity: Tau ² Test for overall effect Study or Subgroup Higazy 2021 Wei 2021	30 16.9 30 16.9 15.9 5.05 = 107.97; Chi t: Z = 1.08 (P HoLEP Mean SD 22.8 18.9 23.15 9.9	$\frac{104}{58} + \frac{104}{58} + 1$	Mean Si 14 1 15 6. 90, df = 1 (PKE Mean S 27 17 21.6 10	D Total 5 48 5 58 106 7 P 0.0 P 0.0 D Total 6 53 8 80	47.9% 52.1% 100.0% 001); l ² = <u>I Weigh</u> 3 35.29 0 64.89	Mean Difference IV, Random, 95% CI 6.00 [9.53, 22.47] 0.90 [-1.22, 3.02] 8.13 [-6.66, 22.91] 95% Mean Difference IV, Random, 95% CI 6 -4.20 [-11.12, 2.72] 1.55 [-1.66, 4.76]	-20 -10 0 10 20 HoLEP ThuLEP Mean Difference IV, Random, 95% CI
Becker 2018 Becker 2018 Zhang 2020 Total (95% CI) Heterogeneity: Tau ² Test for overall effect Study or Subgroup Higazy 2021 Wei 2021 Total (95% CI)	30 16.9 30 16.9 15.9 5.05 = 107.97; Chi :: Z = 1.08 (P HoLEP Mean SD 22.8 18.9 23.15 9.9	104 104 $2^{2} = 18.2$ = 0.28 104 = 0.28 104 = 0.28	Mean Si 14 1 15 6. 90, df = 1 (PKE Mean S 27 17 21.6 10	D Total 5 48 5 58 106 P 0.0 D Total 6 53 8 80 133	Weight 47.9% 52.1% 52.1% 100.0% 001); I ² = Image: 100 million of the second s	Mean Difference IV, Random, 95% CI 6.00 [9.53, 22.47] 0.90 [-1.22, 3.02] 8.13 [-6.66, 22.91] 95% Mean Difference IV, Random, 95% CI 6 -4.20 [-11.12, 2.72] 1.55 [-1.66, 4.76] 6 -0.47 [-5.86, 4.91]	-20 -10 0 10 20 HoLEP ThuLEP Mean Difference IV, Random, 95% CI
Becker 2018 Becker 2018 Zhang 2020 Total (95% Cl) Heterogeneity: Tau ² Test for overall effect Study or Subgroup Higazy 2021 Wei 2021 Total (95% Cl) Heterogeneity: Tau ² =	30 16.9 30 16.9 15.9 5.05 = 107.97; Chi :: Z = 1.08 (P HoLEP Mean SD 22.8 18.9 23.15 9.9 = 8.96; Chi ² =	104 104 104 2 = 18.1 = 0.28) Total 5 4 80 134 2.18, d	Mean Si 14 1 15 6. 90, df = 1 (PKE Mean S 27 17 21.6 10 f = 1 (P = 0)	$\frac{1}{5} - \frac{1}{5} + \frac{1}$	Weight 47.9% 52.1% 100.0% 001); I ² = I Weight 3 35.29 0 64.89 3 100.09 5 4%	Wean Difference IV, Random, 95% CI 6.00 [9.53, 22.47] 0.90 [-1.22, 3.02] 8.13 [-6.66, 22.91] 95% Mean Difference IV, Random, 95% CI 6 -4.20 [-11.12, 2.72] 1.55 [-1.66, 4.76] 6 -0.47 [-5.86, 4.91]	-20 -10 0 10 20 HoLEP ThuLEP Mean Difference IV, Random, 95% CI
Becker 2018 Becker 2018 Zhang 2020 Total (95% Cl) Heterogeneity: Tau ² Test for overall effect Study or Subgroup Higazy 2021 Wei 2021 Total (95% Cl) Heterogeneity: Tau ² Test for overall effect	30 16.9 30 16.9 15.9 5.05 = 107.97; Chi :: Z = 1.08 (P HoLEP Mean SD 22.8 18.9 23.15 9.9 = 8.96 ; Chi ² = : Z = 0.17 (P =	104 104 104 104 2 = 18.1 104 2 = 18.1 104 104 104 104 104 104 104 104 104 104 104 104 104 104 104 104 104 104 104 104 104 104 104 105 104 104 105 104 105 105 105 106 106 107 107 107 108 108 108 108 108 108 108 108 108 108 108 108 108 108 108 108 108 108 108 108 108 108 108 108 108 108 108 108 108 108 108 108 108 108 108 108 108 108 108 108 108 108 108 108 108 108 108 108 108 108 108 108 108 108 108 108 108 108 108 108 108 108 108 108 108 108 108 108 108 108 108 108 108 108 108 108 108 108 108 108 108 108 108 108 108 108 108 108 108 108 108 108 108 108 108 108 108 108 108 108 108 108 108 108 108 108 108 108 108 108 108 108 108 108 108 108 108 108 108 108 108 108 108 108 108 108 108 108 108 108 108 108 108 108 108 108 108 108 108 108 108 108 108 108 108 108 108 108 108 108 108 108 108 108 108 108 108 108 108 108 108 108 108 108 108 108 108 108 108 108 108 108 108 108 108 108 108 108 108 108 108 108 108 108 108 108 108 108 108 108 108 108 108 108 108 108 108 108 108 108 108 108 108 108 108 108 108 108 108 108 108 108 108 108 108 108 108 108 108 108 108 108 108 108 108 108 108 108 108 108 108 108 108 108 108 108 108 108 108 108 108 108 108 108 108 108 108 108	Mean Si 14 1 15 6. 90, df = 1 (PKE Mean S 27 17 21.6 10 f = 1 (P = 0)	Distance 5 48 5 58 106 52 P Tota 0 Tota 36 52 106 52 8 80 132 132 9.14); 12 14); 12	Weight 47.9% 52.1% 100.0% 001); I ² = I Weight 3 35.2% 0 64.8% 3 100.0% 54.8% 3 100.0%	Wean Difference IV, Random, 95% CI 0.90 [-1.22, 3.02] 8.13 [-6.66, 22.91] 95% Mean Difference IV, Random, 95% CI 6 -4.20 [-11.12, 2.72] 1.55 [-1.66, 4.76] 6 -0.47 [-5.86, 4.91]	-20 -10 0 10 20 HoLEP ThuLEP Mean Difference IV, Random, 95% CI
Rudy of Subgroup Becker 2018 Zhang 2020 Total (95% Cl) Heterogeneity: Tau ² Test for overall effect Study or Subgroup Higazy 2021 Wei 2021 Total (95% Cl) Heterogeneity: Tau ² = Test for overall effect months	30 16.9 30 16.9 15.9 5.05 = 107.97 ; Chi :: Z = 1.08 (P HoLEP Mean SD 22.8 18.9 23.15 9.9 = 8.96 ; Chi ² = : Z = 0.17 (P =	101 46 58 104 2 = 18.1 = 0.28) Total 54 54 80 134 2.18, de 0.86)	Mean Si 14 1 15 6. 90, df = 1 (PKE Mean S 27 17 21.6 10 f = 1 (P = 0)	$\frac{1000}{1000} = \frac{1000}{1000}$	i 47.9% i 47.9% i 52.1% i 100.0% 0011); I ² = I Weigh 3 35.2% 0 64.8% 3 100.0% 3 100.0% 5 54%	Mean Difference IV, Random, 95% CI 0.90 [-1.22, 3.02] 8.13 [-6.66, 22.91] 95% Mean Difference IV, Random, 95% CI 6 -4.20 [-11.12, 2.72] 1.55 [-1.66, 4.76] 6 -0.47 [-5.86, 4.91]	-20 -10 0 10 20 HoLEP ThuLEP Mean Difference IV, Random, 95% CI
Rudy of Subgroup Becker 2018 Zhang 2020 Total (95% CI) Heterogeneity: Tau ² Test for overall effect Study of Subgroup Higazy 2021 Wei 2021 Total (95% CI) Heterogeneity: Tau ² = Test for overall effect months	30 16.9 15.9 5.05 = 107.97; Chi [*] t: Z = 1.08 (P HoLEP Mean SD 22.8 18.9 23.15 9.9 = 8.96; Chi ² = : Z = 0.17 (P =	101 46 58 104 2 = 18.1 = 0.28) Total 54 80 134 2.18, d 0.86)	Mean Si 14 1 15 6. 90, df = 1 (PKE Mean S 27 17 21.6 10 f = 1 (P = 0	D Total 5 48 5 58 106 P D Total 6 5: 8 80 13: 0.14); 12	Weight 47.9% 52.1% 100.0% 001); I ² = 1 Weight 3 35.2% 0 64.8% 3 100.0% 54%	Mean Difference V, Random, 95% CI Mean Difference V, Random, 95% CI 6 -4.20 [-11.12, 2.72] 1.55 [-1.66, 4.76] 6 -0.47 [-5.86, 4.91]	-20 -10 0 10 20 HoLEP ThuLEP Mean Difference IV, Random, 95% CI
Recker 2018 Becker 2018 Zhang 2020 Total (95% CI) Heterogeneity: Tau ² - Test for overall effect Study or Subgroup Higazy 2021 Wei 2021 Total (95% CI) Heterogeneity: Tau ² = Test for overall effect months Study or Subgroup	Big 30 16.9 30 16.9 5.05 15.9 5.05 5.05 = 107.97; Chi' Chi t: Z 1.08 (P HoLEP Mean SD 22.8 18.9 23.15 9.9 = 8.96; Chi ² = : Z 0.17 (P = HoLEP Mean SD	Total 0 46 58 104 2 18.3 = 0.28) Total 54 54 80 134 2.18, d = 0.86)	Mean Si 14 1 15 6. 90, df = 1 (PKE Mean S 27 17 21.6 10 f = 1 (P = 0 ThuLE Mean SI	Directal 5 48 5 58 106 P D Total 6 5: .8 8(13: .14); 12	Weight 100.0% 001); I ² = Weight 35.2% 64.8% 3100.0% 54%	Mean Difference V, Random, 95% CI Mean Difference V, Random, 95% CI Mean Difference V, Random, 95% CI	-20 -10 0 10 20 HoLEP ThuLEP Mean Difference IV, Random, 95% CI
Recker 2018 Becker 2018 Zhang 2020 Total (95% CI) Heterogeneity: Tau ² - Test for overall effect Study or Subgroup Higazy 2021 Wei 2021 Total (95% CI) Heterogeneity: Tau ² = Test for overall effect months Study or Subgroup Bozzini 2021	Big 16.9 30 16.9 15.9 5.05 = 107.97; Chi' t: Z HoLEP Mean 22.8 18.9 23.15 9.9 = 8.96; Chi ² = : Z 0.17 (P = Mean SD 45.3 25.2	Total 0 46 58 104 2 18.3 = 0.28) Total 54 54 80 134 2.18, d = 0.86) Total 121	Mean SI 14 1 15 6. 90, df = 1 (PKE Mean S 27 17 21.6 10 f = 1 (P = 0 Mean SI 50.9 30.	P 106 P 0.00 P Total 0 Total 13: 0.14); 2 0.14); 2 Total 5 115	Weight 8 100.0% 001); I ² = I I Weight 3 15.2% 0 64.8% 3 100.0% 5 54% Weight 8.2%	Wean Difference IV, Random, 95% CI Mean Difference IV, Random, 95% CI -4.20 [-11.12, 2.72] 1.55 [-1.66, 4.76] -0.47 [-5.86, 4.91]	IV, Random, 95% CI -20 -10 0 10 20 HoLEP ThuLEP Mean Difference IV, Random, 95% CI -10 -5 0 5 10 HoLEP PKEP Mean Difference IV, Random, 95% CI
Study of Subgroup Becker 2018 Zhang 2020 Total (95% CI) Heterogeneity: Tau ² - Test for overall effect Study or Subgroup Higazy 2021 Wei 2021 Total (95% CI) Heterogeneity: Tau ² = Test for overall effect months Study or Subgroup Bozzini 2021 Zhang 2020	Big 16.9 30 16.9 15.9 5.05 15.9 5.05 tz 2 HoLEP Mean 22.8 18.9 23.15 9.9 = 8.96; Chi ² = : Z = 0.17 (P = Mean SD 45.3 25.2 12.1 5.55	Total 46 58 104 2 = 18.1 = 0.28) Total 54 54 54 80 134 2.18, d 0.86) Total 121 58	Mean SI 14 1 15 6. 90, df = 1 (PKE Mean S 27 17 21.6 10 $f = 1$ (P = 0 Mean SI 50.9 30. 14.7 6.	P 106 P 0.00 P Total 0 Total 13: 0.14); 2 0.14); 2 Total 5 115 2 58	Weight 8 35.29 0 64.89 3 35.29 0 64.89 8 100.09 5 54% Weight 8.2% 91.8% 91.8%	Mean Difference IV, Random, 95% CI 6 -4.20 [-1.12, 2.72] 1.55 [-1.66, 4.76] 6 -0.47 [-5.86, 4.91]	IV, Random, 95% CI -20 -10 0 10 20 HoLEP ThuLEP Mean Difference IV, Random, 95% CI -10 -5 0 5 10 HoLEP PKEP Mean Difference IV, Random, 95% CI
Study of Subgroup Becker 2018 Zhang 2020 Total (95% CI) Heterogeneity: Tau ² - Test for overall effect Study of Subgroup Higazy 2021 Wei 2021 Total (95% CI) Heterogeneity: Tau ² = Test for overall effect months Study of Subgroup Bozzini 2021 Zhang 2020 Total (95% CI)	Hole 30 16.9 15.9 5.05 15.9 5.05 $HoLEP$ HoLEP Mean SD 22.8 18.9 23.15 9.9 = 8.96; Chi ² = : Z = 0.17 (P = HoLEP Mean SD 45.3 25.2 12.1 5.55	Total 46 58 104 2 = 18.1 = 0.28) Total 54 80 134 2.18, d 0.86) Total 121 58 179	Mean Si 14 1 15 6. 90, df = 1 (PKE Mean S 27 17 21.6 10 $f = 1$ (P = 0 Mean SI 50.9 30. 14.7 6.	D Total 5 48 5 58 106 P O Total 6 53 8 80 133 133 0.14); 2 7 5 115 2 58 173	Weight 8 35.29 0 64.89 3 35.29 0 64.89 3 100.09 5 54% Weight 8.2% 91.8% 100.09	Mean Difference IV, Random, 95% CI 95% Mean Difference IV, Random, 95% CI 6 -4.20 [-11.12, 2.72] 1.55 [-1.66, 4.76] 6 -0.47 [-5.86, 4.91]	-20 -10 0 10 20 HoLEP ThuLEP Mean Difference IV, Random, 95% CI
Study of Subgroup Becker 2018 Zhang 2020 Total (95% CI) Heterogeneity: Tau ² : Test for overall effect Study of Subgroup Higazy 2021 Wei 2021 Total (95% CI) Heterogeneity: Tau ² = Test for overall effect months Study of Subgroup Bozzini 2021 Zhang 2020 Total (95% CI) Heterogeneity: Tau ² =	Hole 30 16.9 15.9 5.05 = 107.97; Chi' t: Z 1.08 (P HoLEP Mean SD 22.8 18.9 23.15 9.9 = 8.96; Chi ² = : Z 0.17 (P Mean SD 45.3 25.2 12.1 5.55 = 0.00; Chi ² = = 0.00; Chi ² =	Total 46 58 104 2 = 18.1 = 0.28) Total 54 55 121 58 179 0.62, d	Mean Si 14 1 15 6. 90, df = 1 (PKE Mean S 27 17 21.6 10 $f = 1$ (P = 0 Mean SI 50.9 30. 14.7 6. $f = 1$ (P = 0	$P = \frac{1000}{1000}$ P < 0.00 $P = \frac{1000}{1000}$ $P = \frac{1000}{1000$	Weight 8 100.0% 001); I ² = I I Weight 3 100.0% 0 64.8% 3 100.0% 5 54% Weight 8.2% 91.8% 100.0% 0% 0%	Mean Difference IV, Random, 95% CI 95% Mean Difference IV, Random, 95% CI 6 -4.20 [-11.12, 2.72] 1.55 [-1.66, 4.76] 6 -0.47 [-5.86, 4.91] Mean Difference IV, Random, 95% CI -5.60 [-12.76, 1.56] -2.60 [-4.74, -0.46] -2.85 [-4.90, -0.79]	IV, Random, 95% CI
Study of Subgroup Becker 2018 Zhang 2020 Total (95% CI) Heterogeneity: Tau ² - Test for overall effect Study of Subgroup Higazy 2021 Wei 2021 Total (95% CI) Heterogeneity: Tau ² = Test for overall effect Bozzini 2021 Zhang 2020 Total (95% CI) Heterogeneity: Tau ² = Test for overall effect:	Hole Hole 30 16.9 15.9 5.05 15.9 5.05 t: Z = 1.08 (P Hole Hole Hole Mean SD 22.8 18.9 23.15 9.9 = 8.96; Chi ² = : Z = 0.17 (P = Hole Hole Mean SD 45.3 25.2 12.1 5.55 : 0.00; Chi ² = Z Z = 2.72 (P = Z	Total 46 58 104 2 = 18.1 = 0.28) Total 54 80 134 2.18, d 0.86) 121 58 179 0.62, d 0.007;	Mean SI 14 1 15 6. 90, df = 1 (PKE Mean S 27 17 21.6 10 $f = 1$ (P = 0 S0.9 30. 14.7 6. $f = 1$ (P = 0	D Total 5 48 5 58 1066 9 D Total 6 51 8 8 1.14); I ² 5 15 2 58 173 .43); I ²	Weight 8 35.29 0 64.89 3 35.29 0 64.89 3 100.09 5 54% Weight 8.2% 91.8% 100.0% = 0%	Mean Difference IV, Random, 95% CI 6 -4.20 [-11.12, 2.72] 1.55 [-1.66, 4.76] 6 -0.47 [-5.86, 4.91]	IV, Random, 95% CI -20 -10 0 10 20 HoLEP ThuLEP Mean Difference IV, Random, 95% CI -10 -5 0 5 10 HoLEP PKEP Mean Difference IV, Random, 95% CI -10 -5 0 5 10 HoLEP ThuLEP
Study of Subgroup Becker 2018 Zhang 2020 Total (95% CI) Heterogeneity: Tau ² - Test for overall effect Wei 2021 Total (95% CI) Heterogeneity: Tau ² = Test for overall effect months Study of Subgroup Bozzini 2021 Zhang 2020 Total (95% CI) Heterogeneity: Tau ² = Test for overall effect:	Hole 30 16.9 15.9 5.05 = 107.97; Chi ¹ t: Z 1.08 (P Hole Hole Mean SD 22.8 18.9 23.15 9.9 23.15 9.9 = 8.96; Chi ² = : Z Hole Hole Mean SD 45.3 25.2 12.1 5.55 • 0.00; Chi ² = Z 2.72 (P PKEP PKEP	Total 46 58 104 2 = 18.1 = 0.28) Total 54 50 134 2.18, d = 0.86) Total 121 58 179 0.62, d 0.0072	Mean Si 14 1 15 6. 90, df = 1 (PKE Mean S 27 17 21.6 10 f = 1 (P = 0 50.9 30. 14.7 6. f = 1 (P = 0	$P = \frac{1000}{1000}$	47.9% 47.9% 52.1% 100.0% 001); I ² = I Weight 3 3 100.0% 52.1% 400.0% 52.1% 100.0% 91.8% 100.0% 0%	Mean Difference IV, Random, 95% CI 6 -4.20 [-11.12, 2.72] 6 -4.20 [-11.12, 2.72] 6 -0.47 [-5.86, 4.91] Mean Difference IV, Random, 95% CI -5.60 [-12.76, 1.56] -2.60 [-4.74, -0.46] -2.85 [-4.90, -0.79]	IV, Random, 95% CI -20 -10 0 10 20 HoLEP HoLEP Mean Difference IV, Random, 95% CI -10 -5 0 5 10 HoLEP PKEP Mean Difference IV, Random, 95% CI -10 -5 0 5 10 HoLEP PKEP IV, Random, 95% CI IV <
Study of Subgroup Becker 2018 Zhang 2020 Total (95% CI) Heterogeneity: Tau ² - Test for overall effect Wei 2021 Total (95% CI) Heterogeneity: Tau ² = Test for overall effect months Study of Subgroup Bozzini 2021 Zhang 2020 Total (95% CI) Heterogeneity: Tau ² = Test for overall effect: Study of Subgroup	Hole Ferrit 30 16.9 30 16.9 15.9 5.05 15.9 5.05 Hole Ferrit Mean SD 22.8 18.9 23.15 9.9 23.15 9.9 23.15 9.9 23.15 9.9 23.15 9.9 23.15 9.9 23.15 9.9 23.15 9.9 23.15 9.9 23.15 9.9 23.15 9.9 45.3 25.2 12.1 5.55 9.000; Chi ² = Z Z 2.72 (P PKEP Mean Mean SD	Total 46 58 104 2 = 18.1 = 0.28) Total 54 50 134 2.18, d - 0.86) Total 121 58 179 0.62, d 0.0077 Total	Mean Si 14 1 15 6. 90, df = 1 (PKE Mean S 27 17 21.6 10 f = 1 (P = 0 50.9 30. 14.7 6. f = 1 (P = 0 DILE Mean S S	$P = \frac{1000}{1000}$	Weight 8 35.2? 001); I ² = I I Weight 3 100.0% 0 5.2? 3 100.0% 5 5.4% Weight 8.2% 91.8% 100.0% 100.0% 0%	Mean Difference IV, Random, 95% CI 6 95% Mean Difference IV, Random, 95% CI 6 -4.20 [-11.12, 2.72] 6 -0.47 [-5.86, 4.91] Mean Difference IV, Random, 95% CI -5.60 [-12.76, 1.56] -2.60 [-4.74, -0.46] -2.85 [-4.90, -0.79] Mean Difference IV, Random, 95% CI	IV, Random, 95% CI -20 -10 0 10 20 HoLEP HoLEP Mean Difference IV, Random, 95% CI -10 -5 0 5 10 HoLEP PKEP 10 -10 -5 10 HoLEP PKEP 10 -10 -5 10 HoLEP ThuLEP 10 -10 -5 10
Study of Subgroup Becker 2018 Zhang 2020 Total (95% CI) Heterogeneity: Tau ² - Test for overall effect Study of Subgroup Higazy 2021 Wei 2021 Total (95% CI) Heterogeneity: Tau ² = Test for overall effect Months Study of Subgroup Bozzini 2021 Zhang 2020 Total (95% CI) Heterogeneity: Tau ² = Test for overall effect: Study of Subgroup Wu 2016	No. Second	Total 46 58 104 = 18.1 = 0.28) Total 54 50 134 2.18, d 0.86) 121 58 179 0.62, d 0.007; Total 40	Mean SI 14 1 15 6. 90, df = 1 (PKE Mean S 27 17 21.6 10 $f = 1$ (P = 0 S0.9 30. 14.7 6. $f = 1$ (P = 0 DILE Mean S0.23 10	$\begin{array}{c} \mathbf{P} \\ \mathbf{D} \\ \mathbf{Tota} \\ \mathbf{S} \\ \mathbf{A} \\ \mathbf{S} \\ \mathbf{S} \\ \mathbf{S} \\ \mathbf{S} \\ \mathbf{D} \\ \mathbf{Tota} \\ \mathbf{S} \\ S$	Weight 8 35.29 0 64.89 3 35.29 0 64.89 3 100.09 5 54% Weight 8.2% 91.8% 100.0% 100.0% 0% I Weight 8 100.0% 0 88.49	Mean Difference IV, Random, 95% CI 6 -4.20 [-11.12, 2.72] 6 -4.20 [-11.12, 2.72] 6 -5.50 [-1.66, 4.76] -6.60 [-2.76, 1.56] -2.60 [-4.74, -0.46] -2.85 [-4.90, -0.79] Mean Difference IV, Random, 95% CI -5.60 [-2.76, 1.56] -2.85 [-4.90, -0.79] Mean Difference IV, Random, 95% CI	IV, Random, 95% CI -20 -10 0 10 20 HoLEP ThuLEP Mean Difference IV, Random, 95% CI -10 -5 0 5 10 HoLEP PKEP Mean Difference IV, Random, 95% CI -10 -5 0 5 10 HoLEP PKEP Mean Difference IV, Random, 95% CI -10 -5 0 5 10 HoLEP ThuLEP Mean Difference IV, Random, 95% CI
Study of Subgroup Becker 2018 Zhang 2020 Total (95% CI) Heterogeneity: Tau ² - Test for overall effect Study of Subgroup Higazy 2021 Wei 2021 Total (95% CI) Heterogeneity: Tau ² = Test for overall effect Months Study of Subgroup Bozzini 2021 Zhang 2020 Total (95% CI) Heterogeneity: Tau ² = Test for overall effect: Study of Subgroup Wu 2016 Xu 2013	No. Second	Total 46 58 104 = 18.1 = 0.28) Total 54 80 134 2.18, d 0.86) 121 58 179 0.62, d 0.007; Total 40 40	Mean Si 14 1 15 6. 90, df = 1 (PKE Mean S 27 17 21.6 10 $f = 1$ (P = 0 Mean SI 50.9 30. 14.7 6. $f = 1$ (P = 0 DiLE Mean S 22.3 15.95 29	$\begin{array}{c} \mathbf{P} \\ \mathbf{D} \\ \mathbf{Tota} \\ \mathbf{S} \\ \mathbf{A} \\ \mathbf{S} \\ \mathbf{S} \\ \mathbf{S} \\ \mathbf{S} \\ \mathbf{D} \\ \mathbf{Tota} \\ \mathbf{S} \\ S$	Weight 8 35.29 0 64.89 3 35.29 0 64.89 3 100.09 0 54% Weight 8.100.09 0 64.89 3 100.09 0 91.8% 100.09% 0% I Weight 100.09% 0%	Mean Difference IV, Random, 95% CI 6 -1.22, 3.02] 8.13 [-6.66, 22.91] 95% Mean Difference IV, Random, 95% CI 6 -4.20 [-11.12, 2.72] 1.55 [-1.66, 4.76] 6 -0.47 [-5.86, 4.91] Mean Difference IV, Random, 95% CI -5.60 [-12.76, 1.56] -2.60 [-4.74, -0.46] -2.85 [-4.90, -0.79] Mean Difference tV, Random, 95% CI 6 -1.60 [-6.78, 3.58] 4.35 [-9.95, 18.65]	IV, Random, 95% CI -20 -10 0 10 20 HoLEP ThuLEP Mean Difference IV, Random, 95% CI -10 -5 0 5 10 HoLEP PKEP Mean Difference IV, Random, 95% CI -10 -5 0 5 10 HoLEP PKEP Mean Difference IV, Random, 95% CI -10 -5 0 5 10 HoLEP ThuLEP Mean Difference IV, Random, 95% CI
Study of Subgroup Becker 2018 Zhang 2020 Total (95% CI) Heterogeneity: Tau ² - Test for overall effect Study of Subgroup Higazy 2021 Wei 2021 Total (95% CI) Heterogeneity: Tau ² = Test for overall effect Months Study of Subgroup Bozzini 2021 Zhang 2020 Total (95% CI) Heterogeneity: Tau ² = Test for overall effect: Study of Subgroup Wu 2016 Xu 2013 Total (95% CI)	Book Book 30 16.9 30 16.9 15.9 5.05 15.9 5.05 HoLEP HoLEP Mean SD 22.8 18.9 23.15 9.9 = 8.96; Chi ² = : Z = 0.17 (P = HoLEP Mean SD 45.3 25.2 12.1 5.55 • 0.00; Chi ² = Z Z = 2.72 (P = PKEP Mean SD 20.7 13.1 20.3 35.4	Total 46 58 104 = 18.1 = 0.28) Total 54 80 134 2.18, d 0.86) 121 58 179 0.62, d 0.007; Total 40 40 80	Mean SI 14 1 15 6. 90, df = 1 (PKE Mean S 27 17 21.6 10 $f = 1$ (P = 0 Mean SI 50.9 30. 14.7 6. $f = 1$ (P = 0 DILE Mean S 22.3 15.95 29	$\begin{array}{c} \mathbf{P} \\ \mathbf{D} \\ \mathbf{Total} \\ \mathbf{S} \\ \mathbf{A} \\ \mathbf{S} \\ \mathbf{S} \\ \mathbf{S} \\ \mathbf{S} \\ \mathbf{D} \\ \mathbf{Total} \\ \mathbf{S} \\ \mathbf$	Weight 8 100.0% 001); I ² = I I Weight 3 35.29 0 64.89 3 100.0% 0 54% Weight 8.100.0% 9 91.8% 100.0% 90.88.49 0 88.49 0 88.49 0 11.69 0 100.0%	Mean Difference IV, Random, 95% CI 6 -0.90 [-1.22, 3.02] 8.13 [-6.66, 22.91] 95% Mean Difference IV, Random, 95% CI 6 -4.20 [-11.12, 2.72] 1.55 [-1.66, 4.76] 6 -0.47 [-5.86, 4.91] Mean Difference IV, Random, 95% CI -5.60 [-12.76, 1.56] -2.60 [-4.74, -0.46] -2.85 [-4.90, -0.79] Mean Difference t IV, Random, 95% CI 6 -1.60 [-6.78, 3.58] 6 -0.91 [-5.78, 3.96]	Nean Difference IV, Random, 95% CI HoLEP ThuLEP Mean Difference IV, Random, 95% CI Mean Difference IV, Random, 95% CI Mean Difference IV, Random, 95% CI Mean Difference IV, Random, 95% CI
Study of Subgroup Becker 2018 Zhang 2020 Total (95% CI) Heterogeneity: Tau ² - Test for overall effect Study of Subgroup Higazy 2021 Wei 2021 Total (95% CI) Heterogeneity: Tau ² = Test for overall effect months Study of Subgroup Bozzini 2021 Zhang 2020 Total (95% CI) Heterogeneity: Tau ² = Test for overall effect: Study of Subgroup Wu 2016 Xu 2013 Total (95% CI) Heterogeneity: Tau ² =	No. No. 30 16.9 30 16.9 15.9 5.05 15.9 5.05 HoLEP Mean 22.8 18.9 23.15 9.9 = 8.96; Chi ² = : Z	Total 46 58 104 2 = 18.1 = 0.28) Total 54 50 134 2.18, d 0.86) 121 58 179 0.62, d 0.007) Total 40 40 80 0.59, d	Mean Si 14 1 15 6. 90, df = 1 (PKE Mean S 27 17 21.6 10 $f = 1$ (P = 0 50.9 30. 14.7 6. $f = 1$ (P = 0 DILE Mean Mean S 22.3 10 15.95 29 $f = 1$ (P = 0	P = 0.00 $P = 0.00$	Weight 8 35.29 0 64.89 3 35.29 0 64.89 3 100.09 0 54.89 8 100.09 5 54% Weight 8.2% 91.8% 100.09 0 88.49 1 Weight 100.09 0% 1 0.09 0 11.69 0 100.09 0 0%	Mean Difference IV, Random, 95% CI 6 -4.20 [-1.12, 2.72] 1.55 [-1.66, 4.76] 6 -0.47 [-5.86, 4.91] Mean Difference IV, Random, 95% CI 6 -0.47 [-5.86, 4.91] -2.60 [-4.74, -0.46] -2.85 [-4.90, -0.79] Mean Difference IV, Random, 95% CI -5.60 [-5.78, 3.58] 6 -0.47 [-5.78, 3.96]	IV, Random, 95% CI -20 -10 0 10 20 HoLEP ThuLEP Mean Difference IV, Random, 95% CI -10 -5 0 5 10 HoLEP PKEP Mean Difference IV, Random, 95% CI -10 -5 0 5 10 HoLEP ThuLEP Mean Difference IV, Random, 95% CI -10 -5 0 5 10 HoLEP ThuLEP Mean Difference IV, Random, 95% CI

Figure 5. Meta-analysis of outcomes. Functional outcomes: c) QoL, d) PVR.

HoLEP – holmium laser enucleation of the prostate; ThuLEP – thulium laser enucleation of the prostate; SD – standard deviation; Cl – confidence interval; PKEP – plasma kinetic enucleation of the prostate; DiLEP – diode laser enucleation of the prostate

d)

6	monthe	

Study or Subaroup	Mean SD	Total Mea	n SD Tot	al Weight	IV. Random. 95% CI	IV. Random, 95% CI
Becker 2018	12 8.25	46	0 9.9 4	8 49.0%	12.00 [8.32, 15.68]	
hang 2020	9.3 5.2	58 8	2 5.8 5	8 51.0%	1.10 [-0.90, 3.10]	
Fotal (95% CI)		104	10	6 100.0%	6.44 [-4.24, 17.12]	
leterogeneity: Tau ² =	= 57.12; Chi ² =	= 26.01, df =	= 1 (P < 0.0)	0001 ; $I^2 =$	96% -	
Test for overall effect	: Z = 1.18 (P =	= 0.24)				HoLEP ThuLEP
Study or Subgroup	PKEP Mean SD	Total Mea	DiLEP n SD To	otal Weigh	Mean Difference t IV, Random, 95% CI	Mean Difference IV, Random, 95% CI
Wu 2016	18.7 12.7	40 22.	2 11.5	40 49.19	% -3.50 [-8.81, 1.81]	
Xu 2013	4.75 10.9	40 4.	1 12.75	40 50.99	% 0.65 [-4.55, 5.85]	
Total (95% CI)		80		80 100.09	6 -1.39 [-5.45, 2.68]	-
Heterogeneity: Tau ² = Test for overall effect:	= 1.42; Chi ² = Z = 0.67 (P =	1.20, df = 1 0.50)	(P = 0.27); I	2 = 17%		-10 -5 0 5 10 PKEP DILEP
2 months						
Study or Subaroun	HOLEP	Total Man	ThuLEP	Walaht	Mean Difference	Mean Difference
Study or Subgroup	Mean SD	10tal Mea	n 50 lota	weight	10 20 (15 22 5 10)	iv, kandom, 95% Cl
Bozzini 2021 Zhang 2020	31.9 20.35 6.5 3.85	121 42. 58 7.	5 4.4 5	5 46.5% 8 53.5%	-10.20 [-15.22, -5.18] -1.00 [-2.50, 0.50]	
Total (95% CI)		179	17	3 100.0%	-5.28 [-14.27, 3.72]	-
Heterogeneity: $Tau^2 =$	38.74; Chi ² =	11.84. df =	1 (P = 0.000)	6); $l^2 = 92\%$	6	
Test for overall effect:	Z = 1.15 (P =	0.25)				-20 -10 0 10 20 HoLEP ThuLEP
c	HoLEP	T -1-1-1	PKEP		Mean Difference	Mean Difference
study or Subgroup	Mean SD	Total Mea	In SD To	tal Weight	IV, Random, 95% Cl	IV, Kandom, 95% Cl
Habib 2020	22.15 5.2	33 20	3 8.6	31 37.1%	1.85 [-1.66, 5.36]	
Higazy 2021	22.5 17.2	54 25	5 15.1	53 13.7%	6 -3.00 [-9.13, 3.13]	
			- 0.0	70 40 10	0 00 1 2 05 2 051	
Wei 2021	18.8 9.15	80 19	7 9.8	79 49.1%	-0.90 [-3.65, 2.05]	-
Wei 2021 Total (95% CI)	18.8 9.15	80 19 167	.7 9.8	63 100.0%	6 -0.17 [-2.51. 2.18]	
Wei 2021 Total (95% CI) Heterogeneity: Tau ² =	18.8 9.15	80 19 167 2.33. df = 2	(P = 0.31) ¹	79 49.1% 63 100.0% $1^2 = 14\%$	-0.17 [-2.51, 2.18]	
Wei 2021 Total (95% CI) Heterogeneity: Tau ² = Test for overall effect:	18.8 9.15 = 0.65; Chi ² = = Z = 0.14 (P =	80 19 167 2.33, df = 2 = 0.89)	(P = 0.31);	63 100.0% I ² = 14%	-0.17 [-2.51, 2.18] -	-10 -5 0 5 10 HOLEP PKEP
Wei 2021 Total (95% CI) Heterogeneity: Tau ² = Test for overall effect: Study or Subgroup	18.8 9.15 = 0.65; Chi ² = = Z = 0.14 (P = PKEP Mean SD	80 19 167 2.33, df = 2 0.89) Total Mea	1 (P = 0.31); DiLEP n SD To	79 49.1% 63 100.0% 1 ² = 14%	 -0.50 [-3.63, 2.05] -0.17 [-2.51, 2.18] - Mean Difference IV. Random. 95% CI 	-10 -5 0 5 10 HoLEP PKEP Mean Difference IV. Random. 95% CI
Wei 2021 Total (95% CI) Heterogeneity: Tau ² = Test for overall effect: <u>Study or Subgroup</u> Wu 2016	18.8 9.15 = 0.65; Chi ² = Z = 0.14 (P = PKEP Mean SD 24.2 13.9	80 19 167 2.33, df = 2 0.89) Total Mea 40 23.	1 (P = 0.31); DILEP n SD To 4 16.3	 79 49.1% 63 100.0% I² = 14% tal Weight 40 7.0% 	 -0.50 [-5.85, 2.05] -0.17 [-2.51, 2.18] Mean Difference IV, Random, 95% CI 0.80 [-5.84, 7.44] 	-10 -5 0 5 10 HoLEP PKEP Mean Difference IV, Random, 95% CI
Wei 2021 Total (95% Cl) Heterogeneity: Tau ² = Test for overall effect: <u>Study or Subgroup</u> Wu 2016 Xu 2013	18.8 9.15 = 0.65; Chi ² = = Z = 0.14 (P = PKEP Mean SD 24.2 13.9 2.15 5	80 19 167 2.33, df = 2 • 0.89) Total 40 23. 40 1.2	1 (P = 0.31); DiLEP <u>n SD To</u> 4 16.3 5 3.1	79 49.1% 63 100.0% i² = 14% i tal Weight 40 7.0% 40 93.0%	Mean Difference IV, Random, 95% CI 0.80 [-5.84, 7.44] 0.90 [-0.92, 2.72]	-10 -5 0 5 10 HoLEP PKEP Mean Difference IV, Random, 95% CI
Wei 2021 Total (95% Cl) Heterogeneity: Tau ² = Test for overall effect: <u>Study or Subgroup</u> Wu 2016 Xu 2013 Total (95% Cl)	18.8 9.15 0.65; Chi ² = Z = 0.14 (P = PKEP Mean SD 24.2 13.9 2.15 5	80 19 167 2.33, df = 2 0.89) Total Mea 40 23. 40 1.2 80	1 (P = 0.31); DiLEP n SD To 4 16.3 5 3.1	 79 49.1% 63 100.0% 63 100.0% 63 100.0% 64 100.0% 60 100.0% 	Mean Difference IV, Random, 95% CI 0.80 [-5.84, 7.44] 0.90 [-0.92, 2.72] 0.89 [-0.87, 2.65]	-10 -5 0 5 10 HoLEP PKEP Mean Difference IV, Random, 95% CI
Wei 2021 Total (95% CI) Heterogeneity: Tau ² = Test for overall effect: Study or Subgroup Wu 2016 Xu 2013 Total (95% CI) Heterogeneity: Tau ² = Test for overall effect:	18.8 9.15 = 0.65; Chi ² = Z = 0.14 (P = PKEP Mean SD 24.2 13.9 2.15 5 = 0.00; Chi ² = : Z = 1.00 (P =	80 19 167 2.33, df = 2 0.89) Total Mea 40 23. 40 1.2 80 0.00, df = 1 = 0.32)	$\frac{1}{(P = 0.31)};$ $\frac{DiLEP}{16.3}$ $\frac{1}{5}$ $\frac{1}{3.1}$ $(P = 0.98);$	Y9 49.1% 63 100.0% l^2 14% tal Weight 40 7.0% 40 93.0% 80 100.0% l^2 0%	Mean Difference IV, Random, 95% CI 0.30 [-5.84, 7.44] 0.90 [-0.92, 2.72] 0.89 [-0.87, 2.65]	-10 -5 0 5 10 HoLEP PKEP Mean Difference IV, Random, 95% CI
Wei 2021 Total (95% CI) Heterogeneity: Tau ² = Test for overall effect: Study or Subgroup Wu 2016 Xu 2013 Total (95% CI) Heterogeneity: Tau ² = Test for overall effect:)	18.8 9.15 0.65; Chi ² = Z = 0.14 (P = PKEP Mean SD 24.2 13.9 2.15 5 = 0.00; Chi ² = Z = 1.00 (P =	80 19 167 2.33, df = 2 = 0.89) Total Mea 40 23. 40 1.2 80 0.00, df = 1 = 0.32)	1 (P = 0.31); DiLEP n SD To 4 16.3 5 3.1 (P = 0.98);	$\begin{array}{rrrr} 79 & 49.17\\ \hline 63 & 100.09\\ 1^2 = 14\%\\ \hline tal & Weight\\ 40 & 7.0\%\\ 40 & 93.0\%\\ 80 & 100.0\%\\ 1^2 = 0\%\\ \end{array}$	Mean Difference IV, Random, 95% CI 0.80 [-5.84, 7.44] 0.90 [-0.92, 2.72] 0.89 [-0.87, 2.65]	-10 -5 0 5 10 HoLEP PKEP IV, Random, 95% CI
Wei 2021 Total (95% CI) Heterogeneity: Tau ² = Test for overall effect: <u>Study or Subgroup</u> Wu 2016 Xu 2013 Total (95% CI) Heterogeneity: Tau ² = Test for overall effect:) months	18.8 9.15 0.65; Chi ² = Z = 0.14 (P = PKEP Mean SD 24.2 13.9 2.15 5 = 0.00; Chi ² = ; Z = 1.00 (P =	80 19 167 2.33, df = 2 0.89) Total Mea 40 23. 40 1.2 80 0.00, df = 1 = 0.32)	$ \begin{array}{r} 1 \\ (P = 0.31); \\ \hline 1 \\ P = 0.31); \\ \frac{DiLEP}{4 16.3} \\ 5 3.1 \\ (P = 0.98); \\ P = 0.98); $	$\begin{array}{rrrr} 79 & 49.17\\ \hline 63 & 100.09\\ l^2 &= 14\%\\ \hline tal & Weight\\ 40 & 7.0\%\\ 40 & 93.0\%\\ 80 & 100.0\%\\ l^2 &= 0\% \end{array}$	Mean Difference IV, Random, 95% CI 5 0.80 [-5.84, 7.44] 5 0.89 [-0.87, 2.65] -	-10 -5 0 5 10 HoLEP PKEP Mean Difference IV, Random, 95% CI
Wei 2021 Total (95% Cl) Heterogeneity: Tau ² = Test for overall effect: Study or Subgroup Wu 2016 Xu 2013 Total (95% Cl) Heterogeneity: Tau ² = Test for overall effect:) months	18.8 9.15 0.65; Chi ² = Z = 0.14 (P = PKEP 24.2 13.9 2.15 5 0.00; Chi ² = Z = 1.00 (P = PKEP	80 19 167 2.33, df = 2 0.89) Total Mea 40 23. 40 1.2 80 0.00, df = 1 = 0.32)	1 (P = 0.31); DILEP n SD To 4 16.3 5 3.1 (P = 0.98); DILEP	$\frac{1}{79} - \frac{49.17}{49.17}$ $\frac{63}{63} - \frac{100.09}{100}$ $\frac{1}{7}^{2} = 14\%$ $\frac{100}{40} - \frac{7.0\%}{7.0\%}$ $\frac{100.0\%}{100}$ $\frac{1000.0\%}{100}$	Mean Difference (V, Random, 95% CI 0.80 [-5.84, 7.44] 0.90 [-0.92, 2.72] 0.89 [-0.87, 2.65] Mean Difference	HoLEP PKEP Mean Difference IV, Random, 95% CI -10 -5 0 5 10 -10 -5 0 5 10 PKEP DiLEP Mean Difference
Wei 2021 Total (95% CI) Heterogeneity: Tau ² = Test for overall effect: Study or Subgroup Wu 2016 Xu 2013 Total (95% CI) Heterogeneity: Tau ² = Test for overall effect:) i months Study or Subgroup	18.8 9.15 0.65; Chi ² = Z = 0.14 (P = PKEP Mean SD 24.2 13.9 2.15 5 = 0.00; Chi ² = Z = 1.00 (P = PKEP Mean SD	80 19 167 2.33, df = 2 0.89) Total Mea 40 23. 40 1.2 80 0.00, df = 1 0.32) Total Mea	1 (P = 0.31); DILEP n SD To 4 16.3 5 3.1 (P = 0.98); DILEP n SD Tota	 79 49.1% 63 100.0% 1² = 14% tal Weight 40 7.0% 40 93.0% 80 100.0% 80 100.0% 1² = 0% Meight 	Mean Difference 1, Random, 95% CI 0.80 [-5.84, 7.44] 0.90 [-0.92, 2.72] 0.89 [-0.87, 2.65] Mean Difference IV, Random, 95% CI	HoLEP PKEP Mean Difference IV, Random, 95% CI -10 -5 0 5 10 -10 -5 0 5 10 PKEP DiLEP Mean Difference IV, Random, 95% CI
Wei 2021 Total (95% CI) Heterogeneity: Tau ² = Test for overall effect: Study or Subgroup Wu 2016 Xu 2013 Total (95% CI) Heterogeneity: Tau ² = Test for overall effect:) imonths Study or Subgroup Wu 2016	18.8 9.15 0.65; Chi ² = Z = 0.14 (P = PKEP 13.9 24.2 13.9 2.15 5 0.00; Chi ² = Z = 1.00 (P = PKEP Mean SD 17.6 6.9	80 19 167 2.33, df = 2 2.089 Mea 40 23. 40 1.2 80 0.00, df = 1 $= 0.32$ Mea 40 18.	$ \begin{array}{r} 1 \\ (P = 0.31); \\ \hline 101LEP \\ n SD To \\ 4 16.3 \\ 5 3.1 \\ (P = 0.98); \\ \hline 01LEP \\ n SD Tota \\ 8 7.3 4 \end{array} $	$\begin{array}{r} 79 49.1\% \\ 63 100.0\% \\ 1^2 = 14\% \\ \hline \\ 40 7.0\% \\ 40 93.0\% \\ 80 100.0\% \\ 1^2 = 0\% \\ \hline \\ 1 \\ \hline \\ 1 \\ \hline \\ 0 \\ 50.4\% \end{array}$	Mean Difference IV, Random, 95% CI 0.80 [-5.84, 7.44] 0.90 [-0.92, 2.72] 0.89 [-0.87, 2.65] Mean Difference IV, Random, 95% CI -1.20 [-4.31, 1.91]	HoLEP PKEP Mean Difference IV, Random, 95% CI -10 -5 0 5 10 -10 -5 0 5 10 PKEP DiLEP Mean Difference IV, Random, 95% CI
Wei 2021 Total (95% CI) Heterogeneity: Tau ² = Test for overall effect: Study or Subgroup Wu 2016 Xu 2013 Total (95% CI) Heterogeneity: Tau ² = Test for overall effect:) months Study or Subgroup Wu 2016 Zou 2018	18.8 9.15 0.65; Chi ² = Z = 0.14 (P = PKEP Mean SD 24.2 13.9 2.15 5 = 0.00; Chi ² = Z = 1.00 (P = PKEP Mean SD 17.6 6.9 14.1 8.3	80 19 167 2.33, df = 2 2.0.89) 0.089) Total Mea 40 23, 40 40 1.2 80 0.00, df = 1 = 0.32) 0.32)	$\begin{array}{r} \mathbf{p} = 0.31;\\ (P = 0.31);\\ \hline \mathbf{p} = 0.31;\\ \mathbf{p} = 0.31;\\ (P = 0.98);\\ (P = 0.98);\\ \hline \mathbf{p} = 0.98;\\ \mathbf{p} = 0$	Y9 49.1% 63 100.0% 12 14% tal Weight 40 7.0% 40 93.0% 80 100.0% $l^2 = 0\%$ 100.0% 12 0% 14 Weight 0 50.4% 7 49.6%	Mean Difference (V, Random, 95% Cl 0.89 [-0.87, 2.65] 0.89 [-0.87, 2.65] Mean Difference IV, Random, 95% Cl -1.20 [-4.31, 1.91] -0.10 [-3.24, 3.04]	HoLEP PKEP Mean Difference IV, Random, 95% CI -10 -5 0 5 10 Mean Difference IV, Random, 95% CI Mean Difference IV, Random, 95% CI
Wei 2021 Total (95% CI) Heterogeneity: Tau ² = Test for overall effect: Study or Subgroup Wu 2016 Xu 2013 Total (95% CI) Heterogeneity: Tau ² = Test for overall effect:) months Study or Subgroup Wu 2016 Zou 2018 Total (95% CI)	18.8 9.15 0.65; Chi ² = Z = 0.14 (P = PKEP Mean SD 24.2 13.9 2.15 5 = 0.00; Chi ² = Z = 1.00 (P = PKEP Mean SD 17.6 6.9 14.1 8.3	80 19 167 2.33, df = 2 ○ 0.89) Total Mea 40 23. 40 1.2 80 0.00, df = 1 ○ 0.32) Total Mea 40 18. 57 14. 97	$\begin{array}{r} \mathbf{J} & 9.8 \\ \mathbf{I} \\ (\mathbf{P} = 0.31); \\ \mathbf{DiLEP} \\ \mathbf{n} \mathbf{SD} \mathbf{Tot} \\ 4 16.3 \\ 5 3.1 \\ (\mathbf{P} = 0.98); \\ \mathbf{Oterial} \\ (\mathbf{P} = 0.98); \\ \mathbf{Oterial} \\ \mathbf{Oterial} \\ \mathbf{Oterial} \\ \mathbf{Oterial} \\ \mathbf{Oterial} \\ \mathbf{SD} \mathbf{Totic} \\ \mathbf{SD} \mathbf{Totic} \\ \mathbf{SD} \mathbf{Totic} \\ \mathbf{SD} \mathbf{Totic} \\ \mathbf{SD} \mathbf{SD} \mathbf{Totic} \\ \mathbf{SD} \mathbf{SD} \mathbf{Totic} \\ \mathbf{SD} \mathbf{SD} \mathbf{SD} \\ \mathbf{SD}$	$\frac{100.0\%}{12} = 14\%$ $\frac{1}{40} = 10\%$ $\frac{1}{10} = 0\%$	Mean Difference IV, Random, 95% CI 0.89 [-0.87, 2.65] 0.89 [-0.87, 2.65] Mean Difference IV, Random, 95% CI -1.20 [-4.31, 1.91] -0.10 [-3.24, 3.04] -0.65 [-2.87, 1.56]	HoLEP PKEP Mean Difference IV, Random, 95% CI -10 -5 0 5 10 PKEP DiLEP Mean Difference IV, Random, 95% CI
Wei 2021 Total (95% CI) Heterogeneity: Tau ² = Test for overall effect: Study or Subgroup Wu 2016 Xu 2013 Total (95% CI) Heterogeneity: Tau ² = Test for overall effect:) months Study or Subgroup Wu 2016 Zou 2018 Total (95% CI) Heterogeneity: Tau ² =	$18.8 9.15$ $0.65; Chi^2 = 0.14; (P = 0.00); (P =$	80 19 167 2.33, df = 2 2.33, df = 2 0.89) Total Mea 40 23, 40 40 1.2 80 0.00, df = 1 = 0.32) 1.2 Total Mea 40 1.8, 57 57 14. 97 0.24, df =	$\begin{array}{r} \mathbf{J} & 9.8 \\ \mathbf{I} \\ (\mathbf{P} = 0.31); \\ \mathbf{DiLEP} \\ \mathbf{n} & \mathbf{SD} & \mathbf{Tot} \\ 4 & 16.3 \\ 5 & 3.1 \\ (\mathbf{P} = 0.98); \\ \mathbf{DiLEP} \\ \mathbf{n} & \mathbf{SD} & \mathbf{Tota} \\ 8 & 7.3 & 4 \\ 2 & 8.8 & 5 \\ 9 \\ 1 (\mathbf{P} = 0.63) \end{array}$	Y9 49.17 63 100.0% 12 14% tal Weight 40 7.0% 40 93.0% 80 100.0% 12 0% 11 Weight 0 50.4% 7 49.6% 7 100.0% 12 0%	Mean Difference IV, Random, 95% CI 0.80 [-5.84, 7.44] 0.90 [-0.92, 2.72] 0.89 [-0.87, 2.65] Mean Difference IV, Random, 95% CI -1.20 [-4.31, 1.91] -0.10 [-3.24, 3.04] -0.65 [-2.87, 1.56]	HoLEP PKEP Mean Difference IV, Random, 95% CI -10 -5 0 5 10 PKEP DiLEP Mean Difference IV, Random, 95% CI -10 -5 0 5 10 PKEP DiLEP
Wei 2021 Total (95% CI) Heterogeneity: Tau ² = Test for overall effect: Study or Subgroup Wu 2016 Xu 2013 Total (95% CI) Heterogeneity: Tau ² = Test for overall effect:) months Study or Subgroup Wu 2016 Zou 2018 Total (95% CI) Heterogeneity: Tau ² = Test for overall effect	$18.8 9.15$ $= 0.65; Chi^2 = = Z = 0.14 (P = PKEP + CARC) = 0.00; Chi^2 = Z = 0.00; Chi^2 = Z = 1.00 (P = PKEP + CARC) = 0.00; Chi^2 = Z = 0.00; Chi^$	80 19 167 2.33, df = 2 $2.33, df = 2$ 0.89 Total Mea 40 23, 40 40 1.2 80 0.00, df = 1 $= 0.32$ 12 20 0.00, df = 1 $= 0.32$ 12 97 14. 97 0.24, df = 0.56	$\begin{array}{r} \mathbf{p} = 0.31;\\ (P = 0.31);\\ \mathbf{p} = 0.31;\\ \mathbf{p} = 0.31;\\ \mathbf{p} = 0.31;\\ \mathbf{p} = 0.31;\\ (P = 0.98);\\ \mathbf{p} = 0.98;\\ \mathbf{p} = 0.98$	$\begin{array}{r} 79 49.1\% \\ \hline 79 49.1\% \\ \hline 63 100.0\% \\ \hline 1^2 = 14\% \\ \hline tal Weight \\ 40 7.0\% \\ 40 93.0\% \\ \hline 80 100.0\% \\ \hline 1^2 = 0\% \\ \hline \\ \hline \\ \hline \\ \hline \\ 100.0\% \\ \hline \\ 7 49.6\% \\ \hline \\ 7 100.0\% \\ \hline \\ ; \ l^2 = 0\% \end{array}$	Mean Difference IV, Random, 95% CI 0.80 [-5.84, 7.44] 0.90 [-0.92, 2.72] 0.89 [-0.87, 2.65] Mean Difference IV, Random, 95% CI -1.20 [-4.31, 1.91] -0.10 [-3.24, 3.04] -0.65 [-2.87, 1.56]	HoleP PKEP $HoleP PKEP$
Wei 2021 Total (95% CI) Heterogeneity: Tau ² = Test for overall effect: Study or Subgroup Wu 2016 Xu 2013 Total (95% CI) Heterogeneity: Tau ² = Test for overall effect:) Study or Subgroup Wu 2016 Zou 2018 Total (95% CI) Heterogeneity: Tau ² = Test for overall effect 2 months	18.8 9.15 0.65; Chi ² = Z = 0.14 (P = PKEP 13.9 24.2 13.9 2.15 5 0.00; Chi ² = Z = 1.00 (P = PKEP Mean SD 17.6 6.9 14.1 8.3 = 0.00; Chi ² = Z = 0.58 (P	80 19 167 2.33, df = 2 2.033, df = 2 0.89 Total Mea 40 23. 40 1.2 80 0.00, df = 1 = 0.32) 14 40 18. 57 14. 97 - 0.24, df = - = 0.56) -	$\begin{array}{r} \mathbf{P} = 0.31; \\ (P = 0.31); \\ \hline \mathbf{DiLEP} \\ \mathbf{n} \mathbf{SD} \mathbf{Tot} \\ 4 16.3 \\ 5 3.1 \\ (P = 0.98); \\ \hline \mathbf{DiLEP} \\ \mathbf{n} \mathbf{SD} \mathbf{Tota} \\ 8 7.3 4 \\ 2 8.8 5 \\ 9 \\ 1 (P = 0.63) \end{array}$	$\begin{array}{rrrr} 79 & 49.1\% \\ \hline 79 & 49.1\% \\ \hline 63 & 100.0\% \\ 1^2 &= 14\% \\ \hline tal & Weight \\ 40 & 7.0\% \\ 40 & 93.0\% \\ 80 & 100.0\% \\ 1^2 &= 0\% \\ \hline 80 & 100.0\% \\ 1^2 &= 0\% \\ \hline 80 & 100.0\% \\ 7 & 49.6\% \\ \hline 7 & 100.0\% \\ 1^2 &= 0\% \end{array}$	Mean Difference IV, Random, 95% CI 0.80 [-5.84, 7.44] 0.90 [-0.92, 2.72] 0.89 [-0.87, 2.65] Mean Difference IV, Random, 95% CI -1.20 [-4.31, 1.91] -0.10 [-3.24, 3.04] -0.65 [-2.87, 1.56]	HoleP PKEP $HoleP PKEP$
Wei 2021 Total (95% CI) Heterogeneity: Tau ² = Test for overall effect: Study or Subgroup Wu 2016 Xu 2013 Total (95% CI) Heterogeneity: Tau ² = Test for overall effect:) Study or Subgroup Wu 2016 Zou 2018 Total (95% CI) Heterogeneity: Tau ² = Test for overall effect 2 months Study or Subgroup	18.8 9.15 0.65; Chi ² = Z = 0.14 (P = PKEP 24.2 13.9 2.15 5 0.00; Chi ² = Z = 1.00 (P = PKEP Mean SD 17.6 6.9 14.1 8.3 = 0.00; Chi ² = Z = 0.58 (P =	80 19 167 2.33, df = 2 $2 = 0.89$ 7 Total Mea 40 23. 40 1.2 80 0.00, df = 1 $= 0.32$ 14 97 0.24, df = $= 0.56$ 14.	$\begin{array}{r} \mathbf{P} = 0.31; \\ \mathbf{P} = 0.31; \\ \mathbf{DiLEP} \\ \mathbf{n} \mathbf{SD} \mathbf{Tot} \\ 4 16.3 \\ 5 3.1 \\ (\mathbf{P} = 0.98); \\ \mathbf{DiLEP} \\ \mathbf{n} \mathbf{SD} \mathbf{Tota} \\ 8 7.3 4 \\ 2 8.8 5 \\ 9 \\ 1 (\mathbf{P} = 0.63) \\ \mathbf{PKEP} \\ \mathbf{n} \mathbf{SD} \mathbf{Tota} \\ \mathbf{SD} \mathbf{Tota} \\ \mathbf{N} \\ $	79 49.17 63 100.09 $l^2 = 14\%$ tal Weight 40 7.0% 40 93.0% 80 100.0% $l^2 = 0\%$ 1 Weight 7 100.0% ; $l^2 = 0\%$	Mean Difference IV, Random, 95% CI 0.80 [-5.84, 7.44] 0.90 [-0.92, 2.72] 0.89 [-0.87, 2.65] Mean Difference IV, Random, 95% CI -1.20 [-4.31, 1.91] -0.10 [-3.24, 3.04] -0.65 [-2.87, 1.56] Mean Difference IV, Random, 95% CI	HoleP PKEP $HoleP PKEP$
Wei 2021 Total (95% CI) Heterogeneity: Tau ² = Test for overall effect: Study or Subgroup Wu 2016 Xu 2013 Total (95% CI) Heterogeneity: Tau ² = Test for overall effect:) months Study or Subgroup Heterogeneity: Tau ² = Test for overall effect 2 months Study or Subgroup Habib 2020	18.8 9.15 0.65; Chi ² = Z = 0.14 (P = PKEP 13.9 24.2 13.9 2.15 5 0.00; Chi ² = Z = 1.00 (P = PKEP Mean SD 17.6 6.9 14.1 8.3 = 0.00; Chi ² = Z = 0.58 (P HoLEP Mean SD	80 19 167 2.33, df = 2 2.0.89) 23. 40 23. 40 1.2 80 0.00, df = 1 • 0.32) 1.4 97 14. 97 0.24, df = • 0.24, df = 0.56)	$\begin{array}{r} \mathbf{P} = 0.31; \\ (P = 0.31); \\ \hline \mathbf{DiLEP} \\ \mathbf{n} \mathbf{SD} \mathbf{Tot} \\ 4 16.3 \\ 5 3.1 \\ (P = 0.98); \\ \hline \mathbf{OILEP} \\ \mathbf{n} \mathbf{SD} \mathbf{Tota} \\ 8 7.3 4 \\ 2 8.8 5 \\ 9 \\ 1 (P = 0.63) \\ \hline \mathbf{PKEP} \\ \mathbf{n} \mathbf{SD} \mathbf{Tota} \\ \mathbf{SD} \mathbf{Tota} \\ \mathbf{SD} \mathbf{Tota} \\ \mathbf{N} \\ \mathbf{N} \\ \mathbf{SD} \mathbf{Tota} \\ \mathbf{N} \\ $	$\frac{100.0\%}{100.0\%}$ $\frac{100.0\%}{1^2} = 14\%$ $\frac{100.0\%}{100.0\%}$ $\frac{100.0\%}{1^2} = 0\%$ $\frac{100.0\%}{100.0\%}$ $\frac{100.0\%}{100.0\%}$ $\frac{100.0\%}{100.0\%}$ $\frac{100.0\%}{100.0\%}$	Mean Difference IV, Random, 95% CI 0.89 [-0.87, 2.65] Mean Difference IV, Random, 95% CI -1.20 [-4.31, 1.91] -0.10 [-3.24, 3.04] -0.65 [-2.87, 1.56] Mean Difference IV, Random, 95% CI -2 SO [0.05 4 24]	Mean Difference $IV, Random, 95% CI$ $Mean Difference$ $IV, Random, 95% CI$ $Mean Difference$ $IV, Random, 95% CI$ $Mean Difference$ $IV, Random, 95% CI$
Wei 2021 Total (95% CI) Heterogeneity: Tau ² = Test for overall effect: Study or Subgroup Wu 2016 Xu 2013 Total (95% CI) Heterogeneity: Tau ² = Test for overall effect:) months Study or Subgroup Wu 2016 Zou 2018 Total (95% CI) Heterogeneity: Tau ² : Test for overall effect 2 months Study or Subgroup Habib 2020 Wei 2021	18.8 9.15 0.65; Chi ² = Z = 0.14 (P = KEP Mean SD 24.2 13.9 2.15 5 0.00; Chi ² = Z = 1.00 (P = KEP Mean SD 17.6 6.9 14.1 8.3 = 0.00; Chi ² = Z = 0.58 (P HoLEP Mean SD 20.2 4.6 17.5 1.8	80 19 167 2.33, df = 2 2.33, df = 2 0.89 Total Mea 40 23. 40 1.2 80 0.00, df = 1 = 0.32) 1.2 Total Mea 40 18. 57 14. 97 0.24, df = = 0.56) 33 Total Mean 33 17.3 80 17.3	$\begin{array}{rrrr} \mathbf{P} = 0.31;\\ (P = 0.31);\\ \hline \mathbf{DiLEP} \\ \mathbf{n} \mathbf{SD} \mathbf{Tot}\\ 4 16.3 \\ 5 3.1 \\ (P = 0.98);\\ (P = 0.98);\\ \hline \mathbf{n} \mathbf{SD} \mathbf{Tota}\\ 8 7.3 4 \\ 2 8.8 5 \\ 9\\ 1 \ (P = 0.63) \\ \hline \mathbf{PKEP} \\ \hline \mathbf{n} \mathbf{SD} \mathbf{Tota}\\ 7 5.3 3;\\ 7 1.8 7; \\ \end{array}$	$\begin{array}{c} \mathbf{r} \mathbf{y} \mathbf{y} \mathbf{y} \mathbf{y} \mathbf{y} \mathbf{y} \mathbf{y} y$	Mean Difference IV, Random, 95% CI 0.80 [-5.84, 7.44] 0.90 [-0.92, 2.72] 0.89 [-0.87, 2.65] -1.20 [-4.31, 1.91] -0.10 [-3.24, 3.04] -0.65 [-2.87, 1.56] Mean Difference IV, Random, 95% CI 2.50 [0.06, 4.94] -0.20 [-0.76, 0.36]	Mean Difference IV, Random, 95% CI Mean Difference IV, Random, 95% CI Mean Difference IV, Random, 95% CI Mean Difference IV, Random, 95% CI Mean Difference IV, Random, 95% CI
Wei 2021 Total (95% CI) Heterogeneity: Tau ² = Test for overall effect: Study or Subgroup Wu 2016 Xu 2013 Total (95% CI) Heterogeneity: Tau ² = Test for overall effect:) months Study or Subgroup Wu 2016 Zou 2018 Total (95% CI) Heterogeneity: Tau ² = Test for overall effect 2 months Study or Subgroup Habib 2020 Wei 2021 Total (95% CI)	18.8 9.15 0.65; Chi ² = Z = 0.14 (P = PKEP 12.15 5 0.00; Chi ² = 2.15 5 0.00; Chi ² = 2.2 = 1.00 (P = PKEP Mean SD 17.6 6.9 14.1 8.3 0.00; Chi ² = 2.2 = 0.58 (P HOLEP Mean SD 20.2 4.6 17.5 1.8	80 19 167 2.33, df = 2 2.033, df = 2 0.89 Total Mea 40 23, 40 40 1.2 80 0.00, df = 1 = 0.32) 14. 97 0.24, df = = 0.56) 14. 97 0.23, df = 1 133 17.3 113 113	$\begin{array}{r} \mathbf{p} = 0.31; \\ (P = 0.31); \\ \hline \mathbf{p} = 0.31; \\ \mathbf{p} = 0.31; \\ 16.3 \\ 5 \\ 3.1 \\ (P = 0.98); \\ \hline \mathbf{p} = 0.98; \\ \mathbf{p} = 0.9$	1 Weight 1 39.9% 1 00.0%	Mean Difference IV, Random, 95% CI 6 -0.17 [-2.51, 2.18] 6 -0.17 [-2.51, 2.18] 6 -0.17 [-2.51, 2.18] 6 -0.17 [-2.51, 2.18] 6 -0.80 [-5.84, 7.44] 6 -0.90 [-0.92, 2.72] 5 -0.89 [-0.87, 2.65] 	HoleP PKEP $HoleP PKEP$
Wei 2021 Total (95% CI) Heterogeneity: Tau ² = Test for overall effect: Study or Subgroup Wu 2016 Xu 2013 Total (95% CI) Heterogeneity: Tau ² = Test for overall effect:) immonths Study or Subgroup Wu 2016 Zou 2018 Total (95% CI) Heterogeneity: Tau ² = Test for overall effect 2 months Study or Subgroup Habib 2020 Wei 2021 Total (95% CI) Heterogeneity: Tau ² =	18.8 9.15 0.65; Chi ² = Z = 0.14 (P = KEP Mean SD 24.2 13.9 2.15 5 Z = 1.00 (P = KEP Mean SD 17.6 6.9 14.1 8.3 Z = 0.00; Chi ² = Z = 0.00; Chi ² = Z = 0.58 (P Mean SD 20.2 4.6 17.5 1.8 Z = 0.83; Chi ² =	80 19 167 2.33, df = 2 2.33, df = 2 0.89 Total Mea 40 23. 40 1.2 80 0.00, df = 1 = 0.32) 14. 97 0.24, df = = 0.56) 33 Total Meaa 33 17.3 80 17.3 4.48 df = -13	$\begin{array}{r} \mathbf{P} = 0.31; \\ \mathbf{P} = 0.33; \\$	$\begin{array}{r} 79 49.17\\ 79 49.17\\ 63 100.09\\ 1^2 = 14\%\\ 100.09\\ 40 7.0\%\\ 40 93.0\%\\ 80 100.0\%\\ 1^2 = 0\%\\ 100.0\%\\ 1^2 = 0\%\\ 100.0\%\\ 1^2 = 0\%\\ 100.0\%\\ 1^2 = 0\%\\ 100.0\%\\ 1^2 = 0\%\\ 100.0\%\\ 1^2 = 7\%\\ 100.0\%\\ 100.0\%\\ 1^2 = 7\%\\ 100.0\%\\ 100.0\%\\ 1^2 = 7\%\\ 100.0\%\\ 100.0\%\\ 1^2 = 7\%\\ 100.0\%\\ 100.0\%\\ 1^2 = 7\%\\ 100.0\%\\ 100.0\%\\ 1^2 = 7\%\\ 100.0$	Mean Difference IV, Random, 95% CI 0.89 [-0.87, 2.65] 0.89 [-0.87, 2.65] 0.89 [-0.87, 2.65] 0.89 [-0.87, 2.65] 0.89 [-0.87, 2.65] - Mean Difference IV, Random, 95% CI -1.20 [-4.31, 1.91] -0.10 [-3.24, 3.04] -0.65 [-2.87, 1.56] - Mean Difference IV, Random, 95% CI 2.50 [0.06, 4.94] -0.20 [-0.76, 0.36] 0.88 [-1.71, 3.47]	Mean Difference IV, Random, 95% CI Mean Difference IV, Random, 95% CI Mean Difference IV, Random, 95% CI Mean Difference IV, Random, 95% CI Mean Difference IV, Random, 95% CI

Figure 5. Meta-analysis of outcomes. Functional outcomes: d) PVR, e) IIEF.

HoLEP – holmium laser enucleation of the prostate; ThuLEP – thulium laser enucleation of the prostate; SD – standard deviation; Cl – confidence interval; PKEP – plasma kinetic enucleation of the prostate; DiLEP – diode laser enucleation of the prostate

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Author	Year	Intervé arr	ention m		IPSS	(mean/SD)		QoL	(mean/SD)		Qmax, n	nL/s (mean/SI	()	PVR, n	ר (mean/SD)		IIEF	(mean/SD)	
	5	EEP1	EEP2	Follow- -up	EEP1	EEP2	p-value	EEP1	EEP2	p-value	EEP1	EEP2	p-value	EEP1	EEP2	p-value	EEP1	EEP2	p-value
Becker et al. [13]	2018	HOLEP	ThuLEP	1 m 8 m 12 m	11 ±2.25 NR 5 ±1.75 NR	9 ±2 NR 5 ±1.5 NR	0.429 NR 0.73 NR	3 ±0.75 NR 1 ±0.5 NR	2 ±0.5 NR 1 ±0.25 NR	≤0.040 NR 0.824 NR	21.3±2.45 NR 25±5.62 NR	22 ±3.13 NR 25.9 ±4.73 NR	0.8 NR 0.616 NR	30 ±16.88 NR 12 ±8.25 NR	14 ±15 NR 0 ±9.88 NR	0.351 NR 0.527 NR	NR NR NR	N N N N N N N N N N N N N N N N N N N	NR NR NR
Bozzini et al. [14]	2021	HOLEP	ThuLEP	1 m 8 m 12 m	NR 6.12 ±3.75 NR 7.34 ±5.43	NR 5.45 ±6.88 NR 6.81 ±4.92	NR 0.16 NR 0.21	NR 44.2 ±13.22 NR 45.6 ±11.59	NR 40.9 ±15.22 NR 43.6 ±12.49	NR 0.13 NR 0.17	NR 20.76 ±9.78 NR 19.43 ±12.56	NR 25.87 ±11.09 NR 26.12 ±7.76	NR 0.12 NR 0.08	NR 45.3 ±25.16 NR 31.9 ±20.35	NR 50.9 ±30.46 NR 42.1 ±18.99	NR 0.07 NR 0.11	NN NN NN NN NN NN	NR NR NR	N N N N N N N N N N N N
Zhang et al. [17]	2020	HOLEP	ThuLEP	1 m 8 m 12 m	7 ±0.25 4 ±0.3 3 ±0.25 3 ±0.25	6 ±0.3 3 ±0.5 3 ±0.3 3 ±0.5	0.63 0.18 0.99 0.4	3 ±0.25 2 (1−2.25) 1 ±0.25 1 ±0.25	2 ±0.5 2 (1−2) 1 ±0.25 1 ±0.25	0.077 0.22 0.48 0.48	22.8 ±4.1 24.8 ±4.7 26.0 ±4.5 26.6 ±4.9	23.3 ±3.8 25.2 ±4.4 25.3 ±4.7 25.5 ±4.5	0.51 0.68 0.45 0.2	15.9 ±5.05 12.1 ±5.55 9.3 ±5.2 6.5 ±3.85	15.0±6.5 14.7±6.2 8.2±5.8 7.5±4.4	0.72 0.19 0.76 0.34	NR N NR NR NR	NR N NR NR	N N N N N N N N N N N N
Habib et al. [18]	2020	HoLEP	PKEP	1 m 8 m 12 m	NR NR NR 3 ±1.5	NR NR NR 3 ±1.5	NR NR NR 0.48	NR NR NR 2 ±0.5	NR NR NR 2 ±0.75	NR NR NR 0.22	NR NR NR 25.6±11.25	NR NR NR 25 ±9.1	NR NR NR 0.78	NR NR NR 22.15 ±5.21	NR NR NR 20.29 ±8.63	NR NN NN NN NN NN	NR NR NR 20.16 ±4.56	NR NR NR 17.68 ±5.27	NR NR NR 0.074
Higazy et al. [19]	2021	HOLEP	PKEP	1 m 6 m 12 m	4.6±0.7 5.1±1 NR 5.8±1.4	4.8 ±0.6 5.23 ±0.97 NR 6 ±1.8	0.2 0.56 NR 0.11	NR NR NR 1.4±0.5	NR NR NR 1.3 ±0.5	NR NR 0.9	24.8±2 22.22±1.85 NR 20.74±1.7	23.2 ±1.8 21.94 ±1.79 NR 20 ±1.8	0.65 0.43 NR 0.523	22.8 ±18.9 24.8 ±18.9 NR 22.5 ±17.2	27 ±17.6 28 ±17.6 NR 25.5 ±15.1	0.31 0.23 NR 0.41	NR N NR NR NR	N N N N N N N N	N N N N N N N N N N N N N
Wei et al. [20]	2021	HoLEP	PKEP	1 m 3 m 12 m	10.71 ±1.93 NR 7.63 ±1.95 6.58 ±1.64	10.63 ±2.52 NR 7.94 ±2.13 6.52 ±2.04	0.81 NR 0.33 0.85	2.55 ±0.63 NR 2.18 ±0.81 1.69 ±0.89	2.61 ±0.61 NR 2.21 ±0.84 1.56 ±1.04	0.53 NR 0.77 0.4	21.60 ±2.59 NR 22.36 ±1.96 23.00 ±1.91	20.94 ±2.49 NR 22.31 ±1.75 23.25 ±2.02	0.1 NR 0.87 0.42	23.15 ±9.94 NR 21.30 ±9.77 18.83 ±9.15	21.56±10.77 NR 21.11±9.18 19.72±9.82	0.33 NR 0.9 0.55	NR NR NR 17.46 ±1.77	NR NR NR 17.71 ±1.77	NR NR 0.38
Elshal et al. [24]	2015	HOLEP	Gre- enVEP	1 m 8 m 12 m	N N N N N N N N	N N N N N N N	N N N N N	NR NR NR	AR A A A	N N N N N N N N N N N N N N N N N N N	24.7±12.5 26.4±13.2 31.1±14 NR	20.4 ±9.4 19.9 ±10.8 18.5 ±7 NR	0.06 0.02 0.01 NR	NR NR NR	NR NR NR	NN NN NN NN	AN AN AN AN	NR NR NR	N N N N N N N N N N N N
He et al. [15]	2019	HOLEP	DiLEP	1 m 8 m 12 m	NR 9.8 ±3.7 6.5 ±3.4 5.9 ±2.6	NR 9.9 ±3.3 7.5 ±3.9 6.2 ±2.7	NR 0.92 0.137 0.55	NR 1.4±0.9 1.3±0.7 0.8±0.1	NR 1.5 ±0.9 1.3 ±0.8 0.7 ±0.1	NR 0.566 0.816 0.281	NR 22.8 ±2.7 24.2 ±3.6 24.3 ±3.3	NR 22.5 ±2.5 23.9 ±2.8 24.6 ±3.1	NR 0.589 0.598 0.655	NR 20.7 ±16.1 10.2 ±8.7 8.3 ±8.2	NR 20.3 ±13.5 12.3 ±9.1 10.2 ±6.6	NR 0.881 0.178 0.152	NR N NR NR N	NR N NR NR	N N N N N N N N N
Feng et al. [16]	2016	ThuLEP	PKEP	1 m 8 m 12 m 12 m	NR 8.07 ±2.57 7.69 ±2.29 6.87 ±2.54	NR 8.85 ±2.94 8.15 ±2.22 7.03 ±2.38	NR 0.11 0.25 0.71	NR 1.64 ±0.59 1.54 ±0.53 1.32 ±0.47	NR 1.74 ±0.71 1.64 ±0.58 1.38 ±0.49	NR 0.2 0.43 0.49	NR 20.13 ±4.33 21.07 ±3.85 21.46 ±4.05	NR 19.14 ±5.34 20.62 ±3.47 21.09 ±3.29	NR 0.25 0.31 0.57	NR 21.05 ±12.49 18.41 ±12.44 17.56 ±11.75	NR 22.62 ±13.04 19.27 ±11.19 18.33 ±10.47	NR 0.49 0.68 0.7	NN NN NN NN NN NN	N N N N N N N N N	N N N N N N N N N N N N
Wu et al. [21]	2016	PKEP	DiLEP	1 m 6 m 12 m	NR 7.2 ±3.5 5.5 ±3.1 4.3 ±2.2	NR 7.6 ±3.2 4.7 ±2.8 3.6 ±2.3	NR 0.6 0.23 0.16	NR 1.6±1.0 1.4±0.8 1.2±0.9	NR 1.8 ±1.2 1.6 ±1.1 1.3 ±1.1	NR 0.42 0.36 0.65	NR 16.3 ±7.3 18.5 ±8.2 17.0 ±6.7	NR 17.5 ±6.6 19.8 ±9.3 18.2 ±6.3	NR 0.44 0.51 0.41	NR 20.7 ±13.1 18.7 ±12.7 24.2 ±13.9	NR 22.3 ±10.4 20.2 ±11.5 23.4 ±16.3	NR 0.55 0.58 0.81	NR 16.3 ±5.8 17.6 ±6.9 17.2 ±7.4	NR 15.5 ±6.2 18.8 ±7.3 16.8 ±8.3	NR 0.55 0.45 0.82

Central European Journal of Urology

Table 4. Post-operative functional outcomes

Author	Vear	Interve ari	ention m		SSdI	(mean/SD)		QoL	(mean/SD)		Qmax, r	nL/s (mean/S	(D)	PVR, r	nL (mean/SD	(IIEF	(mean/SD)	
	5	EEP1	EEP2	Follow- -up	EEP1	EEP2	p-value	EEP1	EEP2	p-value	EEP1	EEP2	p-value	EEP1	EEP2	p-value	EEP1	EEP2	p-value
				1 M	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Xu	C 10 C			3 M	7.45 ±1.89	7.03±1.29	0.24	1.88 ± 0.97	1.65 ± 0.74	0.25	22.86 ±4.51	23.09 ±4.29	0.82	20.30 ±35.43	15.95 ± 29.58	0.55	NR	NR	NR
et al. [22]	STU2	РЛЕ Р	UILEY	6 m	6.30 ±1.74	6.08 ± 1.23	0.51	1.55 ± 0.60	1.48 ± 0.55	0.56	23.11 ±4.29	23.33 ±3.73	0.812	4.75 ±10.89	4.07 ±12.75	0.8	NR	NR	NR
				12 m	5.28 ±1.32	4.88±1.24	0.17	1.23 ±0.48	1.18 ± 0.45	0.63	23.32 ±3.67	23.45 ±3.33	0.87	2.15 ±5.02	1.25 ± 3.10	0.34	NR	NR	NR
				1 m	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
noz	0100			3 M 3	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
et al. [23]	\$T07	r Ner N	UILEF	6 m	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	14.1 ± 8.3	14.2 ±8.8	NR
				12 m	2.9 ±2.6	3.0±2.2	NR	NR	NR	NR	28.1 ±7.2	28.0 ±7.0	NR	NR	NR	NR	NR	NR	NR
PSS – Inten	national P of the nr	rostate Sy	/mptom 5	Score; SD	– standard de	eviation; QoL	– quality Hate: DKF	of life; PVR – D – plasma ki	post-void resi	idual; IIEf	F – Internation	al Index of Ere	sctile Fun. da ED	ction; EEP – end	doscopic enuc	leation pro	ocedures; Hc	LEP – holmiu	um las

EEP improves IPSS, QoL, Qmax, and PVR regarding efficacy. On comparing different EEP, Thu-LEP significantly improves IPSS and QoL scores more than HoLEP in the short term (1 month), but not in the longer-term (12 months). We identified no other functional outcome differences in meta-analyses.

Although the efficacy and safety among different EEPs are similar, it has been shown that the length of learning may differ. The learning curve is steep, with a plateau of around 30–40 cases for Ho-LEP [29]. Therefore, the complications and functional outcomes reported in the current study may be skewed by surgeons who were still mastering the procedure. In addition, outcomes may well be affected by the differences in power settings [30], variations in the technique, such as the number of lobes enucleated [31], and the type of morcellators [32] used.

Enucleation using plasma kinetic energy is an alternative option where laser facilities are not readily available. Most of the outcomes following PKEP are similar to enucleation using lasers, but may be superior due to lower cost and hospital expenses [20]. In addition, it achieves less blood loss and improved IPSS, QoL, and Qmax compared with TURP [33].

Implication for clinical practice and future research

All enucleation methods appeared to improve shortterm IPSS with a low incidence of severe complications. However, there are not enough RCTs with consistent reporting to conclude on which enucleation method is more superior. More RCTs are needed to compare different EEPs, and future research should focus on 'standardised' reporting, i.e., reporting pre- and post-operative IPSS/IIEF and uroflowmetry parameters and, using the Clavien-Dindo system for complications.

Strengths and limitations

Strengths of this review include the systematic approach, adherence to the PRISMA checklist, and RoB assessment of individual studies. A limitation was the heterogeneity among studies regarding their primary endpoints, follow-up duration, and reporting of IPSS/IIEF at different time points. Due to the small number of studies included in the meta-analysis for each outcome, we did not perform a subgroup analysis (sensitivity analysis).

Figure 6. Risk of bias assessment of included studies using the Cochrane RoB for RCTs tools. RoB – risk of bias; RCTs – randomised-controlled trials

Although most studies did report patient blinding during hospitalization, performance bias was judged high in all of the included studies. In addition, we did not stratify the enucleation details further, such as the energy level used and the number of lobes enucleated.

CONCLUSIONS

EEPs improve symptom and QoL scores and Qmax. Procedures are safe with a low incidence of Clavien-Dindo I–III complications. However, ThuLEP was associated with shorter operative time, lower haemoglobin decrease, and lower incidence of low-grade complications compared with HoLEP. Thorough meta-analyses were not possible due to the lack of RCTs for some EEP comparisons. RCTs comparing various EEPs are highly needed to gather further information about the possible advantages of different energy sources and enucleation techniques. Reporting of complications should be done uniformly to avoid a high inter-study bias for essential safety outcomes.

CONFLICTS OF INTEREST

The authors declare no conflicts of interest.

AUTHOR CONTRIBUTION

KHP and GO had full access to all the data in the study and takes responsibility for the integrity of the data and the accuracy of the data analysis. Study concept and design: CSB, TT Acquisition of data: KHP, GO, YY Analysis and interpretation: KHP, GO Drafting of the manuscript: KHP, GO Critical revision of the manuscript: KHP, GO, CYY, CSB, TT Statistical analysis: KHP, GO

Obtaining funding: None

Administrative, technical or material support: KHP, GO, CYY, CSB, TT Supervision: CSB, TT

APPENDIX

Appendix 1. PRISMA 2020 Checklist

PRISMA – Preferred Reporting Items for Systematic Reviews and Meta-analyses

Section and Topic	Item #	Checklist item	Location where item is reported (page)
TITLE			
Title	1	Identify the report as a systematic review.	Title page
ABSTRACT			
Abstract	2	See the PRISMA 2020 for Abstracts checklist.	Abstract page
INTRODUCTION			
Rationale	3	Describe the rationale for the review in the context of existing knowledge.	1
Objectives	4	Provide an explicit statement of the objective(s) or question(s) the review addresses.	1
METHODS			
Eligibility criteria	5	Specify the inclusion and exclusion criteria for the review and how studies were grouped for the syntheses.	2
Information sources	6	Specify all databases, registers, websites, organisations, reference lists and other sources searched or consulted to identify studies. Specify the date when each source was last searched or consulted.	2
Search strategy	7	Present the full search strategies for all databases, registers and websites, including any filters and limits used.	2
Selection process	8	Specify the methods used to decide whether a study met the inclusion criteria of the review, including how many reviewers screened each record and each report retrieved, whether they worked independently, and if applicable, details of automation tools used in the process.	2
Data collection process	9	Specify the methods used to collect data from reports, including how many reviewers collected data from each report, whether they worked independently, any processes for obtaining or confirming data from study investigators, and if applicable, details of automation tools used in the process.	2
Data items	10a	List and define all outcomes for which data were sought. Specify whether all results that were compatible with each outcome domain in each study were sought (e.g. for all measures, time points, analyses), and if not, the methods used to decide which results to collect.	2
	10b	List and define all other variables for which data were sought (e.g. participant and intervention characteristics, funding sources). Describe any assumptions made about any missing or unclear information.	2
Study risk of bias assessment	11	Specify the methods used to assess risk of bias in the included studies, including details of the tool(s) used, how many reviewers assessed each study and whether they worked independently, and if applicable, details of automation tools used in the process.	2
Effect measures	12	Specify for each outcome the effect measure(s) (e.g. risk ratio, mean difference) used in the synthesis or presentation of results.	2, 3
	13a	Describe the processes used to decide which studies were eligible for each synthesis (e.g. tabulating the study intervention characteristics and comparing against the planned groups for each synthesis (item #5)).	2
	13b	Describe any methods required to prepare the data for presentation or synthesis, such as handling of missing summary statistics, or data conversions.	2, 3
Countly a size	13c	Describe any methods used to tabulate or visually display results of individual studies and syntheses.	2, 3
methods	13d	Describe any methods used to synthesize results and provide a rationale for the choice(s). If meta-analysis was performed, describe the model(s), method(s) to identify the presence and extent of statistical heterogeneity, and software package(s) used.	3
	13e	Describe any methods used to explore possible causes of heterogeneity among study results (e.g. subgroup analysis, meta-regression).	NR
	13f	Describe any sensitivity analyses conducted to assess robustness of the synthesized results.	NR
Reporting bias assessment	14	Describe any methods used to assess risk of bias due to missing results in a synthesis (arising from reporting biases).	2
Certainty assessment	15	Describe any methods used to assess certainty (or confidence) in the body of evidence for an outcome.	2, 3
RESULTS			
Church and the	16a	Describe the results of the search and selection process, from the number of records identified in the search to the number of studies included in the review, ideally using a flow diagram.	6, suppl figure 2
SLUGY SELECTION	16b	Cite studies that might appear to meet the inclusion criteria, but which were excluded, and explain why they were excluded.	3

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Appendix 1. Continued

Section and Topic	ltem #	Checklist item	Location where item is reported (page)				
Study characteristics	17	Cite each included study and present its characteristics.	3-6, tables 1-3				
Risk of bias in studies	18	Present assessments of risk of bias for each included study.	6, suppl figure 3				
Results of individual studies	19	For all outcomes, present, for each study: (a) summary statistics for each group (where appropriate) and (b) an effect estimate and its precision (e.g. confidence/credible interval), ideally using structured tables or plots.	3-6, figure 1				
	20a	For each synthesis, briefly summarise the characteristics and risk of bias among contributing studies.	6, suppl figure 3				
Results	20b	Present results of all statistical syntheses conducted. If meta-analysis was done, present for each the summary estimate and its precision (e.g. confidence/credible interval) and measures of statistical heterogeneity. If comparing groups, describe the direction of the effect.	3-6, figure 1				
or syntheses	20c	Present results of all investigations of possible causes of heterogeneity among study results.	3-6, figure 1, tables 1-3				
	20d	Present results of all sensitivity analyses conducted to assess the robustness of the synthesized results.	NR				
Reporting biases	21	Present assessments of risk of bias due to missing results (arising from reporting biases) for each synthesis assessed.	6, suppl figure 3				
Certainty of evidence	22	Present assessments of certainty (or confidence) in the body of evidence for each outcome assessed.	figure 1				
DISCUSSION		Provide a general interpretation of the results in the context of other evidence.					
	23a	 Provide a general interpretation of the results in the context of other evidence. Discuss any limitations of the evidence included in the review. Discuss any limitations of the review processes used. Discuss implications of the results for practice, policy, and future research. 					
<u>.</u>	23b						
Discussion	23c						
	23d						
OTHER INFORMA	TION						
Registration and	24a	Provide registration information for the review, including register name and registration number, or state that the review was not registered.	2				
protocol	24b	Indicate where the review protocol can be accessed, or state that a protocol was not prepared.	NR				
	24c	Describe and explain any amendments to information provided at registration or in the protocol.	NR				
Support	25	Describe sources of financial or non-financial support for the review, and the role of the funders or sponsors in the review.	Title page				
Competing interests	26	Declare any competing interests of review authors.	Title page				
Availability of data, code and other materials	27	Report which of the following are publicly available and where they can be found: template data collection forms; data extracted from included studies; data used for all analyses; analytic code; any other materials used in the review.	NR				

From: Page MJ, McKenzie JE, Bossuyt PM, et al. The PRISMA 2020 statement: an updated guideline for reporting systematic reviews. BMJ 2021;372:n71. doi: 10.1136/bmj.n71

For more information, visit: http://www.prisma-statement.org/

Author	Year	Inclusion criteria	Exclusion criteria
Becker et al. [13]	2018	Qmax ≤15 ml/s, IPSS ≥12, age ≥18, failed medical therapy for BPO, recurrent UTI, acute or recurrent episodes of urinary retention or postrenal acute kidney injury	Previous urethral/prostatic surgery, active prostate cancer (PCa), urethral strictures, urodynamically diagnosed neurogenic bladder
Bozzini et al. [14]	2021a	IPSS ≥8, weak or no response to previous medical treatments, Qmax <15 ml/sec, acute urinary retention	History of prostatic surgery, prostate or bladder cancer suspicion/history, documented/suspected neurogenic bladder, urethral stricture, anticoagulant/antiaggregant therapy, concurrent bladder stones, patients unfit for surgery, failure to sign informed consent
Zhang et al. [17]	2019	Prostate size (TRUS) ≥80 ml, Qmax ≤15 ml/sec, IPSS ≥12, urodynamic obstruction without detrusor dysfunction and no response to pharmacologic therapy	Neurogenic bladder, suspicion for prostate cancer, urethral strictures, poor tolerance for surgery
Habib et al. [18]	2020	IPSS ≥13, Qmax <15 ml/sec, prostate size ≥80 g	Urethral stricture, neurological disorder affecting bladder function, bladder or prostate cancer, previous history of TURP or bladder neck surgery
Higazy et al. [19]	2021	LUTS secondary to BPH, prostate volume ≥ 80ml, failed medical treatment, refractory haematuria, recurrent attacks of urine retention, upper urinary tract affected or high IPSS ≥20 that affects Qo 3, IPSS ≥8	Anticoagulant or antiplatelet medication, neurogenic bladder, urethral stricture, bladder stones, prostate cancer, previous prostate urethral surgery
Wei et al. [20]	2021	Patients with LUTS and obstruction due to BPH who had indication for surgical treatment and failed on conservative medical therapy with alpha blockers and 5-alpha reductase inhibitors	Severe pulmonary disease or heart disease, bladder calculus, neurogenic bladder dysfunction, bladder cancer, previous prostate surgery, prostate cancer, urethral stricture or coagulopathy
Elshal et al. [24]	2015	Age >50, refractory LUTS secondary to BPH, I-PSS >15, QoL-score ≥3, Qmax <15 ml/sec, acute urinary retention secondary to BPH in whom trial of voiding failed, prostate volume on TRUS 40–150 ml	Neurological disorder, active UTI, bladder/prostate cancer
He et al. [15]	2019	Qmax ≤15 ml/s, QoL ≥3, IPSS ≥8	Prostate cancer, prior prostate surgery, acute prostatitis or urethritis, neurogenic bladder and urethral injury
Feng et al. [16]	2016	Age ≥50 and ≤85, IPSS ≥7, Qmax < 15 ml/sec, medical therapy failure	Neurogenic bladder, documented or suspected prostate cancer, prior prostatic or urethral surgery, poor tolerance for surgery
Wu et al. [21]	2016	Indication for surgical treatment of BPH	Severe pulmonary or heart disease, bladder calculus, neurogenic bladder dysfunction, bladder or prostate cancer, urethral stricture or coagulopathy
Xu et al. [22]	2013	Age ≥50, IPSS ≥7, Qmax < 1 ml/sec	Neurogenic bladder, history of prostatic or urethral surgery, prostate cancer
Zou et al. [23]	2018	IPSS ≥12, QoL ≥4, Qmax <15 ml/sec and/or Schafer grade ≥2 and/or failed medical therapy for BPO and/or recurrent urinary retention	Previous urethral/prostatic surgery, prostate cancer, urethral stricture, neurogenic bladder, neurologic disorder affecting micturition

Appendix 2. Inclusion and exclusion of included studies

IPSS – international prostate symptom score; BPO – benign prostatic obstruction; Pca – prostate cancer; UTI – urinary tract infections; TRUS – transrectal ultrasound; BPH – benign prostatic hyperplasia; LUTS – lower urinary tract symptoms; TURP – transurethral resection of the prostate

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Appendix 3. Post-operative complications

Author	Year	Interv a	rm	reter	ntion/p	Clot prolony turia, n (%)	ged ha	ema-	Suj	perficia mo	al blad due to rcellat n (%)	lder in o tion,	jury	viol	ation/ o	Capsul perfora perativ n (%)	e ation ii /e,	ntra-		На	ematu n (%)	ıria,	
		EEP1	EEP2	Ove- rall	EEP1	EEP2	Tre- at- ment	p-va- lue	Ove- rall	EEP1	EEP2	Tre- at- ment	p-va- lue	Ove- rall	EEP1	EEP2	Tre- at- ment	p-va- lue	Ove- rall	EEP1	EEP2	Tre- at- ment	p-va- lue
Becker et al. [13]	2018	Holep	ThuVEP	4 (4.3)	2 (4.3)	2 (4.2)	Blad- der irriga- tion	0.499	1 (1.1)	0 (0)	1 (2.1)	No spe- cial the- rapy	0.281	NR	NR	NR	NR	NR	1 (1.1)	1 (2.2)	0 (0)	Trans- fusion	0.267
Bozzini et al. [14]	2021	Holep	ThuLEP	NR	NR	NR	NR	NR	1 (0.4)	1 (0.8)	0 (0)	NR	0.8	NR	NR	NR	NR	NR	10 (4.2)	8 (6.6)	2 (1.7)	Trans- fusion	0.03
Zhang et al. [17]	2020	Holep	ThuLEP	4 (3.4)	3 (5.2)	1 (1.7)	Blad- der irriga- tion	0.62	5 (4.3)	4 (6.9)	1 (1.7)	no treat- ment	0.36	NR	NR	NR	NR	NR	0 (0)	0 (0)	0 (0)	NR	-
Habib et al. [18]	2020	Holep	PKEP	NR	NR	NR	NR	NR	0 (0)	0 (0)	0 (0)	NR	_	1 (1.6)	0 (0)	1 (3.2)	Ca- the- ter dra- inage	0.48	0 (0)	0 (0)	0 (0)	NR	-
Higazy et al. [19]	2021	Holep	РКЕР	1 (0.9)	1 (1.9)	0 (0)	NR	0.32	1 (0.9)	0 (0)	1 (1.9)	Pro- lon- ged ca- the- ter dura- tion	0.31	1 (0.9)	0 (0)	1 (1.9)	Pro- lon- ged ca- the- ter	0.31	NR	NR	NR	NR	NR
Wei et al. [20]	2021	Holep	PKEP	NR	NR	NR	NR	NR	0 (0)	0 (0)	0 (0)	NR	-	0 (0)	0 (0)	0 (0)	NR	-	NR	NR	NR	NR	NR
Elshal et al. [24]	2015	Holep	Gre- enVEP	3 (2.9)	1 (2)	2 (3.7)	Ca- the- teri- zation	1	5 (4.9)	4 (8)	1 (1.8)	Ca- the- ter dra- inage of blad- der	0.19	4 (3.9)	1 (2)	3 (5.6)	Ca- the- ter dra- inage of blad- der	0.61	1 (1)	0 (0)	1 (1.8)	Trans- fusion	1
He et al. [15]	2019	Holep	Dilep	NR	NR	NR	NR	NR	0 (0)	0 (0)	0 (0)	NR	-	0 (0)	0 (0)	0 (0)	NR	-	0 (0)	0 (0)	0 (0)	NR	-
Feng et al. [16]	2016	ThuLEP	PKEP	NR	NR	NR	NR	NR	0 (0)	0 (0)	0 (0)	NR	-	1 (0.8)	0 (0)	1 (1.5)	NR	0.33	1 (0.8)	0 (0)	1 (1.5)	Trans- fusion	0.33
Wu et al. [21]	2016	PKEP	Dilep	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	1 (1.3)	1 (2.5)	0 (0)	NR	0.31	1 (1.3)	1 (2.5)	0 (0)	Trans- fusion	0.31
Xu et al. [22]	2013	PKEP	Dilep	NR	NR	NR	0	NR	0 (0)	0 (0)	0 (0)	NR	-	3 (3.8)	1 (2.5)	2 (5)	NR	0.56	0 (0)	0 (0)	0 (0)	NR	-
Zou et al. [23]	2018	PKEP	Dilep	NR	NR	NR	NR	NR	0 (0)	0 (0)	0 (0)	NR	-	0 (0)	0 (0)	0 (0)	NR	_	0 (0)	0 (0)	0 (0)	NR	-

EEP – endoscopic enucleation of the prostate; HoLEP – holmium laser enucleation of the prostate; ThuVEP – thulium laser vapoenucleation prostate; PKEP – plasma kinetic enucleation of the prostate; NR – not reported; DiLEP – diode laser enucleation of the prostate

Appendix 3. Continued

Author	Year	Interv ar	ention m			UTI <i>,</i> n (%)				In mc	comple orcellation n (%)	te on,			Hyd due ori	roneph to uret ifice inju n (%)	rosis eric ıry,	
		EEP1	EEP2	Overall	EEP1	EEP2	Treat- ment	p-value	Overall	EEP1	EEP2	Treat- ment	p-value	Overall	EEP1	EEP2	Treat- ment	p-value
Becker et al. [13]	2018	Holep	ThuVEP	2 (2.1)	1 (2.1)	1 (2.1)	Antibio- tics	0.499 – 4 weeks follow up, 0.31 – be- tween 1–6 months follow up	1 (1.1)	1 (2.2)	O (O)	Remo- val of enuc- leated tissue in local ana- esthesia	0.267	1 (1.1)	1 (2.2)	0 (0)	Ureteral stent inser- tion	0.267
Bozzini et al. [14]	2021	Holep	ThuLEP	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Zhang et al. [17]	2020	Holep	ThuLEP	4 (3.5)	1 (1.7)	3 (5.2)	Antibio- tics	0.62	0 (0)	0 (0)	0 (0)	NR	-	0 (0)	0 (0)	0 (0)	NR	-
Habib et al. [18]	2020	Holep	PKEP	4 (6.3)	1 (3)	3 (9.7)	Antibio- tics	0.347	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Higazy et al. [19]	2021	Holep	PKEP	8 (7.5)	3 (5.6)	5 (9.4)	Antibio- tics	0.67	0 (0)	0 (0)	0 (0)	NR	-	0 (0)	0 (0)	0 (0)	NR	-
Wei et al. [20]	2021	Holep	PKEP	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Elshal et al. [24]	2015	Holep	Gre- enVEP	4 (3.9)	overall: 0 (0)	overall: 4 (7.6); early: 3 (5.7); late: 1 (1.8)	Antibio- tics	1.0 (early); 0.41 (late)	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
He et al. [15]	2019	Holep	Dilep	7 (5.6)	4 (6.3)	3 (4.8)	Antibio- tics	0.697	NR	NR	NR	NR	NR	0 (0)	0 (0)	0 (0)	NR	-
Feng et al. [16]	2016	ThuLEP	PKEP	3 (2.4)	1 (1.6)	2 (3)	Antibio- tics	0.61	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Wu et al. [21]	2016	PKEP	Dilep	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Xu et al. [22]	2013	PKEP	Dilep	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Zou et al. [23]	2018	PKEP	Dilep	8 (7)	5 (8.8)	3 (5.3)	Antibio- tics	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR

EEP – endoscopic enucleation of the prostate; HoLEP – holmium laser enucleation of the prostate; ThuVEP – thulium laser vapoenucleation prostate; PKEP – plasma kinetic enucleation of the prostate; NR – not reported; DiLEP – diode laser enucleation of the prostate

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Database: Embase <1974 to 2022 February 04>, OVID Medline Epub Ahead of Print, In-Process & Other Non-Indexed Citations, Ovid MEDLINE(R) Daily and Ovid MEDLINE(R) 1946 to Present, EBM Reviews – Cochrane Central Register of Controlled Trials <November 2021>

Search Strategy:

- 1 exp prostate hypertrophy/ or exp Prostatic Hyperplasia/ (63820)
- 2 prostate adenoma/ (1171)
- 3 (benign adj3 (prostate or prostatic) adj3 (obstruction* or enlargement*)).kw,tw. (4677)
- 4 ((prostate or prostatic) adj2 (hyperplasia or hypertroph* or adenoma*)).tw,kw. (53611)
- 5 Prostatism.tw,kw. (1357)
- 6 or/1-5 (79386)
- 7 exp lower urinary tract symptoms/ or exp lower urinary tract symptom/ (64188)
- 8 ((lower urinary or bladder or urethra* or urination or urinating or LUT) adj3 (symptom* or complain*)).tw,kw. (39956)
- 9 "LUTS".tw. (15818)
- 10 (Bladder outlet obstruction or BPH or BPO or BPE or BOO or OAB).tw,kw. (59421)
- 11 bladder obstruction/ (4199)
- 12 bladder neck stenosis/ or Urinary Bladder Neck Obstruction/ (12275)
- 13 ((benign or neck) adj3 bladder adj3 (sclerosis or obstruction* or obstructed voiding or neck strangulation or stenosis or stenoses or scleroses or contracture or stricture* or narrow* or fistula*)).tw,kw. (3450)
- 14 dysuria.tw,kw. (14013)
- 15 (Sensation adj3 incomplete adj3 emptying).tw,kw. (224)
- 16 (Chronic adj3 (urine or urinary) adj3 retention).tw,kw. (971)
- 17 (Incomplete voiding or obstructing voiding).tw,kw. (268)
- 18 (bladder emptying adj2 (dysfunction* or incomplete or incompetent)).tw. (867)
- 19 overactive bladder/ (24014)
- 20 ((Overactive or overactivity or over activit*) adj (bladder or detrusor)).kw,tw. (22604)
- 21 ((detrusor or bladder) adj (underactivit* or failure or acontractile or hypocontract*)).tw. (1705)
- 22 or/7-21 (158864)
- 23 male/ or (men or man or male*).tw,af. (21267456)
- 24 22 and 23 (86615)
- 25 6 or 24 (131426)
- 26 exp Laser Therapy/ (95026)
- 27 exp holmium laser/ (13150)
- 28 laser/ (130458)
- 29 (laser and prostat*).tw,kw. (11250)
- 30 (holmium or "HoLEP" or thulium or "ThuLEP" or BipolEP or diode or DiLEP or greenlep or MoLEP or EEP or greenlight or greenlep).tw,kw. (67792)
- 31 ((prostate or laser or bipola or endoscopic) adj5 enucleation).tw,kw. (4328)
- 32 or/26-31 (286279)
- 33 25 and 32 (8462)
- 34 randomized controlled trial.pt. or randomized controlled trial.mp. (2509637)
- 35 clinical trial.pt. (814043)
- 36 random*.mp. (4774348)
- 37 clinical trial:.mp. (3491403)
- 38 (blind* or double-blind* or placebo*).mp. (1911776)
- 39 (systematic review or meta-analysis).pt. or (systematic review or meta-analysis).ti. (618248)
- 40 or/34-39 (7634123)
- 41 33 and 40 (2554)
- 42 case report/ or case reports/ or case report.ti. (5016554)
- 43 41 not 42 (2537)
- 44 conference abstract.pt. (4326957)
- 45 43 not 44 (2221)
- 46 limit 45 to english language (1941)
- 47 remove duplicates from 46 (1153)
- *****

Appendix 4. Search strategy and results.

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