

Nonsuturing or Skin Adhesives versus Suturing of the Perineal Skin After Childbirth: A Systematic Review

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ABSTRACT: Background: *Suturing of perineal trauma after childbirth can cause problems such as pain, discomfort because of tight sutures, the need for suture removal, and dyspareunia. It is unclear whether leaving the perineal skin unsutured or using skin adhesives might prevent these problems. Methods:* CENTRAL, MEDLINE, EMBASE, CINAHL, and prospective trial registers until January 2013 were searched for (quasi-)randomized controlled trials comparing nonsuturing of the perineal skin or skin adhesives versus suturing of the skin when repairing a second-degree perineal tear or episiotomy. Primary outcome measure was short-term and long-term pain and need for analgesic medication. **Results:** Four randomized and two quasi-randomized controlled trials (involving 2,922 women) with heterogeneity in contexts, designs, and methodological quality were included. Nonsuturing of the skin leads to less short-term and long-term pain compared to suturing and an increased rate of skin separation. Skin adhesives lead to less short-term pain without an increased rate of skin separation. Nonsuturing or skin adhesives lead to less complaints and there are no other adverse effects. **Conclusions:** Nonsuturing of the skin or the use of skin adhesives appears preferable in terms of pain. Nonsuturing could lead to more short-term skin separation when no adhesives are used, but there is no evidence for the clinical importance of skin separation. There is a need for studies with a follow-up of at least 6 months, in which pain is measured homogeneously and for studies comparing the use of skin adhesives with nonsuturing of the skin with the focus on long-term cosmetic results. (BIRTH 42:2 June 2015)

Key words: *pain, perineal skin, skin separation, suturing*

Incidence and Morbidity

Perineal trauma is any damage to the perineum during childbirth which can occur spontaneously or intentionally by an episiotomy (1). First-degree tears include the perineal skin only and second-degree tears also involve the muscles. Tears that extend to the external anal sphincter are defined as third degree, and when the rec-

tal mucosa is torn as well, the tear is defined as fourth degree (1,2).

The incidence of perineal trauma differs around the world and is subject to inconsistency in definitions and reporting practices (3). Perineal trauma occurs in 50–90 percent of childbirths with high rates for nulliparous women and instrumental deliveries (4–9). The incidence of episiotomy has declined in many countries

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since the 1980s (10–12). Graham et al. reported episiotomy rates varying from 9.7 to 100 percent around the world (12), but a recently published study reported an incidence of only 2 percent in a low-risk population of nulliparous women (13). The use of episiotomy is strongly related to preferences of birth attendants and whether the intervention is used restrictively or routinely (14,15).

Perineal trauma can lead to more perineal pain, postpartum use of analgesic medication, (16–19) and long-term morbidity such as sexual problems (6,18–22), pelvic floor disorders (18,19,23–25), wound infections, blood loss, and vulvar hematomas (26–28).

Suture Techniques

There are major differences in suture techniques (29–32). The technique used is not always based on evidence and depends on preferences, experience, and education of the birth attendant (33–36).

The technique described in the literature as frequently used in practice is repair in three stages: vagina, muscles, and skin (37). Different techniques and materials can be used for all layers. Continuous suturing techniques are reported to be preferable to interrupted techniques in terms of short-term pain (31). While there is more need for suture removal, absorbable synthetic sutures have been proved to be superior to chromic catgut sutures in terms of short-term pain and wound breakdown and are not associated with a higher risk of infections (32). A previous systematic review including two randomized controlled trials showed no evidence whether suturing or nonsuturing of the entire first-degree or second-degree perineal wound would improve outcomes (30).

However, the literature is ambiguous about benefits and drawbacks of leaving only the skin unsutured or using skin adhesives when repairing a second-degree tear or episiotomy. It is well known that suturing, especially of the skin, can be very painful (38) and can lead to problems such as discomfort as a result of tight sutures, the need for suture removal, and dyspareunia (37,39). Leaving the skin unsutured or using skin adhesives might prevent these problems (40–42).

Objectives

The aim of this systematic review was to compare nonsuturing of the perineal skin or the use of skin adhesives versus suturing of the skin when repairing a second-degree perineal tear or episiotomy in terms of postpartum perineal pain, analgesic medication, skin separation, feeling of tight sutures, need for suture

removal or resuturing, complications, complaints, mobilization, and women's satisfaction.

Methods

The Cochrane Handbook was used as a guidance for the overall review.

Literature Search

We performed a systematic search on the Cochrane Central Register of Controlled Trials (CENTRAL), MEDLINE (PubMed), CINAHL from the starting date of the database, and EMBASE (Ovid) from 1974 to January 2013. Additionally, three prospective trial registers (ClinicalTrials.gov, Current Controlled Trials, and Netherlands Trial Register), Clinical Evidence, UpToDate, Google Scholar, and related articles of relevant hits and reference lists were searched.

A restriction was applied for publication type (only (quasi-)randomized controlled trials). Studies written in English, Dutch, German, and French were included. An experienced clinical librarian of the University of Amsterdam was consulted for the search.

Study Selection and Eligibility Criteria

Two reviewers (AES, SS) independently selected studies by title and abstract. Full texts were obtained when abstracts did not contain enough information.

Inclusion criteria were all (quasi-)randomized controlled trials comparing nonsuturing of the perineal skin or the use of skin adhesives versus suturing of the skin. Participants were primiparous and parous women who underwent an episiotomy (all types included) or a second-degree perineal tear without sphincter damage and required suturing after vaginal birth. Suturing of the perineal skin included all suturing techniques. Exclusion criteria were studies where the entire perineal wound was left unsutured and studies including women with a first-degree tear only.

Data Collection and Outcome Measures

The two reviewers independently extracted data from the included studies using a predesigned data extraction form. When relevant data were missing, the corresponding author was contacted.

Primary outcome measures were postpartum perineal pain (short-term and long-term pain) and need for analgesic medication. Secondary outcome measures were

separation of the skin edges, feeling of tight sutures, need for suture removal (routinely and when indicated), need for resuturing, resumption of (pain-free) intercourse, dyspareunia, pain during suturing, duration of suturing, wound infection, mobilization, urinary and fecal incontinence, and women's satisfaction. The following characteristics of studies were collected: country, year, inclusion criteria, method of skin repair, and outcome measures; the following characteristics of participating women were also collected: age, previous birth and repair, spontaneous birth, and perineal trauma.

Quality Assessment

The two reviewers independently assessed the risk of bias using the Cochrane Collaboration's tool which contained seven specific domains and they reached consensus by discussion. Because of the nature of the intervention, blinding of participants and personnel is impossible, but blinding of outcome assessment is possible. These items were therefore distinguished.

Data Synthesis

All data were presented separately for nonsuturing and skin adhesives versus suturing. For continuous data, the effects were presented as mean differences with standard deviations and for ordinal data as median differences with the minimum and maximum. For categorical data, the effects were presented as events and percentages. Significance levels were shown as *p*-values or relative risks with 95% CI. Missing data were judged using risk of bias tables. Review Manager 5.2 software was used.

Results

Study Selection

We identified 980 unique records through database searching. Additionally, we found one unpublished study in a prospective trial register (43). After screening of titles and abstracts, we assessed eight full-text articles for eligibility. Three of the papers (41,42,44) were duplicate publications of one cohort and two of these records were therefore excluded.

Study Characteristics

We included six studies involving 2,922 women. Characteristics of studies and participating women are shown in Tables 1 and 2, respectively. Two studies (41,45) inves-

tigated nonsuturing of the skin without adhesives. These studies were undertaken in the United States (41) and Nigeria (45) and were reported between 1998 and 2003. The sample size varied between 823 and 1,780 women.

The other four studies (43,46–48) investigated repair of the skin with adhesives. These studies were undertaken in the United Kingdom (47), Israel (46), Portugal (48), and the United States (43) and were reported (published or unpublished) between 1991 and 2009. The sample size varied between 40 and 117 women. In one study (46), two of the three intervention groups met the inclusion criteria, and therefore, 40 of the 60 participants were included. Two of the studies used quasi-randomization methods, of which one study (46) allocated the participants to one of the groups by registration numbers and one (47) depending on whether the gynecologist was available or not. We included these studies because an attempt was made to randomly allocate the participants to subsequent groups. We assumed that the care providers did not consciously influence the allocation, because the moment of childbirth can generally not be planned and planning the date of induction in such a way that it would influence the allocation is not probable. One of the studies (43) was a noninferiority study, the remaining were superiority studies. Three studies (46–48) only included women requiring repair of an episiotomy.

In each of the studies, the skin was sutured in the control group, but the method of suturing varied (interrupted or continuous techniques). The outcome measures of the included studies were heterogeneous. The primary outcome was perineal pain postpartum (41,45–48), perineal pain, and wound healing (41) or success of repair (no required reclosure of the wound) (43). Pain was measured dichotomously (45), categorically with more than two categories (41,43), on a continuous scale (1–5 or 1–10), or on an ordinal scale (0–35 or 0–150) (46–48) (Tables 3–5). Secondary outcomes were measured dichotomously or categorically (Tables 6–8). Our secondary outcomes, mobilization, urinary incontinence, and fecal incontinence, were not measured in any of the included studies.

Quality Assessment

Details of the risk of bias of the included studies are presented in Table 9. Because of a nonrandom aspect in two studies, the quality of the allocation procedure was low and the randomization procedure could not be blinded (46,47). In all included studies blinding of participants and personnel was not possible as a result of the nature of the intervention. In two studies (41,45), an attempt was made to blind the assessor who examined the perineal wound up to 14 days postpartum, but adequate

Table 1. Characteristics of Studies on Nonsuturing or Adhesives versus Suturing of the Perineal Skin

Study	Country and year	Method of skin repair		Outcome measures
		Unsutured skin	Sutured skin	
Gordon et al (41)	United States; 1992 to 1994	Inclusion criteria <ul style="list-style-type: none"> • Episiotomy or first/second degree tear* • Normal spontaneous delivery • From 1993; also simple (nonrotational forceps or vacuum extraction) instrumental delivery 	Perineal skin unsutured	Continuous or interrupted; polyglactin 910 or chromic catgut <ul style="list-style-type: none"> • At 24–48 hours: pain in the last 24 hours, analgesia, tight sutures, sutures not comfortable, gaping • At 10 days: pain in last 24 hours, analgesia, tight sutures, sutures not comfortable, gaping, nature of healing (1st, 2nd intention, breaking down), sutures removed • At 3 months: pain, analgesia, resumption of sexual intercourse, dyspareunia at first, dyspareunia now, resumption of pain free intercourse, resutured, suture removal
Oboro et al (45)	Nigeria; 2000 to 2001	<ul style="list-style-type: none"> • Episiotomy or a second-degree perineal tear 	Perineal skin unsutured	<ul style="list-style-type: none"> • At 48 hours: perineal pain, tight sutures, analgesic medication, inflammation/bruising, wound gaping • At 14 days: perineal pain in last 1 week, tight sutures in last 1 week, analgesic medication in last 1 week, wound gaping, primary healing, secondary healing, wound breakdown, suture removed • At 6 weeks and 3 months: perineal pain in last 1 week, analgesia in last 1 week, suture removed, resuturing, resumed intercourse, dyspareunia
Adoni and Anteby (46) [†]	Israel; Year unknown	<ul style="list-style-type: none"> • Primiparous and parous women • Mediolateral episiotomy 	Skin adhesives (Histoacryl)	<ul style="list-style-type: none"> • Degree of pain or discomfort at the episiotomy site • Pain and discomfort while walking, sitting, lying down, breastfeeding, sleeping, and during micturition and defecation • Need for analgesics or equipment designed to make sitting more comfortable • All were measured on day 2.
Bowen and Selinger (47)	United Kingdom; 1993 to 1994	<ul style="list-style-type: none"> • Primiparous women • Episiotomy and no further perineal tear • Normal delivery 	Skin adhesives (Histoacryl)	<ul style="list-style-type: none"> • Pain at rest, sitting, micturition, walking, and defecation on day 1, 2, 3, 4, and 5 • Mean time taken to achieve zero pain scores and to achieve pain-free sex • Wound dehiscence • Infection • Suture removal

Table 1 (continued)

Study	Country and year	Inclusion criteria	Method of skin repair			Outcome measures
			Skin adhesives	Sutured skin		
Morgan et al (43)	USA; 2005 to 2006	<ul style="list-style-type: none"> • Episiotomy or perineal tear • Age > 18 years 	Skin adhesives (Dermabond)	(not described)		<ul style="list-style-type: none"> • Proportion of successes of the repair (a perineal skin closure which did not require reclosure) • Presence and extent of skin openings • Acute inflammatory reaction • Pain • Itch • Discomfort associated with the perineal skin area • Skin closure cosmetics • Satisfaction • All were measured at 24 hours, 10 days, and 6 weeks
Mota et al (48) [†]	Portugal; 2005 to 2006	Inclusion: <ul style="list-style-type: none"> • Mediolateral episiotomy and no further perineal or vaginal tears 	Skin adhesives (Octyl-2-cyanoacrylate)	Continuous; Polyglactin 910		<ul style="list-style-type: none"> • At 42–68 hours: analgesia (epidural, local), pain during suturing, difficulties during suturing, duration of repair, failed procedures, number of sutures used, number of adhesive devices used, wound complications (skin dehiscence, complete adhesive detachment, moderate perineal edema, reported from discharge up to day 30, severe pain, partial skin dehiscence, granuloma) • At 30 days: need to seek health care facilities, initiated sexual activity at 30 days • At 7 and 30 days: pain when lying down, pain when seated, pain when walking, pain passing urine or stool

[†]This study also included women with a first-degree tear. Because the amount of women with a first-degree tear was very low (1.5%) and equally divided between the groups, we did not expect an effect on the results. [‡]These studies used quasi-randomization methods.

Table 2. Characteristics of Women Participating in Studies on Nonsuturing or Adhesives versus Suturing of the Perineal Skin

Study	n	Age mean ± SD		Previous birth and repair No. (%)		Spontaneous birth No. (%)		Perineal trauma No. (%)	
		Unsutured skin	Sutured skin	Unsutured skin	Sutured skin	Unsutured skin	Sutured skin	Unsutured skin	Sutured skin
Gordon et al (41)	1,780	28.5 ± 4.8	28.2 ± 5.0	Vaginal birth: 353 (40) Perineal repair: 329 (37)	Vaginal birth: 340 (38) Perineal repair: 314 (35)	735 (83)	734 (82)	Episiotomy: 321 (36) 2nd degree: 550 (62) 1st degree: 12 (1)	Episiotomy: 341 (38) 2nd degree: 532 (60) 1st degree: 14 (2)
Oboro et al (45)	823	26.3 ± 4.0	26.2 ± 3.8	Previous birth: 191 (46) Perineal repair: 129 (31)	Previous birth: 194 (48) Perineal repair: 118 (29)	317 (76)	313 (77)	Episiotomy: 158 (38) 2nd degree: 259 (62)	Episiotomy: 148 (36) 2nd degree: 298 (64)
Adoni and Anteby (46)	40	–	–	Vaginal birth: 0 Perineal repair: 0	Vaginal birth: 0 Perineal repair: 0	–	–	Episiotomy: 20 (100)	Episiotomy: 20 (100)
Bowen and Selinger (47)	62	26.0 ± 4.2	26.0 ± 5.4	Vaginal birth: 0 Perineal repair: 0	Vaginal birth: 0 Perineal repair: 0	32 (100)	30 (100)	Episiotomy: 32 (100)	Episiotomy: 30 (100)
Morgan et al (43)	117	28.8 ± 5.9	29.1 ± 6.0	Vaginal birth: 34 (58) Perineal repair: 32 (54)	Vaginal birth: 32 (55) Perineal repair: 32 (55)	–	–	–	–
Mota et al (48)	100	29.4 ± 4.5	28.8 ± 5.0	Vaginal birth: 10 (19)	Vaginal birth: 9 (19)	–	–	Episiotomy: 53 (100)	Episiotomy: 47 (100)

Table 3. Primary Outcome Short-Term Pain for Nonsuturing or Adhesives versus Suturing of the Perineal Skin

Study	n	Pain up to 7 days		p
		Unsutured skin	Sutured skin	
Gordon et al (41)	1,780	Pain in last 24 hours, <i>n</i> (%): Mild: 303 (34) Moderate: 222 (25) Severe: 20 (2)	Pain in last 24 hours, <i>n</i> (%): Mild: 336 (38) Moderate: 211 (24) Severe: 22 (2)	> 0.05
Oboro et al (45)	823	<i>n</i> (%): 237 (57)	<i>n</i> (%): 265 (65)	RR (95% CI): 0.87 (0.78–0.97)
		Skin adhesives	Sutured skin	p
Adoni and Anteby (46)	40	1–5 scale (mean): Wound: 2.0 Lying: 1.0 Sitting: 1.8 Walking: 1.6 Micturition: 1.0	1–5 scale (mean): Wound: 3.3 Lying: 2.4 Sitting: 3.6 Walking: 2.6 Micturition: 1.7	< 0.001 < 0.001 < 0.001 < 0.001 < 0.001
Bowen and Selinger (47)	62	1–10 scale (mean for day 1, 2, 3, 4, and 5): Rest: 1: 3.2 2: 2.7 3: 2.4 4: 1.9 5: 1.7 Sitting: 1: 4.4 2: 4.0 3: 3.3 4: 2.8 5: 2.7 Walking: 1: 2.9 2: 2.7 3: 2.3 4: 2.1 5: 2.4 Micturition: 1: 4.5 2: 3.5 3: 3.0 4: 2.5 5: 2.1 Defecation: 1: 3.3 2: 2.5 3: 2.2 4: 2.1 5: 1.1	1–10 scale (mean for day 1, 2, 3, 4, and 5): Rest: 1: 3.7 2: 3.2 3: 2.6 4: 2.2 5: 1.8 Sitting: 1: 5.5 2: 4.9 3: 3.8 4: 3.3 5: 2.9 Walking: 1: 4.4 2: 4.0 3: 3.2 4: 2.8 5: 2.2 Micturition: 1: 6.3 2: 5.1 3: 4.0 4: 3.5 5: 2.9 Defecation: 1: 4.2 2: 3.2 3: 4.3 4: 3.7 5: 2.8	0.43 0.45 0.65 0.40 0.74 0.05 0.07 0.33 0.20 0.57 < 0.001 < 0.01 0.07 0.03 0.10 0.03 0.05 0.03 0.08 0.85 0.41 0.03 < 0.01 0.02 0.14
Morgan et al (43)	117	<i>n</i> (%): 23 (39) With pressure: 18 (31) With touching: 4 (7) Continuous: 1 (2)	<i>n</i> (%): 37 (64) With pressure: 26 (45) With touching: 10 (17) Continuous: 1 (2)	> 0.05
Mota et al (48)*	100	0–35 scale, median (min–max): Lying: 9 (0–35) Sitting: 17 (2–35) Walking: 14 (0–35) Micturition or defecation: 10 (0–35)	0–35 scale, median (min–max): Lying: 8 (0–24) Sitting: 20 (0–29) Walking: 15 (0–28) Micturition or defecation: 12 (0–32)	0.84 0.54 0.91 0.33

*Study underpowered.

Table 4. Primary Outcome Long-Term Pain for Nonsuturing or Adhesives versus Suturing of the Perineal Skin

Study	n	Pain from day 7–14			Pain from week 3 to month 3		
		Unsutured skin	Sutured skin	p	Unsutured skin	Sutured skin	p
Gordon et al (41)	1,780	Pain in last 24 hours, n (%): Mild: 134 (15) Moderate: 69 (8) Severe: 18 (2)	Pain in last 24 hours, n (%): Mild: 138 (16) Moderate: 85 (10) Severe: 21 (2)	> 0.05	Pain in last 24 hours, n (%): Mild: 53 (6) Moderate: 10 (1) Severe: 1 (0)	Pain in last 24 hours, n (%): Mild: 63 (7) Moderate: 20 (2) Severe: 5 (1)	0.01
Oboro et al (45)	823	Pain in last week, n (%): 93 (22)	Pain in last week, n (%): 117 (29)	RR (95% CI): 0.77 (0.61–0.98)	Pain in last week, n (%): 6 weeks: 41 (10) 3 months: 4 (1)	Pain in last week, n (%): 6 weeks: 62 (15) 3 months: 21 (5)	RR (95% CI): 0.64 (0.44–0.93) 0.19 (0.06–0.54)
		Skin adhesives			Skin adhesives		
Bowen and Selinger (47)	62	–	–	–	Days taken to achieve zero pain scores (mean): 18	Days taken to achieve zero pain scores (mean): 25	< 0.01
Morgan et al (43)	117	n (%): 20 (34) With pressure: 14 (24) With touching: 6 (10)	n (%): 17 (30) With pressure: 11 (20) With touching: 6 (11)	> 0.05	n (%): 7 (12) With pressure: 7 (12)	n (%): 8 (14) With pressure: 8 (14)	> 0.05
Mota et al (48)*	100				0–150 scale, median (min–max): Lying: 9 (0–92) Sitting: 22 (4–103) Walking: 26 (0–109) Micturition or defecation: 15 (0–106)	0–150 scale, median (min–max): Lying: 8 (0–35) Sitting: 27 (8–76) Walking: 22 (0–103) Micturition or defecation: 14 (0–52)	0.64 0.99 0.46 0.46

Data were not shown for Adoni and Anteby (46), because this study did not report these outcomes. *Study underpowered.

Table 5. Primary Outcome Need for Analgesic Medication for Nonsuturing or Adhesives versus Suturing of the Perineal Skin

Study	n	Need for analgesic medication No. (%)		
		Unsutured skin	Sutured skin	p
Gordon et al (41)	1,780	24–48 hours: 400 (45) 10 days: 73 (8) 3 months: 1 (0)	24–48 hours: 392 (44) 10 days: 69 (8) 3 months: 7 (1)	> 0.05 > 0.05 > 0.05
Oboro et al (45)	823	48 hours: 143 (34) 14 days: 21 (5) 6 weeks: 4 (1) 3 months: 1 (0)	48 hours: 197 (49) 14 days: 38 (9) 6 weeks: 7 (2) 3 months: 6 (1)	RR (95% CI): 0.71 (0.60–0.83) 0.54 (0.32–0.90) 0.56 (0.16–1.89) 0.16 (0.02–1.34)
		Skin adhesives	Sutured skin	p
Adoni and Anteby (46)	40	0 (0)	8 (40)	–

Data were not shown for Bowen and Selinger (47), Morgan et al (43) and Mota et al (48), because these studies did not report these outcomes.

blinding was not possible, because the intervention revealed the allocation in the first days after wound repair. In one study (46), chromic catgut sutures were used, probably because the study was conducted some time ago. Two studies (41,45) used absorbable synthetic sutures and catgut sutures, of which one study reported that it was equally divided between the groups (41). In addition, the suturing technique in the control groups varied across the studies. In two studies suturing was conducted by just two care providers (46,47). One study was an inferiority trial and was carried out by a pharmaceutical company (43). The designs of three studies (41,45,48) were of good methodological quality. However, several effects in one of these studies (48) did not reach statistical significance, possibly because the study was underpowered as a result of missing data.

Effects of Interventions

Because of methodological heterogeneity and a high risk of bias in several domains and studies, we did not conduct a meta-analysis.

Primary outcomes

One of the two studies concerning nonsuturing of the skin (45) reported significantly less pain up to 7 days in the nonsuturing group compared with the suturing group (RR 0.87 [95% CI 0.78–0.97]) (Table 3). The other study (41) did not report a significant difference. Pain from 7 to 14 days postpartum was reported in both studies (41,43,45), of which one (45) reported significantly less pain in the nonsuturing group (RR 0.77

[95% CI 0.61–0.98]) (Table 4). Pain from 3 weeks to 3 months was reported significantly less often in the nonsuturing group of both studies (41,45). In one of the two studies there was significantly less need for analgesic medication after 48 hours (RR 0.71 [95% CI 0.60–0.83]) and 14 days (RR 0.54 [95% CI 0.32–0.90]) when the skin was not sutured (Table 5) (45).

Two of the four studies concerning skin adhesives (46,47) reported significantly less pain up to 7 days for the use of skin adhesives compared with suturing of the skin (Table 3). All studies comparing skin adhesives with suturing (43,46–48) measured pain for several conditions, such as lying, sitting, walking, micturition, and defecation. Significantly less pain was reported in one study for all conditions measured (46) and only for walking, micturition, and defecation in another study (47) when skin adhesives were used. Pain from 7 to 14 days postpartum was measured in one study (43), but there was no significant difference between the groups (Table 4). One study reported that the number of days taken to achieve zero pain scores was significantly lower in the skin adhesive group ($p < 0.01$) (47). Two studies (43,48) did not report a significant difference in pain from 3 weeks to 3 months. Only one study measured the need for analgesic medication (Table 5). None of the 20 women in the skin adhesive group needed analgesic medication, while 8 women needed it when the skin was sutured (46).

Secondary outcomes

Skin separation 24–48 hours postpartum was measured in five studies (Table 6) (41,43,45,47,48), the other secondary outcomes in one to three studies (Tables 6–8).

Table 6. Secondary Outcomes Skin Separation and Feeling of Tight Sutures for Nonsuturing or Adhesives versus Suturing of the Perineal Skin

Study	n	Skin separation, No. (%)		Feeling of tight sutures, No. (%)		
		Unsutured skin	Sutured skin	Unsutured skin	Sutured skin	
Gordon et al (41)	1,780	Gaping > 0.5 cm: 24 hours: 203 (23) 10 days: 227 (26)	Gaping > 0.5 cm: 24 hours: 40 (4) 10 days: 145 (16)	24–48 hours: 162 (18) 10 days: 126 (14)	24–48 hours: 196 (22) 10 days: 163 (18)	> 0.05 0.02
		10 days healing: Primary: 661 (75) Secondary: 219 (25) Breaking down: 5 (0) Not known: 1 (0)	10 days healing: Primary: 740 (84) Secondary: 137 (15) Breaking down: 7 (0) Not known: 1 (0)			
Oboro et al (45)	823	48 hours: Gaping: 107 (26)	48 hours: Gaping: 21 (5)	48 hours: 106 (25) 14 days: 15 (4)	48 hours: 155 (38) 14 days: 47 (16)	RR (95% CI): 0.67 (0.54–0.82) 0.31 (0.18–0.55)
		14 days healing: Gaping: 86 (21) Primary: 234 (56) Secondary: 221 (53) Breaking down: 13 (3)	14 days healing: Gaping: 67 (17) Primary: 251 (62) Secondary: 241 (59) Breaking down: 10 (2)			
Bowen and Selinger (47)	62	0	0	–	–	–
		Relevant skin opening: 24 hours: 0 (0) 10 days: 9 (16) 6 weeks: 0 (0)	Relevant skin opening: 24 hours: 1 (2) 10 days: 5 (9) 6 weeks: 1 (2)	–	–	–
Morgan et al (43)	117					
Mota et al (48)*	100	42–68 hours: 3 (6)	42–68 hours: 2 (4)	–	–	1.00

Data were not shown for Adoni and Anteby (46), because this study did not report these outcomes. *Study underpowered.

Table 7. Secondary Outcomes Need for Suture Removal, Need for Resuturing and Wound Infection for Nonsuturing or Adhesives versus Suturing of the Perineal Skin

Study	n	Need for suture removal beyond 3 months, No. (%)			Need for resuturing, No. (%)			Wound infection		
		Unsutured skin	Sutured skin	p	Unsutured skin	Sutured skin	p	Unsutured skin	Sutured skin	RR (95% CI)
Gordon et al (41)	1,780	59 (7)	98 (11)	< 0.01	4 (0)	9 (1)	> 0.05	–	–	–
Oboro et al (45)	823	26 (6)	41 (10)	RR (95% CI): 0.62 (0.39–0.99)	6 weeks: 11 (3) 3 months: 13 (3)	6 weeks: 17 (4) 3 months: 21 (5)	RR (95% CI): 0.63 (0.30–1.33) 0.60 (0.31–1.19)	48 hours: 59 (14)	48 hours: 59 (14)	0.50 (0.33–0.77)
Bowen and Selinger (47)	62	0	0	1.00	–	–	–	Day 1–5: 0	Day 1–5: 0	1.00
Morgan et al (43)	117	–	–	–	2 (3.4)	1 (2.7)	> 0.05	24 hours: 0 10 days: 0 6 weeks: 0	24 hours: 0 10 days: 0 6 weeks: 0	1.00

Data were not shown for Adoni and Anteby (46) and Mota et al (48), because these studies did not report these outcomes. *Study underpowered.

Table 8. Secondary Outcomes Resumption of Intercourse and Dyspareunia for Nonsuturing or Adhesives versus Suturing of the Perineal Skin

Study	n	Resumption of intercourse No. (%)			p	Dyspareunia No. (%)			p		
		Unsutured skin	Sutured skin			Unsutured skin	Sutured skin				
Gordon et al (41)	1,780	3 months:	3 months:		> 0.05	At first: 361 (44)	At first: 386 (46)	> 0.05			
		Not yet: 104 (13)	Not yet: 96 (11)	Now: 128 (15)		Now: 162 (19)					
		Tried but too painful: 20 (2)	Tried but too painful: 27 (3)	Mild: 83 (10)		Mild: 106 (13)					
		By 3 months: 112 (14)	By 3 months: 119 (14)	Moderate: 38 (5)		Moderate: 51 (6)					
		By 2 months: 423 (51)	By 2 months: 401 (48)	Severe: 7 (1)		Severe: 5 (1)					
By 1 month: 169 (20)	By 1 month: 192 (23)	Not known: 3 (0)	Not known: 2 (0)								
Oboro et al (45)	823	6 weeks: 184 (44)	6 weeks: 149 (37)	RR (95% CI): 1.20 (1.02–1.42) 2.54 (1.82–3.55) 0.43 (0.39–0.99)	6 weeks: 77 (18)	6 weeks: 108 (27)	RR (95% CI): 0.69 (0.54–0.90) 0.60 (0.42–0.85) 0.89 (0.56–1.41)				
		Pain-free: 107 (26)	Pain-free: 41 (10)		Superficial: 45 (11)	Superficial: 73 (18)					
		Tried but too painful: 40 (10)	Tried but too painful: 90 (22)		Deep: 32 (8)	Deep: 35 (9)					
		At < 2 months: 244 (59)	At < 2 months: 204 (50)		3 months: 43 (10)	3 months: 69 (17)					
		At 2–3 months: 93 (22)	At 2–3 months: 65 (16)		Superficial: 26 (6)	Superficial: 49 (12)					
		At 3 months: 337 (81)	At 3 months: 269 (66)		Deep: 17 (4)	Deep: 20 (5)					
		Skin adhesives			Sutured skin			p	Skin adhesives		p
		Bowen and Selinger (47)	62		Mean time until pain-free (days): 34	Mean time until pain-free (days): 52		< 0.001	–	–	–
		Mota et al (48)*	100		1 month: 28 (64)	1 month: 24 (71)		0.52	–	–	–

Data were not shown for Adoni and Anteby (46) and Morgan et al (43), because these studies did not report these outcome. *Study underpowered.

Table 9. Summary of Risk of Bias of Studies on Nonsuturing or Adhesives versus Suturing of the Perineal Skin

	<i>Gordon et al (41)</i>	<i>Oboro et al (45)</i>	<i>Adoni and Anteby (46)</i>	<i>Bowen and Selinger (47)</i>	<i>Morgan et al (43)</i>	<i>Mota et al (48)</i>
Random sequence generation	Low	Low	High ^c	High ^f	Unclear ^g	low
Allocation concealment	Low	Low	High ^c	High ^f	Unclear ^g	Low
Blinding of participants and personnel	High	High	High	High	High	High
Blinding of outcome assessment < 14 days ^j	High	High	Low ^d	High	High	High
Blinding of outcome assessment > 14 days ^k	Low	Low	Not applicable	Low	High	High
Incomplete outcome data	Low	Low ^a	Unclear	Unclear	Low	High ⁱ
Selective reporting	Unclear	Unclear	High ^e	Unclear	Low	Low
Other sources of bias	Low	High ^b	Unclear	Unclear	High ^h	Low

Unclear risk: the study did not report enough information to make a final judgment. ^aMissing data: probably caused by a poor infrastructure; equally balanced across the groups. ^bMethod of suturing of the vaginal wall and perineal muscles was not described; possibly a per-protocol-analysis was performed. ^cRandomization by registration number. ^dOutcome assessment was done verbally. ^eReporting of only significant differences and baseline characteristics not shown. ^fRandomization depended on whether the gynecologist was available. ^gUnequally divided baseline characteristics. ^hCarried out by a pharmaceutical company. ⁱ14% missing data, unequally balanced across the groups, reasons were not reported. ^jOutcomes measured up to 14 days. ^kOutcomes measured beyond 14 days.

Three studies measured skin separation of the skin after ten to 14 days (41,43,45).

In both studies concerning nonsuturing (41,45), the incidence of skin separation was higher in the first 24–48 hours after birth when the skin was not sutured compared to having been sutured. One study reported significantly more skin separation after 10 days ($p < 0.001$) when the skin was not sutured (41) and the other study did not report significant differences after 14 days (45).

Women with nonsutured skin reported significantly less often a feeling of tight sutures, which was measured in two studies at 24–48 hours and 10–14 days (41,45). When the skin was not sutured, there was significantly less need for suture removal (Table 7) (41,45). None of the studies described the indication of suture removal; whether it was carried out routinely, or because of complaints. No significant differences were reported in need for resuturing.

Significantly more women had resumed intercourse before 3 months in one study when the skin was left unsutured (at 3 months RR 1.22 [95% CI 1.12–1.33]) (Table 8) (45). The other study did not report a significant difference (41). In the same study, more women experienced pain-free intercourse at 6 weeks (RR 2.54 [95% CI 1.82–3.55]) and fewer women experienced too much pain when trying to resume intercourse when the skin was not sutured (RR 0.43 [95% CI 0.39–0.99]) (45). Dyspareunia was measured in both studies (41,45), of which one (41) did not report a significant difference. In the other study (45), fewer women had superficial dyspareunia at 6 weeks (RR 0.60 [95% CI 0.42–0.85]) and 3 months (RR 0.52 [95%

CI 0.33–0.81]) when the skin was left unsutured compared with a sutured skin.

The mean duration of suturing was measured in one study (41), which did not report a significant difference (data not shown). Wound infection was assessed in one study (45). Significantly fewer women experienced a wound infection in the nonsuturing group (RR 0.50 [95% CI 0.33–0.77]) (Table 7).

The studies in which skin adhesives were used did not report significant differences for skin separation (Table 6) (43,47,48). None of the studies reported data of feeling of tight sutures and dyspareunia (Tables 6 and 8). One study measured the need for suture removal, but there were no cases (Table 7) (47). The need for resuturing was measured in one study which did not report a significant difference (43). Another study measured whether there was resumption of intercourse after 1 month, but there were no significant differences between the groups (Table 8) (48). A significant difference was reported in one study (47) in the mean time taken to resume pain-free intercourse ($p = 0.0009$) favoring skin adhesives. Pain during suturing was measured in one study (48). More women had pain in the suturing group than in the skin adhesive group, but this effect did not reach statistical significance ($p = 0.054$; data not shown). The mean duration of suturing was measured in one study (48), which reported a lower mean duration ($p = 0.001$) in the skin adhesive group (data not shown). Wound infection was assessed in two studies (43,47), but there were no patients with an infection. Women's satisfaction was measured in one study (43), but there were no significant differences (data not shown).

Discussion

Main Findings

This systematic review summarized six studies, involving 2,922 women, which took place in five countries with considerably different contexts, designs, and methodological quality. In two studies nonsuturing was compared with suturing, while in four studies the use of adhesives was compared with suturing. There was a trend toward women experiencing less short-term and long-term pain for nonsuturing compared with suturing of the perineal skin, but more skin separation 24–48 hours and 10 to 14 days. When skin adhesives were used, there was a trend toward women experiencing less short-term pain without a higher risk of skin separation compared with suturing.

Furthermore, there were no other adverse effects when the skin was left unsutured or when skin adhesives were used. Nonsuturing seems to lead to fewer women experiencing a feeling of tight sutures, less need for suture removal, more women with (pain-free) resumed intercourse before 3 months, and less women experiencing dyspareunia. There seems to be a trend favoring nonsuturing of the skin for the outcomes need for analgesic medication and wound infections, but few studies measured these outcomes and reported significant differences. Few studies investigating skin adhesives reported secondary outcomes. An effect favoring skin adhesives was shown for the need for analgesic medication, resumption of pain-free intercourse, and duration of the suturing.

Strengths and Limitations

This review is the first systematic review studying nonsuturing of the perineal skin or skin adhesives versus suturing of the skin when repairing second-degree tears or episiotomies. All (quasi-)randomized controlled trials were included and assessed on methodological quality. As a result of heterogeneity in methodological quality, study designs, and methods, we have chosen not to conduct a meta-analysis. Future research should measure pain homogeneously, preferably on a continuous scale daily in the first week and with a follow-up of pain for at least 6 months (49).

The results of our review must be interpreted carefully because the number of included studies was low and the included studies had some limitations. Low quality of the allocation procedure in two studies and impossibility of blinding in most studies might have caused bias in the results. Absorbable synthetic sutures are recommended routinely in a systematic review (32) because it may decrease short-term pain and wound

breakdown compared with chromic catgut sutures. These recommended absorbable synthetic sutures were not used in all studies and neither were all layers repaired using the recommended continuous suture techniques (31). This might have overestimated the level of pain, feeling of tight sutures, and need for suture removal if the skin was sutured. Furthermore, bias could have been introduced by varying suturing techniques in the control groups across the studies. The generalizability of the results could have been limited since suturing was conducted by just two care providers in two studies (46,47) and the results of one study were possibly overestimated, because the study was carried out by a pharmaceutical company for skin adhesives which would benefit from a positive outcome (43).

Interpretation

In spite of the differences in methodological quality, studies in this review showed that nonsuturing of the skin or the use of skin adhesives result in less pain and an increased rate of skin separation when no adhesives were used.

There seems to be sufficient evidence from our review and previous literature to conclude that nonsuturing of the perineal skin or using skin adhesives can lead to women experiencing less pain in the postpartum period (30,50–58). This is an important result since perineal pain in the postpartum period can negatively influence the physical and mental functioning of the woman, in terms of decreased ability to mobilize, poorer emotional well-being, increased risk for depression, decreased success in regard to breastfeeding, and more problems in the relationship with the newborn and family (16,59–61).

On the contrary, our review found an increased rate of skin separation after nonsuturing of the skin without the use of adhesives. Short-term skin separation is only clinically important when it is related to morbidity such as infection, but there is no evidence that skin separation causes an increased rate of morbidity (62–66). Long-term cosmetic appearance is an important outcome for the woman (50,51). In one of the included studies in our review (41) a follow-up was performed up to a year, but the cosmetic result was not reported (42). There is no evidence that wounds with separation of the skin will result in poorer cosmetic outcomes than those without separation (51). Concluding that nonsuturing of the skin cannot be recommended because of increased skin separation is therefore premature.

An important outcome of our review was that studies using adhesives for repair of the skin did not report more skin separation compared with suturing. Possibly, adhesives can be used to improve outcomes and

prevent skin separation when required. For all we know, no studies have been conducted comparing nonsuturing of the perineal skin with adhesives. In emergency departments tissue adhesives have been widely used. Two systematic reviews have found that the use of tissue adhesives in settings other than maternity care provide at least as good, or even better, results with decreased pain scores compared with sutures (50,51). Decreased pain scores may be explained by the fact that nerve endings which are located in the skin are not contacted using nonsuture techniques for the skin (52). Furthermore, when the skin does not contain sutures, it might heal with fewer complaints compared to a sutured skin. A randomized controlled trial reported significantly more satisfaction with the treatment with skin adhesives compared to suturing of the skin for the treatment of first-degree tears (53).

Conclusions

In conclusion, nonsuturing of the perineal skin or the use of skin adhesives appears preferable to suturing with regard to the primary outcome pain. Nonsuturing could lead to more short-term skin separation when no adhesives are used, but there is no evidence for the clinical importance of skin separation. There is a need for large studies with a follow-up of at least 6 months, in which pain is measured homogeneously, preferably on a continuous scale. In addition, there is a need for studies comparing the use of skin adhesives with nonsuturing of the skin with the focus on long-term cosmetic results.

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