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CLINICAL ARTICLE

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A 5-year comparative study of efficacy and acceptability of three different sizes of TCu380Ag and TCu380A intrauterine devices

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Abstract

Background: The intrauterine contraceptive device TCu380Ag when compared with TCu380A at 1 year of use had better acceptability and continuation rates.

Objectives: To study the continuation rate, efficacy, and acceptability of TCu380Ag in three sizes versus TCu380A at 5 years of use.

Methods: A total of 600 women opting for intrauterine contraceptive devices were randomized equally into two groups. Group 1 received the TCu380Ag device (Normal, Maxi, and Mini for uterocervical length 7–8.5 cm, 8–9 cm, and 6–7.5 cm, respectively) and Group 2 received the TCu380A device. Follow-up was performed at 5 years to assess efficacy, acceptability, and continuation. Frequency data comparisons was performed across categories using χ^2/Fisher exact test.

Results: At 5 years of use, Kaplan–Meier survival analysis showed that TCu380Ag compared with TCu380A had a higher continuation rate (45% vs. 35%, $P = 0.010$) with 100% efficacy each. TCu380Ag had fewer side effects, including heavy menstrual bleeding (16.6% vs. 34.1%, $P < 0.001$), abdomen pain (12.1% vs. 23.0%, $P = 0.001$), and expulsions (4.4% vs. 8.7%, $P < 0.050$), and fewer discontinuations attributable to contraceptive side effects (42.7% vs. 56.9%, $P = 0.012$). The mini TCu380Ag had the highest continuation rates and least menstrual irregularity ($P < 0.050$).

Conclusions: The TCu380Ag device in three sizes is an alternative to TCu380A for women desiring 5 years of contraception with equal efficacy, better continuation, and acceptability. The mini size is preferred for women with a uterocervical length of 6 to 7.5 cm.

KEYWORDS
acceptability, continuation rates, efficacy, IUD, TCu380A, TCu380Ag

1 | INTRODUCTION

Intrauterine contraceptive devices (IUDs) are highly effective (with a failure rate of 0.6–0.8 per 100 women-years), cost-effective, easy-to-use, long-acting reversible contraceptives with a low expulsion rate (2.4%).[1,2] However, usage in India has been relatively low, possibly because of fear of side effects such as increased menstrual flow and dysmenorrhea.[3] Efforts are continuously ongoing to

develop IUDs with minimal side effects that meet the requirements for an ideal contraceptive. The TCu380Ag device (SMB Corporation of India) with a 5-year lifespan is one such innovation, with the addition of a silver core in the copper wire. It has three sizes (Maxi, Normal, and Mini) and the package includes a sterile disposable uterine sound for accurate uterine size measurement.

When compared with the TCu380A device at 1 year, the TCu380Ag was found to be equally effective with better continuation rates and acceptance due to lower side effects.[4] The authors continued the study for 5 years of follow-up to assess whether TCu380Ag in different sizes has better continuation rates at 5 years also due to fewer side effects.

2 | MATERIALS AND METHODS

This prospective, multicenter, randomized controlled trial was performed in the Departments of Obstetrics & Gynecology of three tertiary centers between August 1, 2015, and December 31, 2021. The study was approved by the ethics committee of each institution and registered in the Clinical Trials Registry, India (CTRI number 2015/09/006180: CTRI Website URL: http://ctri.nic.in). The primary objective was the assessment of the continuation rate, reasons for discontinuation, efficacy, and side effects of the TCu380Ag device in three sizes compared with the TCu380A device at 5 years of use. The secondary objective was to compare any complications reported.

The protocol has been previously described.[4] Healthy married women, aged 20–35 years, with at least one living child, willing to accept an IUD was invited to participate in this pilot study. Women with contraindications to IUD insertion, including a previous history of expulsions, uterine anomalies, and pelvic inflammatory disease, were excluded. Eligible women were counseled, screened, and enrolled after audio-visual and written informed consent, either as an interval (day 5–8 of menses), immediately after medical termination of pregnancy (MTP) by surgical evacuation and after first periods following MTP by medical methods, or postpartum insertions. Complete clinical, menstrual, obstetric, and contraceptive histories were obtained and general physical and vaginal examinations were performed.

Each of the three centers enrolled 200 women: 100 women received the Maxi, Normal, or Mini version of TCu380Ag (Group 1) and 100 women received TCu380A (Group 2). Thus, a total of 600 women were recruited with 300 women per group. Allocation was by double-blind randomization at each center using 200 sealed opaque envelopes labeled from one to 200 containing code number "Group 1" or "Group 2," as generated by a computer randomization list. Once the sealed envelope was opened, the IUD was inserted as indicated by the code. For Group 1 in interval cases, the appropriate size of TCu380Ag to be inserted was determined by the uterine size, measured by the uterine sound. The comparison of vertical arm length and corresponding uterine sound measuring range in various sizes/models of TCu380Ag is shown in Figure 1. For postabortal and postpartum insertions, the Normal and Maxi sizes were used.

IUD insertion was performed with a no-touch technique using aseptic precautions. Antibiotics were not routinely recommended and were prescribed only for women who gave a recent history of infection.

Women were provided with a menstrual diary card. The normal menstrual cycle was a cycle length of 28–30 days and 5–7 bleeding days, normal blood loss as flow the same as before IUD Insertion, and heavy menstrual bleeding (HMB) if number of bleeding days and flow increased compared with previous cycles as per woman's perception and increase in number of pads used.

Follow-up was performed at 1 month after insertion, three-monthly for 1 year, and thereafter 6-monthly until 5 years after insertion. At each follow-up visit, menstrual cycle and complaints were recorded and per speculum/vaginum examination was performed to see the thread. Because of the coronavirus disease 2019 (COVID-19) pandemic, physical attendance was constrained and telephonic follow-up was performed in case women were unable to come for follow-up. Figure 2 depicts the allocation of women at enrollment, follow-up, and analysis.

Assessment of continuation rate, reasons for discontinuation, efficacy, and side effects of the three sizes of TCu380Ag versus TCu380A was performed at 5 years of use.

2.1 | Statistical analysis

Excel (Microsoft) and SPSS version 22.0 (IBM) were used for data recording and statistical analysis, respectively. Kolmogorov–Smirnov test was used for testing continuous variables for normality assumptions. A two-tailed probability of $P < 0.05$ was considered statistically significant. Descriptive statistics such as

Size/Model	Vertical Arm Length	Horizontal Arm Length (Width)	Approx. Sound Measuring Range
Mini	30.5 mm	24 mm	6.0 – 7.5 cm
Normal	33.0 mm	31 mm	7.0 – 8.5 cm
Maxi	38.0 mm	36.5 mm	8.0 – 9.0 cm

FIGURE 1 Comparison of vertical arm length and corresponding uterine sound measuring range in various sizes/models of the SMB TCu380Ag device.

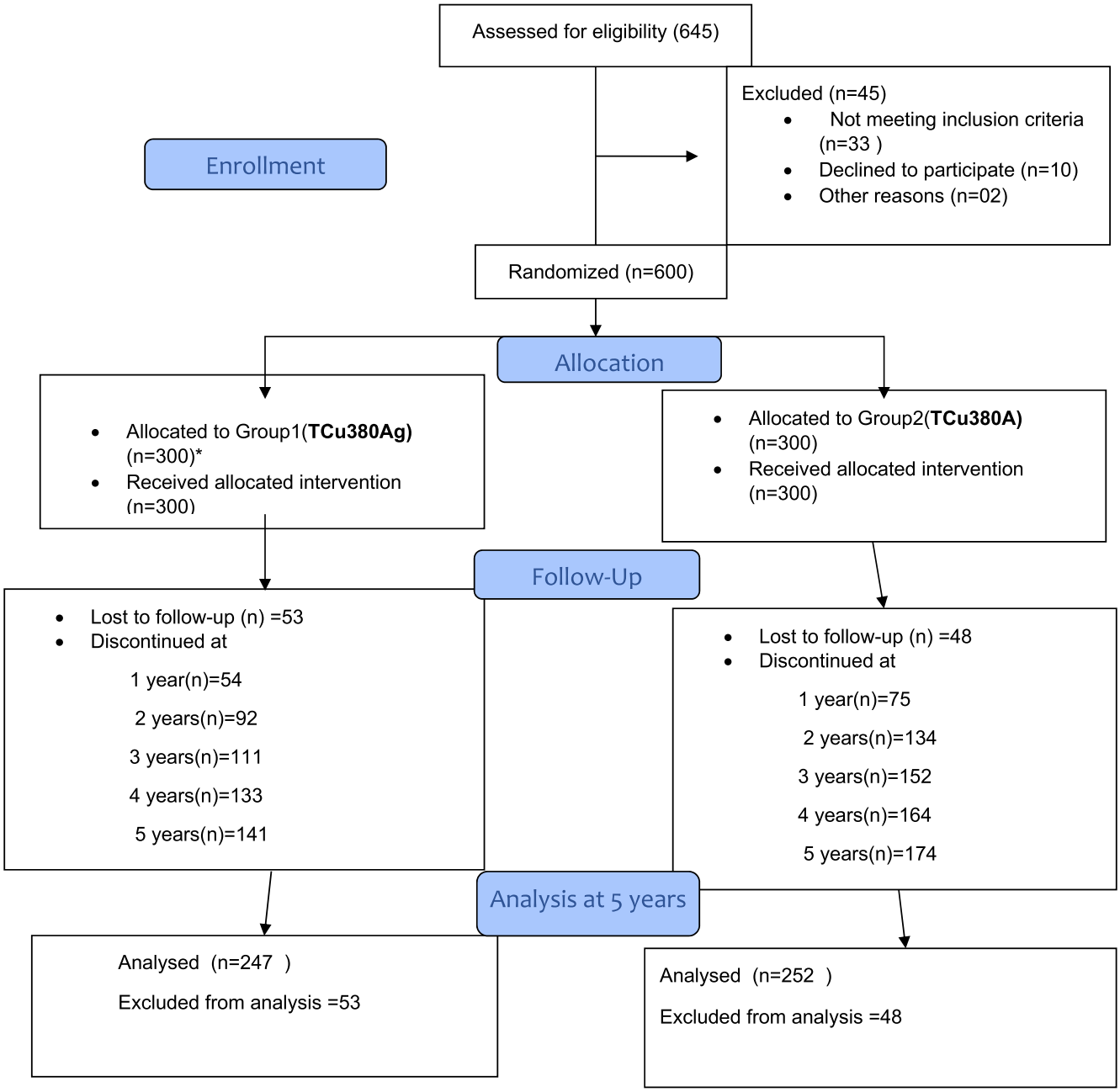

FIGURE 2 Study flow chart. *Participants allocated to the TCu380Ag group received one of three sizes of the device depending on the uterocervical length.

mean, standard deviation (SD), and range values were used for expressing normally distributed variables. Frequency and percent values were used for categorical data. χ^2/Fisher exact test as appropriate was used for comparisons of frequency data across categories. Comparison of mean values of continuous variables meeting normality assumption and median values of nonnormal data was performed by independent *t* test and nonparametric Mann–Whitney *U* test, respectively.

The continuation rate was studied by Kaplan–Meier survival analysis and also studied as the percent of women currently using an IUD at 5 years. The effectiveness rate was calculated as the number of nonpregnant IUD users divided by total number of IUD users times 100.

3 | RESULTS

The COVID-19 pandemic led to disruptions in the follow-up schedule. The continuation rates, reasons for discontinuation, and adverse event recording could be studied in all three centers, either by physical or telephonic contact. However, detailed information on menstrual cycles could be recorded at only one center.

Of 600 women, the majority (304, 50.7%) were in the age group 25 to 29 years, followed by 151 (25.1%) and 145 (24.2%) in the 30- to 31-year and 32- to 35-year age groups, respectively ($P > 0.05$). The mean parity was 2.6 and was similar in both groups (2.54 ± 1.04 and 2.6 ± 1.14 in Groups 1 and 2, respectively)

($P = 0.560$). Table 1 depicts the number of the interval, post-MTP, and postpartum insertions of enrolled women in the two groups. Figure 1 depicts the study flow.

In one case in Group 1 (TCu380Ag Maxi), pregnancy following partial expulsion was observed 6 months after insertion. Medical termination of this pregnancy was performed. The patient then disclosed a previous history of IUD expulsions twice. She had uterine malformation. Thus, this case was deemed a protocol violation and she was excluded from further analysis.

Table 2 and Figure 3 show the annual trend in the continuation of IUDs in the two groups until 5 years after insertion. Annual IUD continuation at 1, 2, 3, 4, and 5 years were 465 of 582 (79.9%), 324 of 540 (60.0%), 274 of 519 (52.8%), 228 of 505 (45.1%), and 182 of 499 (36.5%), respectively. At 5 years of use, Kaplan–Meier survival analysis (Figure 3) showed that TCu380Ag versus TCu380A had a higher continuation rate (45% vs. 35%, $P = 0.010$). Further, the corresponding median time of continuation rate was 5.0 years (95% confidence interval, 4.3–5.7 years) and 3.0 years (95% confidence interval, 2.5–3.4 years), respectively. The discontinuation trend and reasons thereof are shown in Tables 3 and 4 and Figure 4.

The continuation of TCu380Ag versus TCu380A as per the type of insertion and side effects recorded in 188 versus 194 and 247 versus 252 women in Groups 1 and 2, respectively (Tables 5 and 6).

Data on menstrual cycles at 5 years were recorded in 84 and 88 women in Groups 1 and 2, respectively. Before IUD insertion, the mean number of days of bleeding ±2 SDs was 4.11 ± 1.51 and 4.05 ± 1.29 in Groups 1 and 2, respectively ($P > 0.05$). After insertion, this rate was 4.84 ± 1.66 versus 5.3 ± 2.43 in Groups 1 and 2, respectively ($P = 0.150$). At 5 years, regular menstrual cycles were reported in 80 of 84 (95.2%) women versus 83 of 88 (94.3%) women in Group 1 versus Group 2, respectively ($P = 0.995$). Prolonged bleeding was reported by 14 of 84 (15.9%) versus 23 of 88 (26.1%) in Group 1 versus Group 2, respectively ($P > 0.05$). Bleeding more than normal flow was reported by 18 of 84 (21.4%) women versus 33 of 88 (37.5%) women in Group 1 versus Group 2, respectively ($P = 0.021$).

After 5 years of use, there was no pregnancy, ectopic pregnancy, or misplaced IUD reported in either group.

When the three sizes of TCu380Ag were compared, the sociodemographic profile of the users was comparable. The 5-year continuation was highest with Mini device, followed by the Maxi and then the Normal device (Mini: 37 of 55 [67.3%]; Maxi: 21 of 45 [46.7%]; Normal: 46 of 147 [31.3%]) ($P < 0.001$). No difference was observed in contraceptive side effects as reasons for discontinuation between the Normal (44 of 101, 43.6%), Maxi (nine of 24, 37.5%), and Mini (eight of 18, 44.4%) devices ($P = 0.850$).

TABLE 1 Type of IUCD insertion in the two groups.

Group	Interval, *n* (%)	MTP, *n* (%)	PP, *n* (%)	Total, *n*
TCu380Ag	94/300 (31.3)	91/300 (30.3)	115/300 (38.3)	300
TCu380A	89/300 (29.7)	84/300 (28.0)	127/300 (42.3)	300
P value	0.660	0.530	0.318	
Total	183 (30.5)	175 (29.1)	242 (40.3)	600

Abbreviations: IUCD, intrauterine contraceptive device; MTP, medical termination of pregnancy; PP, postpartum.

TABLE 2 Comparison of continuation rates of TCu380Ag and TCu380A.

	Continuation (years)									
IUCDs	1		2		3		4		5	
TCu380Ag										
Sizes	C (242)	M (288)	C (176)	M (264)	C (156)	M (255)	C (126)	M (249)	C (104)	M (247)
Normal (170)	127	162	89	156	80	151	65	148	46	147
Maxi (58)	49	56	33	47	28	46	21	45	21	45
Mini (72)	66	70	54	61	48	58	40	56	37	55
P value	0.006		0.001		0.001		0.002		0.001	
TCu380Ag continuation[a]	242/288 84.0%		176/264 66.7%		156/255 61.2%		126/249 50.6%		104/247 42.1%	
TCu380A	C 223	M 294	C 148	M 276	C 118	M 264	C 102	M 256	C 78	M 252
TCu380A continuation,[a] %	75.8		53.6		44.7		39.8		31.0	
P value[a]	0.014		0.002		0.001		0.015		0.010	
Continued Total, *n* (%)	465 (79.9)		324 (60.0)		274 (52.8)		228 (45.1)		182 (36.5)	

Note: Values are given as number (percentages) unless indicated otherwise.

Based on χ^2/Fisher exact test as appropriate; the cutoff value for significance is $P < 0.05$.

Abbreviations: C, completed 1 year; IUCD, intrauterine contraceptive device; M, monitored.

[a]*P* value test between TCu380Ag and TCu380A device continuation.

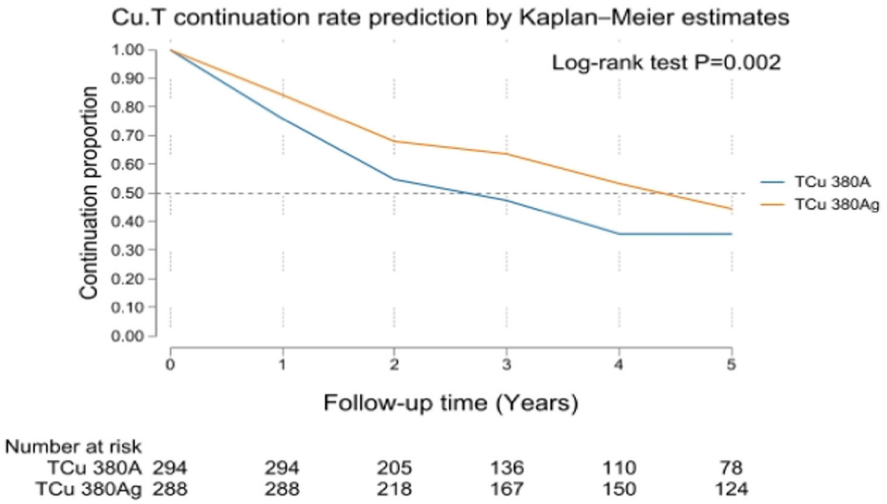

FIGURE 3 Kaplan–Meier survival analysis of continuation rate among the TCu380Ag and TCu380A groups.

TABLE 3 Patient discontinuations as per time since insertion.

	1 year		2 years		3 years		4 years		5 years	
IUCDs after completing	D	M	D	M	D	M	D	M	D	M
Any IUCD, %	129	582	226	540	263	519	297	505	315	499
	22.2		41.8		50.7		58.8		63.1	
TCu380Ag, %[a]	54	288	92	264	111	255	133	249	141	247
	18.7		34.8		43.5		53.4		57.1	
Normal (170), %	41	172	69	156	79	151	93	148	99	147
	23.8		44.2		52.3		62.8		67.3	
Maxi (58), %	9	50	15	47	19	46	24	45	24	45
	18.0		31.9		41.3		53.3		53.3	
Mini (72), %	4	30	8	61	13	58	16	56	18	55
	13.3		13.1		22.4		28.6		32.7	
P value[b]	0.380		0.001		0.001		0.001		0.001	
TCu380A[a]	75	294	134	276	152	264	164	256	174	252
%	25.5		48.5		57.6		64.1		69.0	
P value[a]	0.050		0.001		0.001		0.015		0.006	

Note: Values are given as number (percentages) unless indicated otherwise.
Based on χ^2/Fisher exact test as appropriate; the cutoff value for significance is $P < 0.05$.
Abbreviations: D, discontinued; IUCD, intrauterine contraceptive device; M, monitored.
[a]*P* value test between TCu380Ag and TCu380A device discontinuation.
[b]*P* value test between three sizes of TCu380Ag devices for discontinuation.

At 5 years after insertion when adverse events were compared (Table 6), HMB was reported in 41 of 247 (16.6%) TCu380Ag users versus 86 of 252 (34.1%) TCu380A users ($P < 0.001$). Menstrual disorders as a side effect were reported least in the Mini device (two of 55, 3.7%) compared with 14 of 45 (31.1%) in the Maxi device and 47 of 147 (31.9%) in the Normal device ($P = 0.001$). At 5 years after insertion, there was no difference in the regularity of menstrual cycles, change in the mean number of days of bleeding, or complaints of prolonged or more than normal bleeding and other side effects among the three sizes of TCu380Ag ($P > 0.05$).

4 | DISCUSSION

Long-acting reversible contraception should be offered as the first line to younger women because of the highest contraceptive efficacy.[5] The majority of IUD acceptors in the present study were also young housewives (70.5%), younger than 30 years (50.7%), with a mean parity of 2.6. The sociodemographic profile in our study was similar to a previously published Indian study.[6]

At the end of 5 years, 16.8% (101 of 600) of women were lost to follow-up (Figure 2). Despite all efforts made by the study staff

TABLE 4 Reasons for discontinuation of IUCDs.

Reason	TCu380Ag (143/247)						TCu380A (174/252)		
	Normal ($n = 101$)[a]	Maxi ($n = 24$)[a]	Mini ($n = 18$)[a]	*P* value[a]	Total	Percentage	CuT380A^ ($n = 174$)	Percentage	*P* value^
Found expelled	15	1	0	0.139	**16**	**11.2**	**27**	**15.5**	**0.263**
Separated/divorced/husband died/ personal	5	0	4	0.017	**9**	**6.3**	**9**	**5.2**	**0.668**
Backache and discharge	2	1	0	0.651	**3**	**2.1**	**5**	**2.9**	**0.734**
Bleeding P/V and pain in the abdomen (dysmenorrhea)	7	0	0	0.380	**7**	**4.9**	**27**	**15.5**	**0.002**
Heavy bleeding	11	5	1	0.303	**17**	**11.9**	**36**	**20.7**	**0.037**
Gone to village, away from husband	5	2	0	0.582	**7**	**4.9**	**3**	**1.7**	**0.194**
Pain in abdomen	8	2	5	0.045	**15**	**10.5**	**16**	**9.2**	**0.700**
PID	4	0	0	0.995	**4**	**2.8**	**4**	**2.3**	**0.995**
Wants conception	14	8	5	0.053	**27**	**18.9**	**16**	**9.2**	**0.014**
Incomplete abortion[a]	2	0	0	0.995	**2**	**1.4**	**2**	**1.1**	**0.995**
Irregular periods	4	1	1	0.822	**6**	**4.2**	**9**	**5.2**	**0.684**
Opted for tubal ligation	4	0	1	0.618	**5**	**3.5**	**4**	**2.3**	**0.736**
Medical disease	5	4	0	0.582	**9**	**6.2**	**4**	**2.3**	**0.233**
Vaginitis	6	0	1	0.691	**7**	**4.9**	**2**	**1.1**	**0.084**
Thread not seen	7	0	0	0.380	**7**	**4.9**	**10**	**5.7**	**0.78**

Note: Values are given as number (percentages) unless indicated otherwise.

Based on χ^2/Fisher exact test as appropriate; the cutoff value for significance is $P < 0.05$. Values in bold specify that significance was found between Group 1 and Group 2 results, respectively.

Abbreviations: PID, pelvic inflammatory disease; P/V, per vaginal.

[a]Incomplete abortions are those where intrauterine contraceptive devices (IUCDs) were inserted after medical termination of pregnancy (MTP) and the MTP was later considered an incomplete abortion and women had to be managed for that.

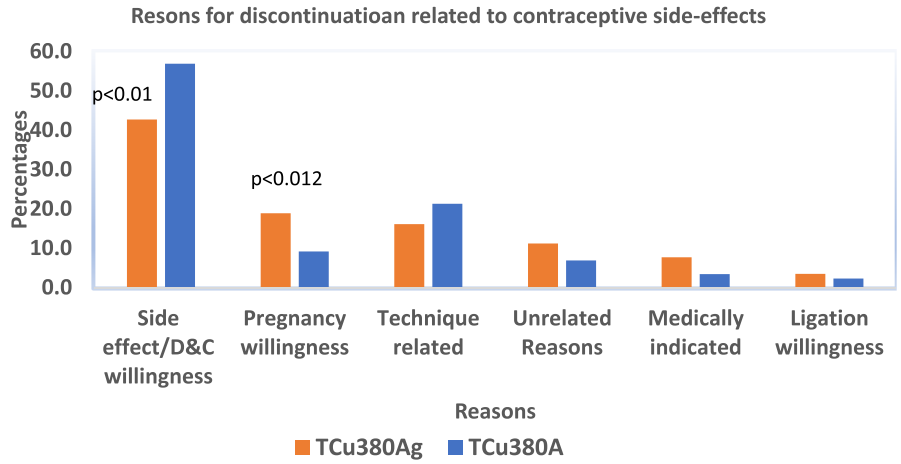

FIGURE 4 Reasons for discontinuations of TCu380Ag and TCu380A at 5 years of use. D&C, dilatation and curettage.

TABLE 5 Comparison of continuation rates among times of insertion after 5 years of follow-up.

Time of insertion	TCu380Ag monitored	Continued	Continuation rate (%)[a]	TCu380A monitored	Continued	Continuation rate (%)[a]	*P* value[a]
Interval	87	55	63.2	83	30	36.1	0.011
After MTP	73	32	43.8	69	27	39.1	0.785
After MTP surgical	65	27		56	22		
After medical abortion	8	5		13	5		
Postpartum	87	17	19.5	100	19	19.0	0.110

Note: Values are given as number (percentages) unless indicated otherwise.

Based on χ^2/Fisher exact test as appropriate; the cutoff value for significance is $P < 0.05$.

Abbreviations: MTP, medical termination of pregnancy.

[a]*P* value test between TCu380Ag and TCu380A continuation as per type of insertion.

including counseling at each visit, the COVID-19 pandemic made home visits not possible. Follow-up care requires further attention in the National Programme.[7] The continuation rates of TCu380Ag were significantly better than TCu380A at all points of time despite similar counseling for all participants at enrollment (Figure 3). At 5 years after insertion, the difference was statistically significant (42.1% versus 31%, $P = 0.010$). One randomized study conducted in several European countries found a 5-year continuation rate of 44.5% for copper-releasing IUDs, which were comparable with our study.[8] Another European study performed in multiple countries also showed a 5-year continuation rate of 40.6% in the copper-releasing IUD group.[9]

Concerning the time of insertion, the continuation of TCu380Ag for interval insertions was significantly higher than TCu380A (63.2% vs. 36.1%, $P = 0.011$), whereas for postpartum and post-MTP insertions there was no significant difference. This may be because it was possible to select the size of TCu380Ag more accurately for interval insertions as per uterine size.

IUDs in our study showed 100% effectiveness with both TCu380Ag and TCu380A acceptors. One pregnancy following expulsion was observed and is a case of protocol violation related to a uterine factor, which may be the reason for expulsion. A significant relationship exists between IUD expulsions and failure.[10]

Women are fearful of menstrual irregularities and complications, which negatively affects long-term IUD acceptance.[11,12] Our study reported significantly less abdomen pain and HMB in TCu380Ag users. We have previously reported that at 1-year post-IUD insertion, the TCu380Ag device had significantly better rates of regular menstrual cycles, and significantly less heavy and prolonged bleeding than TCu380A users ($P > 0.05$).[4] At 5 years, there was no significant difference in regular menstrual cycles, mean number of days of bleeding, and prolonged bleeding between the two groups. However, bleeding more than a normal flow was lower in the TCu380Ag users ($P = 0.021$). At 5 years after insertion when reported adverse effects were compared, HMB was seen in 16.6% of TCu380Ag users versus 34.1% of TCu380A users ($P < 0.001$). Menstrual disorders were seen least in patients with the Mini device (two of 55, 3.7%) compared with 45.1% (14 of 45) in patients with the Maxi device and 31.9% (47 of 147) in those with the Normal device ($P = 0.001$). The menstrual disorders related to IUDs are distressing and cause negative publicity. IUDs associated with fewer menstrual disorders will be better accepted. Menstrual disturbances usually settle with an increased duration of use but need quicker relief for improved retention and uptake. Nonsteroidal anti-inflammatory drugs (NSAIDs) and/or tranexamic acid as the first line of therapy are also recommended to settle bleeding and pain associated with IUDs.[13]

TABLE 6 Comparison of adverse events in two groups.

Events	TCu380Ag ($n = 247$)					TCu380A ($n = 252$)		*P* value	Total	Percentage
	Normal	Maxi	Mini	Total	(%)					
Possibly related										
Menorrhagia	33	07	1	41	16.6	86	34.1	<0.001	127	25.4
Irregular periods	9	04	01	14	5.7	11	4.4	0.505	25	5.0
Polymenorrhea	02	0	0	02	0.8	01	0.4	0.617	3	0.6
Dysmenorrhea	02	03	0	05	2.0	05	2.0	0.995	10	2.0
Vaginitis	32	22	18	72	29.1	52	20.6	0.028	124	24.8
Pain in abdomen	22	04	04	30	12.1	58	23.0	0.001	88	17.6
PID	06	01	0	07	2.8	16	6.3	0.061	23	4.6
UTI	09	0	0	09	3.6	04	1.6	0.170	13	2.6
Husband feeling thread/burning	0	0	02	02	0.8	02	0.8	0.995	4	0.8
Dyspareunia	02	03	0	05	2.0	04	1.6	0.749	9	1.8
Thread not seen	06	00	0	06	2.4	06	2.4	0.972	12	2.4
Backache	05	03	01	09	3.6	07	2.8	0.583	16	3.2
Complete expulsion	10	0	0	10	4.0	22	8.7	0.033	32	6.4
Partial expulsion	02	0	0	02	0.8	0	0	0.245	2	0.4
Generalized weakness	01	0	0	01	0.4	0	0	0.495	1	0.2
Unrelated causes										
Dizziness	0	0	0	0	0	0	0	NA	0	0
Cough	0	0	0	0	0	0	0	NA	0	0
Weakness	04	02	0	06	2.4	4	1.6	0.541	10	2.0
Edema in feet	0	02	0	02	0.8	0	0	0.245	2	0.4
Indigestion	06	0	0	06	2.4	4	1.6	0.541	10	2.0
Itching over body	0	0	0	0	0.0	2	0.8	0.499	2	0.4
Ovarian cyst	0	01	0	02	0.8	2	0.8	0.995	4	0.8
Incomplete abortion	02	0	0	04	1.6	2	0.8	0.446	6	1.2
PPH	0	0	0	0	0	1	0.4	0.995	1	0.2

Note: Values are given as number (percentages) unless indicated otherwise.

Based on χ^2/Fisher exact test as appropriate; the cutoff value for significance is $P < 0.05$.

Abbreviations: PID, pelvic inflammatory disease; PPH, postpartum hemorrhage; UTI, urinary tract infection.

The total number of discontinuations in our study was 22.2% (129 of 582) and 63.1% (317 of 499) at 1 and 5 years of use, respectively. The most common reason for the TCu380A discontinuation was earlier reported as HMB with or without dysmenorrhea.[14–17] HMB with or without dysmenorrhea as the reason for discontinuation (24 of 143, 16.8%) was significantly less in TCu380Ag users versus TCu380A useers (63 of 174, 36.2%) ($P < 0.005$). The 9.7% (24 of 247) discontinuation rate at the end of 5 years attributable to HMB in TCu380Ag users is less than the 14.0% cumulative 5-year discontinuation rates attributable to bleeding in the Nova T380 study.[13] In all, at 5 years of use, the contraceptive adverse effects (bleeding and pain) as the reason for discontinuation were less in TCu380Ag users (61 of 143, 42.7%) than TCu380A users (99 of 174, 56.9%) ($P = 0.012$). Less discontinuation in TCu380Ag caused by adverse events (42.7% vs. 56.9%, $P < 0.05$) and expulsions (11.2% vs. 15.5%, $P > 0.05$) may be a benefit of the silver component, better insertion technique (as reported earlier), and different sizes of the TCu380Ag device.[4] The main barriers to long-term acceptance of IUDs are fear of complications, and the TCu380Ag IUD with fewer side effects was more acceptable as evidenced by better continuation.[18]

Half (160 of 317, 50.5%) of the discontinuations in our study were because of IUD adverse effects. This finding was similar to the Bangladesh study where 47.3% of discontinuations were attributable to the adverse effects of IUDs.[16] The most common reasons for discontinuation in our study were contraceptive side effects (50.5%), followed by 18.9% technique-related problems (e.g., expulsions and the thread not seen) as shown in Figure 4. Women demanded removal when threads were not seen. The latter was less in the TCu380Ag group (16.1% vs. 21.3%). Expulsions

accounted for 15.5% of discontinuations at 5 years of use, similar to the reported 13% expulsion rates.[14,19] Overall, there were fewer expulsions (43 of 499, 8.6%) in the CuT380Ag (16 of 247, 6.47%) versus the TCu380A (27 of 252, 10.7%) groups ($P > 0.05$). At 5 years, the expulsion rate of TCu380Ag (6.47%) was comparable to the 4.9% reported in a long-term follow-up study of NovaT200[19] and slightly more than the 4.1% reported in 5-year clinical experiences with NovaT380.[14] This can be explained by the use of IUDs in a wide range of women including postpartum women. Technique-related reasons for discontinuation suggest that in almost 12.0% of IUD users (60 of 499), improved continuation could be achieved if reinsertion was offered after expulsion and women could be counseled that thread not seen should not be a reason for discontinuation.

As reported earlier, when discontinuations at what time since insertion were studied, the maximum number of discontinuations of 17.03% (54 of 317) were observed at 1 month, which means that 10.8% (54 of 499) of women discontinued at 1 month.[4] Discontinuations at 1 month were significantly less frequent in the TCu380Ag (17 of 298, 5.7%) versus TCu380A (37 of 298, 5.7%) groups. The high discontinuations at 1 month may be because of more expulsions and removal required in post-MTP insertions due to incomplete abortion (six of 582, 1.0%) and in cases of postpartum hemorrhage in postpartum insertions (13 of 582, 2.2%). Hence, re-offering IUD insertion at 1 month in case of expulsions in such cases would be beneficial.

Desire for pregnancy as a reason for discontinuation was similar between the two IUDs and was only 0.7% (4 of 582) compared with up to 39.6% previously reported.[20]

Other contraceptive adverse events such as pelvic inflammatory disease, irregular periods, abdomen pain, and technique-related events as reasons for discontinuation showed no significant difference between the TCu387Ag and TCu380A devices. Pelvic inflammatory disease was seen in 4.6% of cases, but there was no additional case reported after the initial period. A review of the World Health Organization's IUD clinical trial data reported 1.6 cases per 1000 woman-years for the whole duration of use.[21] There was no case of perforation of the uterus or ectopic pregnancy in either of the two groups.

When the three sizes of TCu380Ag were compared, the continuation with the Mini size was best and consistently higher at 1, 2, 3, 4, and 5 years followed by the Maxi and Normal devices. The Mini device was associated with the fewest menstrual disorders and no other difference in adverse effects was seen between sizes. At 5 years of use, the continuation was 67.3% for the Mini versus 46.7% for the Maxi and 31.3% for the Normal devices ($P = 0.001$).

4.1 | Limitations of study

The main limitation of the present study is its small sample size, and the generalization of the current findings are also limited because of the enrollment of only married women younger than 35 years with at least two live children.

5 | CONCLUSIONS

TCu380Ag was comparable to TCu380A in efficacy at 5 years with better continuation rates attributable to fewer menstrual disturbances and other adverse events. It may be offered to women desiring 5 years of spacing. The Mini TCu380Ag shows the best continuation rates compared the other sizes. The silver core in the copper wire may be responsible for better acceptability with TCu380Ag.

AUTHOR CONTRIBUTIONS

Neerja Bhatla: Substantial contributions to the interpretation of data for the work. Revising manuscript critically for important intellectual content; final approval of the version to be published and agreement to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved. Rohini Sehgal: Substantial contributions to the conception and design of the work; Conducting the trial; acquisition, analysis, and interpretation of data for the work; revising it critically for important intellectual content; Final approval of the version to be published; Agreement to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved. Hiralal Konar: Acquisition, analysis, or interpretation of data for the work, Drafting the work; Conducting the trial; Final approval of the version to be published and Agreement to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved. Alka Kriplani: Substantial contributions to the interpretation of data for the work. Revising manuscript critically for important intellectual content; final approval of the version to be published and agreement to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved. C.N. Purandare: Substantial contributions to the conception and design of the work; Drafting the work; Final approval of the version to be published and Agreement to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved. Achanta Vivekanand: Acquisition, analysis, or interpretation of data for the work, Drafting the work; Conducting the trial; Final approval of the version to be published and Agreement to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved. Perumal Vanamail: Acquisition, analysis, or interpretation of data for the work, revising it critically for important intellectual content; Conducting the trial; Final approval of the version to be published and Agreement to be accountable for all aspects

of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

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CONFLICT OF INTEREST STATEMENT

The authors guarantee that no conflict of interest can influence the objectivity of the paper and its review.

DATA AVAILABILITY STATEMENT

Research data are not shared.

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