

A Meta-Analysis Detailing Overall Sexual Function and Orgasmic Function in Women Undergoing Midurethral Sling Surgery for Stress Incontinence



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ABSTRACT

Introduction: More than 200,000 midurethral slings are placed yearly for stress urinary incontinence. Approximately 14% to 20% of women experience worsening sexual function overall after these procedures. We postulated that sling placement injures neural pathways regulating “female prostate” tissue within the anterior vaginal wall.

Aim: To perform a meta-analysis for overall sexual function and orgasm using validated questionnaires for transvaginal tape, transobturator tape, and their variants.

Methods: Effect sizes of preoperative and postoperative questionnaire scores for overall sexual function and orgasm were calculated. Random-effects models were selected for meta-analyses. Statistical analysis involved determination of the ratio of total heterogeneity to total variability.

Main Outcome Measures: Differences of overall sexual and orgasm functions were calculated by subtracting postoperative sling scores from preoperative sling scores. Forest plots of effect sizes were performed.

Results: Sixty-seven percent of midurethral sling procedures analyzed showed no change or improvement in overall sexual function postoperatively, whereas 33% of studies analyzed for orgasm function showed improvement after the procedure. For transvaginal tape, mean total sexual function and orgasm postoperative scores were significantly higher than preoperative scores. For transobturator tape, mean total postoperative score was significantly higher than the preoperative score; however, the mean orgasm postoperative score was not significantly higher than the preoperative score, possibly because of variability in transobturator tape data.

Conclusion: There is a discrepancy between postoperative sexual satisfaction and orgasmic function after midurethral sling surgery. Although overall sexual function remained the same or improved for most women, orgasmic function in only one third of cases improved overall, with most women experiencing no change or deterioration in orgasmic function. Dissection for, and placement of, the midurethral sling can compromise the neural integrity of the anterior vaginal wall, thereby detrimentally affecting the periurethral prostate tissue that is essential to the orgasmic response. We propose that this surgical procedure can compromise orgasmic function in some women. **Szell N, Komisaruk B, Goldstein SW, et al. A Meta-Analysis Detailing Overall Sexual Function and Orgasmic Function in Women Undergoing Midurethral Sling Surgery for Stress Incontinence. Sex Med 2017;5:e84–e93.**

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Key Words: Suburethral Sling; Orgasmic Disorder; Transvaginal Tape; Transobturator Tape; Female Prostate

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INTRODUCTION

A major support mechanism for continence in women appears to be the integrity of the attachments of the anterior wall of the midurethra to the pubic bone through extensions of the perineal membrane and the caudal and ventral portions of the arcus tendinous fascia pelvis, the pubourethral ligaments.¹ The pubourethral ligaments appear to restrict movement of the midurethral anterior wall during increases in intra-abdominal pressure. During such increases in intra-abdominal pressure, the midurethra is compressed shut against this hammock-like, firm, ligamentous support.^{1,2} Therefore, stress incontinence could be associated with a deficiency or weakness in the pubourethral ligaments that can occur over time, initiated by such factors as childbirth, mechanical compression, and tissue breakdown with aging.¹ Using various surgical reconstructive procedures, most of which are termed *midurethral slings*, also referred to as transobturator tapes (TOTs) or transvaginal tapes (TVT), mechanical reinforcement that mimics effective ligamentous support in the midurethral region can be achieved.³ Thus, the continence mechanism has been shown to be well re-established with midurethral sling surgery.¹ In TOT surgery, the sling traverses the obturator foramen in its surgical passage. In TVT surgery, the sling is placed behind the pubic bone adjacent to the urethra.³ Since 2010, due in part to reliability, efficacy of continence restoration, minimally invasive approach, and ease of reproducibility, there have been more than 200,000 surgical procedures completed annually for stress urinary incontinence.¹ Furthermore, the number of these midurethral sling surgical procedures continues to increase yearly.¹

The path of the surgically placed midurethral sling traverses the anterior vaginal wall and lies within adjacent periurethral female prostatic tissue. Recent advances in translabial ultrasonography have shown that the sling makes an approximately 100° angle underneath the midurethra, with the exact angle depending in part on the surgical approach used for sling placement (Figure 1). There is slight variation in the exact angle depending on the surgical approach of sling placement.⁴

The midurethral sling is positioned within the periurethral tissue in the plane between the female urethra and the adventitia of the anterior vaginal wall. Within this periurethral anterior vaginal wall tissue is situated the female prostate⁵ (Figure 2A, B). The female prostate tissue can constitute a component of the unique characteristic of the palpated anterior vaginal wall that Grafenberg⁶ described. Immunohistochemical studies of periurethral female prostatic tissue have reported positive staining for prostate-specific antigen, prostate-specific alkaline phosphatase, and androgen receptor, consistent with female prostatic tissue. Perineal ultrasound and biochemical studies of female ejaculate in those women who have noted small volumes of fluid expulsion during orgasm have confirmed that the ejaculated fluid is rich in prostate-specific antigen and poor in creatinine and therefore biochemically similar to male ejaculate.^{7,8} This is to be distinguished from large-volume “squirters” during orgasm,

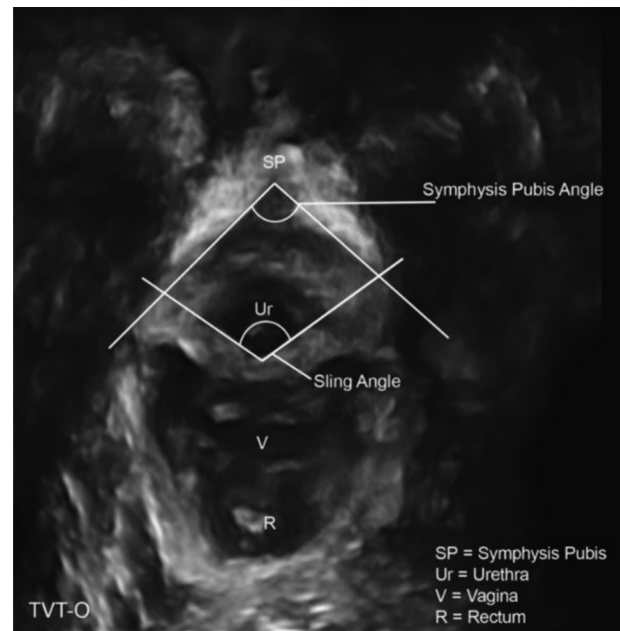


Figure 1. Coronal view of translabial ultrasound of the female urethra.

which is biochemically shown to be more consistent with urine.^{7,8}

During sexual activity, women can experience orgasm from different types of stimulation, including genital and non-genital sites.^{9,10} For genital orgasms, some have used the term *vaginal* or *internal orgasm* as a separate experience from clitoral orgasm. Internal orgasm also can refer to a cervicouterine orgasm. Some women achieve only vaginal orgasm, some experience blended vaginal and clitoral orgasms, and some experience only clitoral orgasm. Some women can distinguish among orgasm types and achieve sexual satisfaction from one or another type of orgasm.^{9,10} However, there is a subgroup of women in whom stimulation specifically of the anterior vaginal wall adjacent to the periurethral female prostate can lead to orgasm and small-volume ejaculation, independent of clitoral stimulation.^{7,8}

We assessed several women in our sexual medicine clinic who, despite having undergone successful midurethral sling placement, were devastated after losing their ability to experience small-volume ejaculation and vaginally elicited orgasm. These women claimed orgasmic dysfunction after midurethral sling surgery. This motivated us to review in the literature the prevalence of orgasmic satisfaction changes of women with stress urinary incontinence who underwent midurethral sling placement surgery. We performed a meta-analysis of women who underwent midurethral sling placement by various methods and who provided objective data concerning sexual and orgasmic function using the Female Sexual Function Index and/or the Pelvic Organ Prolapse/Incontinence Sexual Questionnaire. Then, we analyzed their orgasm function in relation to these databases. We postulated that mechanical injury or destruction of this periurethral female prostate tissue by midurethral sling

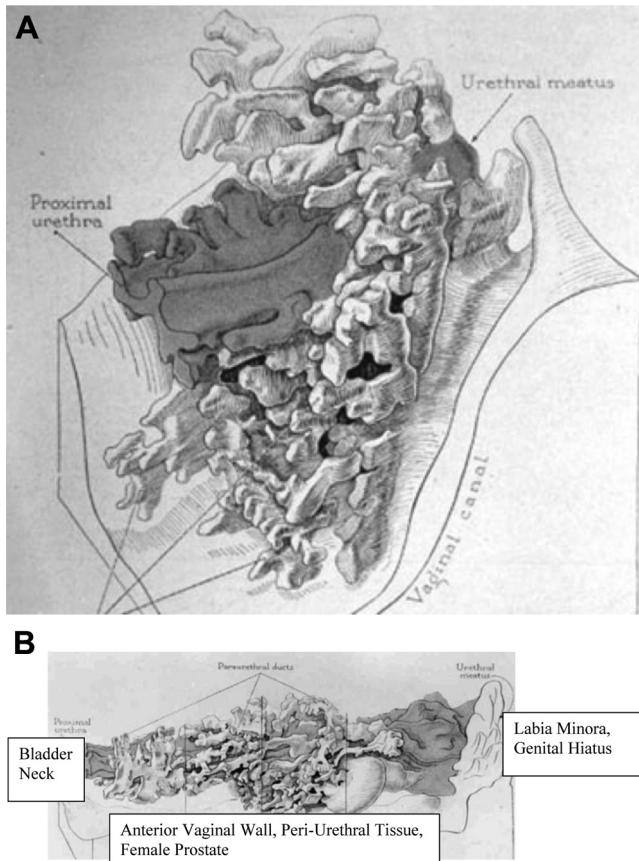


Figure 2. Panels A and B show the anterior and longitudinal aspects, respectively, of J.W. Huffman’s wax model illustrating the female prostate with ductal tissue predominating and with a lobulated appearance similar to the male prostate before puberty.⁸

surgery could injure periurethral neural pathways, thereby compromising the ability of some women to experience vaginally elicited orgasm^{9–13} and causing them distress.

METHODS

A literature search was performed using PubMed, Ovid Medline, and LexisNexis with the key words *midurethral sling*, *sexual function*, and *orgasm*. Twenty-three publications from 2002 through 2015 detailing the outcomes of 2,352 women who underwent midurethral sling surgery for stress incontinence were identified and included. Four articles were examined for subjective background only and excluded from meta-analysis.^{14–17} Articles containing pre- and postoperative questionnaire data on sexual function were included for analysis. Data on concurrent prolapse procedures and anti-incontinence procedures not involving a midurethral sling were excluded. Studies that did not specifically assess sexuality and sexual dysfunction were excluded. Follow-up varied from a minimum of 3 months to a maximum of 24 months. Most studies used the Female Sexual Function Index or the Pelvic Organ Prolapse/Urinary Incontinence Sexual Questionnaire, with two articles using the Lemack questionnaire instead. If the article did not specifically analyze orgasm function as a separate component, attempts were made to contact the authors of each article for these data; however, we did not receive any additional statistical information on orgasm function from any of the contacted authors by the date of initial submission (Figure 3).

Types of midurethral sling surgery included in the analysis were TOT, TVT, TVT with an outside-in approach (TVT-O), single-incision slings, and rectus fascial slings. If the article compared a midurethral sling procedure with another type of non-sling anti-incontinence procedure, then it was excluded. If an article included several different approaches for sling placement (eg, TOT and TVT), then they were analyzed separately for the meta-analysis. If the article surveyed the patients at several points postoperatively, then these follow-up points were analyzed separately. Overall sexual function and orgasmic function were

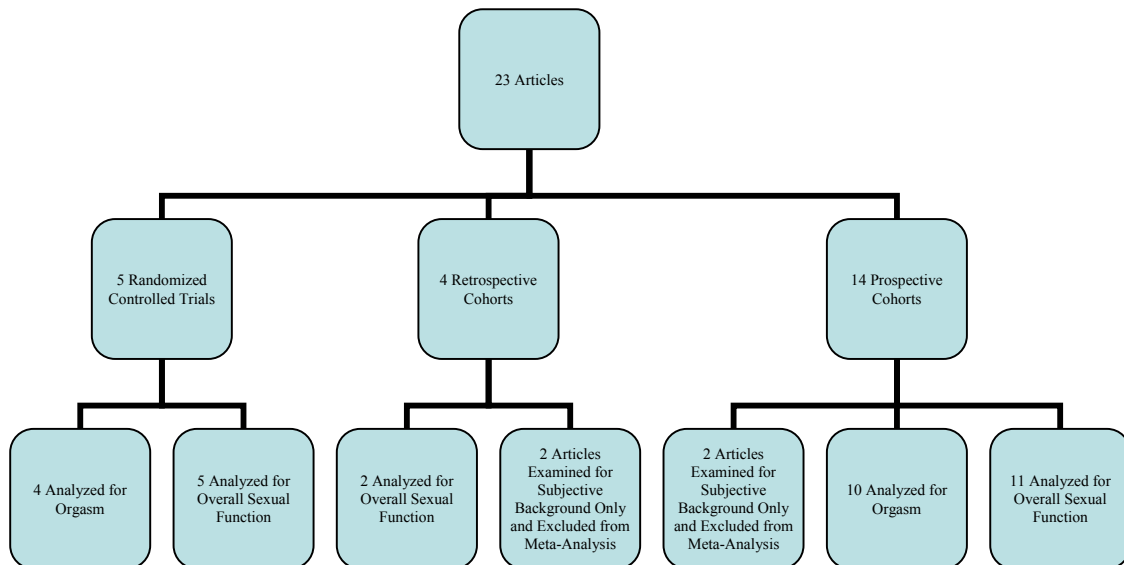


Figure 3. Meta-analysis flow chart.

Table 1. Types of midurethral sling surgery included in overall analysis

Study and year	Sling type	Questionnaire	Follow-up	Sample size	Sexual function outcome	Orgasmic function outcome
El-Enen et al, 2009	TOT	FSFI	12 mo	62	Overall improvement (not statistically significant)	Orgasm deteriorated (not statistically significant)
Elzevier et al, 2004, 2008	TOT, TVT, TVT-O	Lemack	3 mo	78, 65	Overall improvement (not statistically significant)	Orgasm deteriorated (not statistically significant)
Pace and Vicentini, 2008	TVT, TOT	FSFI	3 mo	101	No overall change	Not specifically studied
Yeni 2003	TVT	FSFI	6 mo	32	Overall deterioration (not statistically significant)	Orgasm deteriorated (not statistically significant)
Mazouni 2004	TVT	own questions	>6 wk	55	Overall deterioration (statistically significant)	Not specifically studied
De Souza et al, 2012	TVT, TOT	PISQ	6 and 12 mo	87	Overall improvement (not statistically significant)	No overall change
Liang et al, 2012	TOT	PISQ	12 mo	102	No overall change	Orgasm deteriorated (statistically significant)
Tomus 2012	TOT, TVT	PISQ	6 and 24 mo	597	Overall improvement (statistically significant)	Not specifically studied
Dursan 2012	TOT	FSFI	6 mo	96	Overall improvement (statistically significant)	Orgasm improved (not statistically significant)
Naumann et al, 2013	TVT, single incision	FSFI	6 mo	150	Overall improvement (statistically significant)	Orgasm improved (statistically significant)
Tang et al, 2013	TVT	PISQ	6 and 12 mo	33	Overall improvement (not statistically significant)	Orgasm scores remained similar pre- and postoperatively
Naumann et al, 2013	Single Incision	FSFI	6 mo	73	Overall improvement (statistically significant)	Orgasm improved (not statistically significant)
Bekker et al, 2009	TVT, TOT, TVT-O	Lemack	3–12 mo	136	No overall change	Not specifically studied
Filocamo et al, 2011	TOT, TVT	FSFI	12 mo	133	No overall change	Orgasm deteriorated (statistically significant)
Lau et al, 2010	TVT-O	PISQ	6 mo	56	No overall change	Orgasm deteriorated (statistically significant)
Simsek et al, 2014	TOT	FSFI	12 mo	81	Overall improvement (statistically significant)	Not specifically studied
Wadie et al, 2010	fascial sling, TVT	FSFI	24 mo	63	Preoperative scores not recorded	Orgasm increased overall (statistically significant)

FSFI = Female Sexual Function Index; PISQ = Pelvic Organ Prolapse/Incontinence Sexual Questionnaire; TOT = transobturator tape; TVT = transvaginal tape; TVT-O = transvaginal tape using outside-in approach.

separately analyzed for the meta-analysis, and this included 18 articles that delineated sexual function preoperatively and postoperatively. Five articles were randomized controlled trials, 2 were retrospective cohorts, and 11 were prospective cohorts (Table 1).^{18–31}

Eighteen articles were included in the meta-analysis for overall sexual function and orgasm as an individual parameter using Female Sexual Function Index total scores. Several articles were analyzed twice for each type of intervention recorded, including TVT, TOT, TVT-O, single incision, and fascial sling placement. For example, some studies included separate samples based on the approach (TOT vs TVT), so these articles were analyzed twice, with one analysis for the TOT group and another analysis for the TVT group. Effect sizes and precision of preoperative and postoperative total questionnaire scores for overall sexual function and orgasm from various studies were calculated and collected.³² Because studies varied in the mix of participants and in the implementation of surgical approaches (TOT vs TVT), random-effects models were selected for meta-analyses.

Selection bias for most studies within the meta-analysis was low risk because each treatment group for each study contained a similar number of subjects for comparison, and randomization (on a one-to-one basis) for each group was similar across all studies. However, performance and detection biases were high because the surgeons were all aware of the treatment type for each patient, and each patient was usually aware of the type of procedure she underwent pre- or postoperatively. Attrition and reporting bias were

fairly low because most studies selected for inclusion were analyzed statistically only if all specific variables examined were reported pre- and postoperatively. Although significant bias was present throughout most studies simply because of lack of blinding, the meta-analysis selected for only the best randomized-controlled prospective trials, because no known blinded or “sham” surgery studies for sling placement have been reported.³³

Statistical analysis involved determination of the ratio of total heterogeneity among the various studies to total variability. The difference in overall sexual function was calculated by subtracting the postoperative midurethral sling sexual function score from the preoperative midurethral sling sexual function score. The difference in orgasm function was calculated by subtracting the postoperative midurethral sling orgasm function score from the preoperative midurethral sling orgasm function score. All statistical analyses used R Core Team 2015 (R Foundation for Statistical Computing, Vienna, Austria).

RESULTS

Forest plots of effect sizes for overall sexual function and for orgasm of all midurethral sling procedures analyzed are presented in Figures 4 and 5, respectively.

Because TVT (including TVT-O) and TOT are the two main different approaches to midurethral slings, meta-analyses were performed for TVT and TOT separately. To show the difference in effect size between TOT and TVT, error bar plots (± 1 SD) of

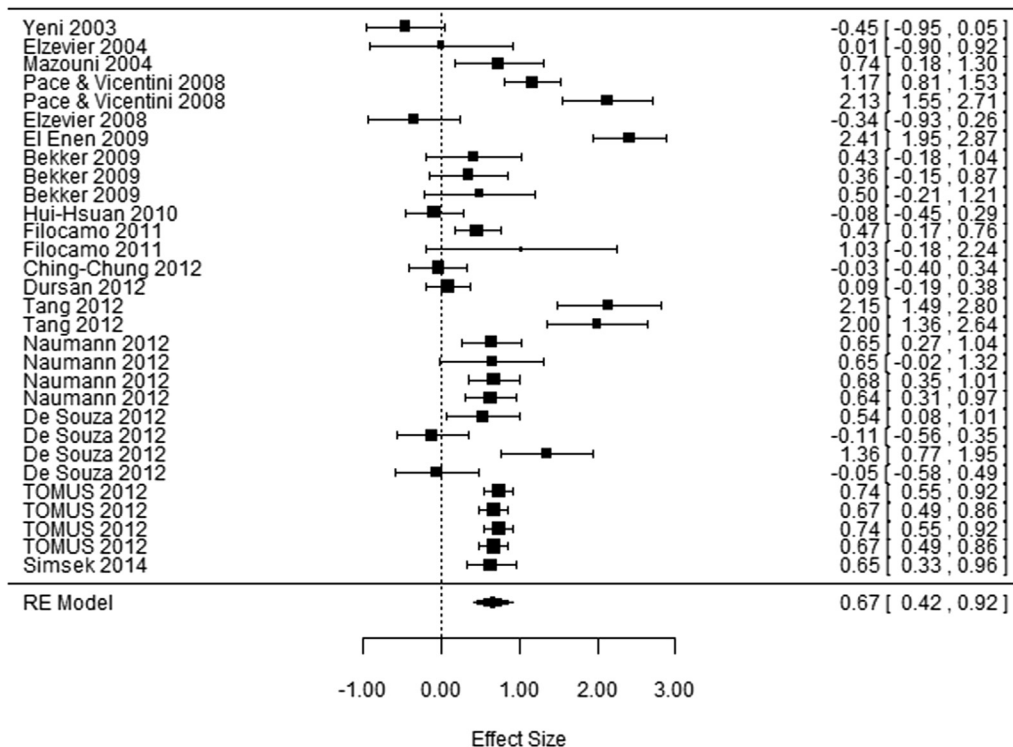


Figure 4. Forest plot of effect sizes for overall sexual function.

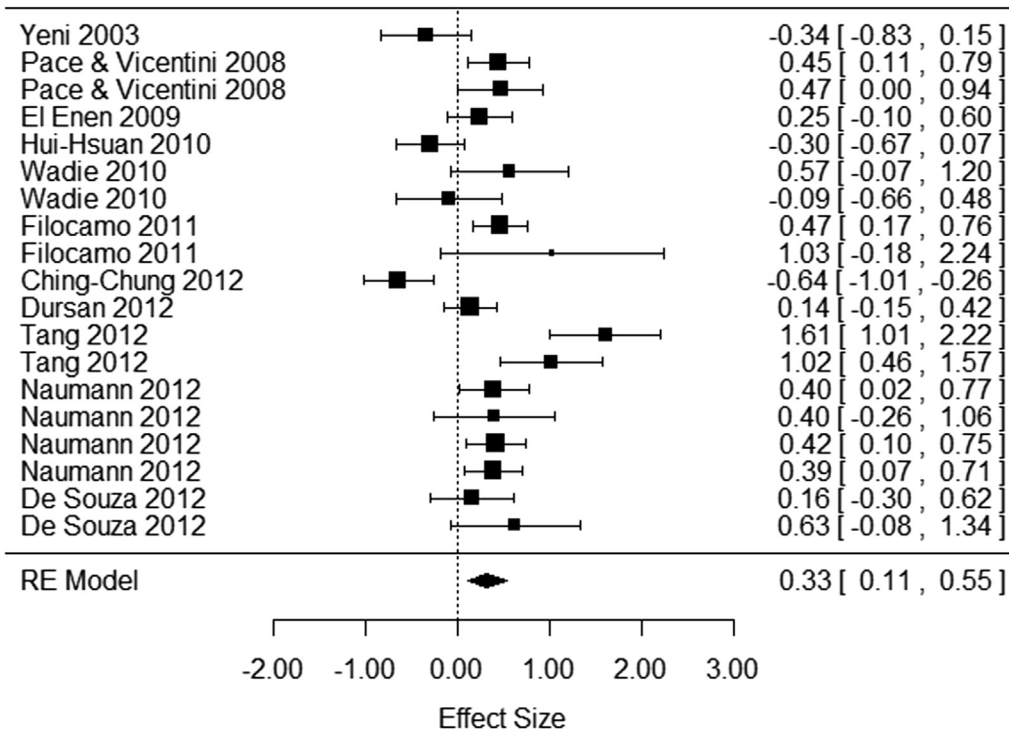


Figure 5. Forest plot of effect sizes for orgasm.

total and orgasm effect sizes are presented in Figures 6 and 7, respectively.

Overall, 67% of midurethral sling procedures analyzed showed no change or improvement in overall sexual function postoperatively. Statistical analysis for the difference in overall sexual function using the total questionnaire score (postoperative vs preoperative midurethral sling sexual function score) showed that the postoperative scores were significantly higher than the preoperative scores ($P < .0001$).

In contrast, only approximately 33% of studies analyzed for orgasm function showed an overall improvement in orgasm after

the midurethral sling procedure. Thus, percentage of improvement of overall sexual function was double that of orgasm function postoperatively. Statistical analysis for the difference of orgasm using the total questionnaire score (postoperative vs preoperative midurethral sling orgasm function score) showed that the postoperative scores were significantly higher than the preoperative scores ($P < .004$).

In studies in which total sexual function was analyzed, the ratio of total heterogeneity to total variability was 79.60%.^{32,33} In studies in which orgasm function was analyzed, the ratio of total heterogeneity to total variability was 93.13%. This shows

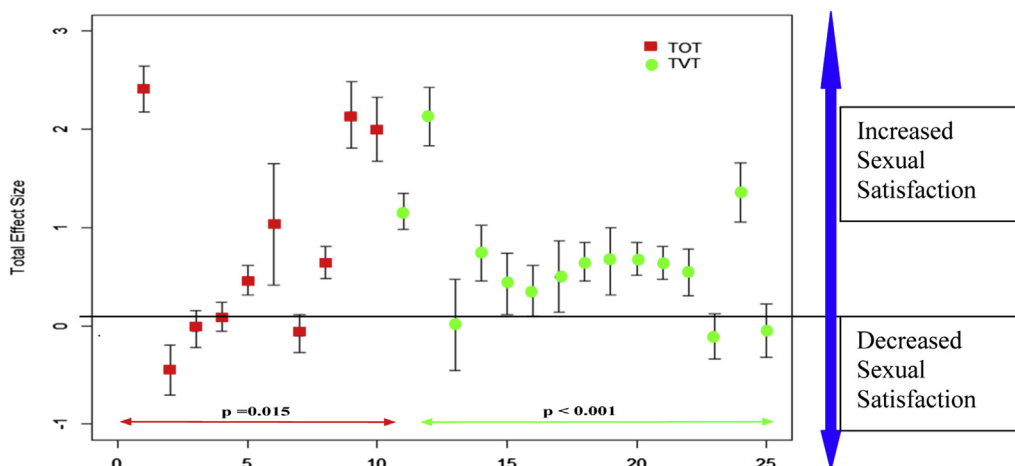


Figure 6. To show the difference in effect size between TOT and TVT, error bar plots (± 1 SD) of sexual satisfaction effect sizes are provided. TOT = transobturator tape; TVT = transvaginal tape.

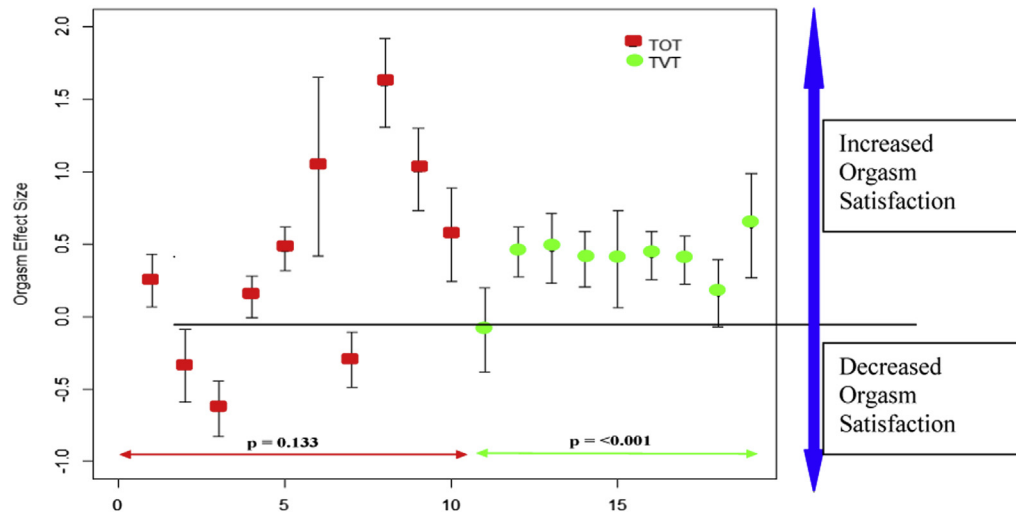


Figure 7. To show the difference in effect size between TOT and TVT, error bar plots (± 1 SD) of orgasm effect sizes are provided. TOT = transobturator tape; TVT = transvaginal tape.

that there was considerable heterogeneity in these studies.³⁴ However, the heterogeneity was not significant. A P value of .67 for the random-effects model of overall sexual function and a P value of 0.33 for orgasm function noted on each forest plot indicate that the heterogeneity is not biased.

Because TVT (including TVT-O) and TOT were the major types of midurethral sling surgery performed, meta-analyses were performed for TVT and TOT separately. For TVT, the mean total sexual function and orgasm postoperative scores were significantly higher than the preoperative scores ($P < .0001$ for the two comparisons). For TOT, the mean total postoperative sexual function scores were significantly higher than the mean total preoperative sexual function scores ($P = .015$); however, the mean orgasm postoperative scores were not significantly higher than the mean preoperative scores ($P = .13$). These results can be explained by the total heterogeneity of the TOT data overall. However, the surgical pathway of the TOT sling (vs the retropubic or transvaginal approach) could cause more localized injury to crucial nerve endings that are inherent to sensation and orgasm. Moreover, the TOT type of sling might tend to remain within its initial midurethral dissection long term, whereas the TVT type of sling might gradually progress proximally toward the bladder neck (and away from the periurethral glandular tissue) as the surgical site heals over time.

DISCUSSION

Our study showed that two thirds of midurethral sling procedures analyzed resulted in no change or improvement in sexual function postoperatively. We concluded that the stable, or even improved, postoperative sexual function was, more likely than not, related to the elimination of “coital urinary incontinence” that many women with stress incontinence are, to varying degrees, distressed by during sexual activity.^{35–37} We emphasize the importance of distinguishing “coital urinary incontinence”

from “female ejaculation and vaginal orgasm during sexual activity” as two distinctly different entities. The female ejaculate fluid contains high levels of prostate-specific antigen and low levels of creatinine, thus distinguishing female ejaculate from urine, with the latter characterized by high levels of creatinine but the absence of prostate-specific antigen.^{35,36} Another implication of our findings is that women who showed no change in orgasm after midurethral sling procedures are those women who derive sexual and orgasmic pleasure from clitoral stimulation, and that midurethral sling procedures are unlikely to negatively influence clitoral neural pathways. Similarly, the reports that the sexual response, including orgasm, of some, but not most, women is detrimentally affected by hysterectomy was hypothesized to be related to whether the women’s preferred source of stimulation was clitoral or vaginal, because the clitoral sensory innervation would likely be spared, but the vaginal sensory innervation would be compromised, by the hysterectomy procedures.³⁸

Our study also identified a large discrepancy between total sexual function and orgasm function postoperatively, with only approximately one third of patients analyzed for orgasm function showing an overall improvement in orgasm after the midurethral sling procedure. Our hypothesis for this postoperative orgasm function discrepancy involves the difference between women who experience primary satisfaction from clitorally elicited orgasm and those who experience primary satisfaction from vaginally elicited orgasm. We believe that a subgroup of women who derive their primary orgasmic function from vaginally elicited orgasms, that is, through penetration or stimulation of the anterior vaginal wall and periurethral female prostate region, could lose this response postoperatively after placement of the midurethral sling. The dissection for, and placement of, the midurethral sling clearly is likely to compromise the neural integrity of the anterior vaginal wall and periurethral female prostatic tissue.^{4,5,10,13,39}

Our analysis of the sexual medicine literature showed that elicitation of orgasm by vaginal penetration exclusively is experienced by approximately 15% to 20% of the female population.¹⁰ These women cite various means of stimulation to induce their vaginally elicited orgasm, including intercourse with deep thrusting, vibrators, and digital massage of the anterior vaginal wall.¹⁰ These stimulation methods center on the anterior vaginal wall and periurethral female prostate tissue. If this region is disrupted by a suburethral sling, it is likely that the neural pathways for vaginal orgasm also are disrupted. Cadaveric studies have shown disruption of the cavernous nerves from the vaginal plexus on their path to the anterior vaginal wall during placement of the midurethral sling.³⁹ Therefore, these nerves are at risk of injury during dissection of the anterior vaginal wall regardless of the TOT or TVT approach.

It is well recognized that there are separate neural pathways underlying the different types of orgasm. For example, women who have a history of complete spinal cord injury can experience orgasm with vaginal and cervical stimulation, despite their clitoris being insensate.^{40–43} The TVT and TOT procedures involve a primary dissection and vertical incision through the anterior vaginal wall, disrupting periurethral female prostate tissue. Postoperative ultrasound examination has shown that the midurethral slings are situated within the anterior vaginal wall and periurethral female prostatic tissue, regardless of the surgical approach.⁴ Tunitsky-Bitton et al⁴ completed an analysis of three different sling approaches, including the TOT, TVT, and TVT-O. They examined the position of the slings after placement using translabial ultrasound and found that most were situated within the median urethral length for most women, regardless of the type of sling approach. Gravina et al¹³ found that the urethrovaginal tissue was thinner overall in women who were unable to experience vaginally elicited orgasm. We have complementary analogous data that loop electrosurgical excision procedures of the cervix adversely affect orgasm in 11% of patients.⁴⁴ In consequence, any surgical intervention in the female genitalia, especially the vagina, cervix, or anterior vaginal wall, can adversely influence neural input to orgasm. The cervix evidently is innervated by three separate neural pathways, namely the pelvic, hypogastric, and vagus nerves.⁴² The anterior vaginal wall and periurethral female prostatic tissue could be similarly innervated by three separate neural pathways.

Our study also attempted to compare the sexual and orgasm effects of TVT vs TOT. The data for TOT showed more variability in effect than TVT. Prior data showed a possible disruption of the cavernous nerves with TVT surgical placement but did not analyze the effects of the TOT approach.³⁸ We propose that the variability existing within TOT data is best explained by the angle of the sling itself that has more opportunity to disrupt anterior wall and periurethral female prostatic tissue in the subgroup of susceptible women with pleasurable effects during vaginally elicited sexual stimulation. Further studies are needed to test this hypothesis in women who have

reported primary vaginal orgasm before undergoing the midurethral sling procedure.

Different “sexperts” and researchers have differing opinions on the distinct anatomic component of the “G-spot”; however, all would agree that this particular area in women is specifically within the anterior vaginal wall and underneath the urethra.⁴⁵ Several sexual medicine investigators also have pointed out that most studies analyzing the sexual function of women after sling placement for stress incontinence and anterior repairs for pelvic organ prolapse report overall better function after these surgeries.^{45,46} This is presumably because of better functionality to the vaginal canal after prolapse repair and less leakage during activity to interfere with sexual intercourse. Jannini et al⁴⁵ also hypothesized that a longer follow-up period might be necessary to determine the deleterious effects after these types of surgeries. A strength of this particular meta-analysis is that some studies included had a follow-up period longer than 12 months for full analysis.⁴⁶

We conclude that it is important for the surgeon to preoperatively counsel and discuss female orgasmic responses with all patients before midurethral sling procedures for treatment of stress urinary incontinence. We believe these data support the need for surgeons to identify and delineate, preoperatively, women at risk, such as those who derive sexual satisfaction from vaginally elicited orgasm and/or female ejaculation. Such information could lead to preoperative patient warning and perhaps a different treatment for their stress urinary incontinence. We have started to develop and test an assessment of orgasmic function by preoperative questionnaire as part of procedure decision-making and informing surgeons and patients of the potential for orgasmic dysfunction. We interviewed healthy women to develop a draft questionnaire to be administered preoperatively to assess women’s experiences with vaginally or clitorally elicited orgasm, with or without female ejaculation. We are currently testing this questionnaire in women who are being counseled for midurethral sling procedures with the intent to retest them at specific postoperative periods and refine the questionnaire as advisable.

In summary, our study supports the hypothesis that the large discrepancy between postoperative sexual function effects and postoperative orgasm effects is best explained by the strong probability that midurethral slings can negatively influence orgasm and ejaculatory function in a subgroup of women who preoperatively routinely experienced vaginally elicited orgasm. We conclude that this orgasmic ejaculatory dysfunction could be due to direct injury and scarring or fibrosis of the anterior vaginal wall and periurethral female prostatic tissue from midurethral sling surgery.

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