Improving Menstrual Health: How Technologies Can Help with Dysmenorrhea

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Achieving menstrual health is vital for every person who menstruates. During menstruation, dysmenorrhea can cause discomforts, which affect menstrual health. The current main treatments for dysmenorrhea remain pharmaceutical. Pharmaceutical treatments might have side effects, which are concerned. As technologies have been developed, non-medical treatments or supports are being investigated. In this study, interviews and surveys were conducted to investigate the possibilities for Human-Computer Interaction technologies to provide support and how they might support. The results present that technologies may help people with dysmenorrhea both physically and mentally.

CCS Concepts: • **Human-centered computing** → *User studies.*

Additional Key Words and Phrases: menstrual health, menstruation, dysmenorrhea

1 INTRODUCTION

Menstruation is a natural phenomenon for women and it is tightly related to every human being. It is related to every woman's health situation both physically and mentally. Improving menstrual health plays a crucial role in improving women's health. Additionally, menstrual health has an important influence on gender equality, world sustainable development, and human population health [8]. Therefore, improving menstrual health for people who menstruate is vital. To achieve menstrual health, bodies must get enough care during menstruation such that comfort is supported [8]. Discomforts during menstruation are usually caused by dysmenorrhea, which happens during menstruation and can cause menstrual discomforts such as recurrent painful cramps, vomiting, and diarrhea [1, 10]. The effect of the discomforts and disorders during menstruation can affect menstrual health [8]. Thus, helping people who menstruate reduce the discomforts caused by dysmenorrhea is crucial for improving their menstrual health.

Currently, there are not so many non-medical products that are technically produced for treatment being used by a large number of people. As Human-Computer Interaction (HCI) technologies have been developed rapidly, there are products such as menstrual cycle trackers, which aim to help improve users' menstrual health. Nevertheless, these menstrual products instead reproduce the stigma that considers menstruation as something wrong or needed to be hidden [3, 9, 22]. Other than this, there are not many products that are designed specifically for dysmenorrhea within the HCI field.

Therefore, regarding this problem, this research aimed to investigate how technologies with the HCI field can help with dysmenorrhea. The following research questions were investigated in this study. **RQ1:**How can technologies help people who suffer from dysmenorrhea? **RQ1a:** How is the user satisfaction of existing remedies or products that help with dysmenorrhea? **RQ1b:** What kinds of products would people like to have when they suffer from dysmenorrhea? To examine these research questions, interviews and an online survey were conducted to investigate the menstruation experience of people and the user experience of the products they used during menstruation. According to the analysis

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of the results, it is possible to design products that can help decrease discomforts caused by dysmenorrhea within the HCI field. Also, other kinds of support to reduce the effects that dysmenorrhea has on life may be designed.

2 BACKGROUND

There are two kinds of dysmenorrhea. One is called primary dysmenorrhea. The other one is called secondary dysmenorrhea. Primary dysmenorrhea is the pain or discomforts that are not caused by specific pathologic reasons during menstruation [20]. While secondary dysmenorrhea is the pain or discomforts caused by an organic pathologic condition or any disorders [20]. The previous research that investigated how to treat or help with dysmenorrhea can be categorized into three categories.

2.1 Medical products for dysmenorrhea treatment

Pharmaceutical treatments are currently the primary methods that help with primary dysmenorrhea. The medical products for helping people who have primary dysmenorrhea reduce pain and discomforts are nonsteroidal anti-inflammatory drugs (NSAIDs) and/or hormonal contraceptives [20]. However, for patients who use NSAIDs to treat chronic inflammatory conditions, the risks to some organ damages such as gastric mucosal injuries, small bowel injuries, cardiovascular disease, and renal injury, can be increased [2]. For people who have secondary dysmenorrhea, different remedies can be taken according to different specific situations [20].

2.2 Non-medical products for dysmenorrhea treatment outside the HCI field

Outside the HCI field, some existing non-medical products can help people with pain relief including menstrual pain. A wearable menstrual pain relief product Undu was created by Katrycz et al. [11, 12]. Undu uses air-casting technologies to produce heat. It is filled with thermal gels, which makes the pack very soft and thin. It can be placed where users feel menstrual pain. Since it is very thin and soft, it can be placed on the tummy under clothes for daily use. However, the wearable heat pack cannot adjust the temperate automatically. Besides, it cannot maintain a constant temperature, which means that it will cool down after using it for a while. So users have to reheat it by using a microwave oven or some hot water, which is not convenient.

Another kind of non-medical product is developed by Transcutaneous Electrical Nerve Stimulation (TENS) technology. TENS technology is a therapeutic application that can produce electrical nerve stimulation through the skin, which is mainly utilized for controlling the pain of patients [7]. There exist many studies that illustrate that TENS technology can effectively help reduce menstrual pain, especially TENS with high frequency [13, 21, 24, 27]. Examples of products that used TENS technology to help reduce menstrual pain are Livia [14], Monthli [16], Ovira [17], and Beurer EM 50 Menstrual Relax [19]. All of them use the TENS technique to produce different intensities of pulse that can control the pain. Users need to put some cabled stickers on where it hurts during menstruation and use the controller to provide the pulse. However, the maximum stimulation frequency of TENS technology is limited [4], which means that the adjustable frequency levels of pulse might not be appropriate for all users. Additionally, for people with cardiac pacemakers, pregnancy, and bleeding disorders, TENS technology cannot be used [18]. Also, below the electrodes, TENS technologies may lead to mild skin irritation [18].

2.3 Non-medical products for dysmenorrhea treatment within the HCI field

Within the HCI field, so far there are not many products designed to help with dysmenorrhea. However, there exist some studies that investigated menstrual experience within the HCI field.

Firstly, Søndergaard et al. [23] designed an open-ended prototyping toolkit that consists of shape-changing actuators and heat pads, Menarche Bit. Within the workshop where participants used this toolkit to prototype products that are related to their menstrual experience, such as a modular cushion for menstrual cramps [23]. As Søndergaard et al. [23] mentioned, one of the future works can be developing what the participants prototyped into high fidelity prototypes, which can help them better understand adolescents' menstrual experience. Secondly, Ståhl et al. [25] developed a Soma carpet that can provide heat pulse by heat pads, by using a somaesthetic approach. Although this product is not designed for any pain relief, it illustrates that it is possible to design HCI products that can provide heat or pulse to give people mediation or body supports. As mentioned earlier, heat or pulse may be used to help people reduce menstrual pain. Thus, it may be able to design products to help people with dysmenorrhea with HCI techniques. In addition, there exist some apps that can track the menstrual cycle. Although they aim to help people who menstruate have a better menstrual experience, they have some disadvantages. The main disadvantages are inaccurate prediction, gendered interface design, and troubling privacy data protection [5, 6]. Finally, McDonald et al. [15] fabricated fused washable sanitary napkins by using 3D printing skills. This shows that HCI technologies can be used to address problems with current menstrual technologies [15].

3 RESEARCH METHODOLOGY

3.1 Research Methods

Interviews and surveys were chosen for this research. The aim to conduct semi-structured interviews is to obtain insights from people's dysmenorrhea experience. After the interviews, an online survey was conducted according to the results of the interviews. The aim of conducting this survey is to see if a large number of people also have encountered the problems the interviewees encountered during menstruation.

3.2 Participants

Five interviews were conducted within this research. Five females who have experienced dysmenorrhea volunteered to participate in the interviews. The age of these five participants ranges from 23 to 27 years old. The strategy for selecting the participant is to select people who menstruate and have experienced dysmenorrhea. There were 27 valid responses. Within these 27 participants, there were 25 participants whose ages are from 18 to 30 years old and 2 participants whose ages are from 31 to 40 years old. The strategy for selecting the participants is convenience sampling.

3.3 Data analysis

For the qualitative interview data, affinity diagramming was used to summarize the problems the interviewees encountered during menstruation. Affinity diagramming was chosen because it is good for designers to obtain insights from large amounts of data such as interview data [26]. Besides, the products they have used to help with dysmenorrhea were recorded. For the qualitative data of the questionnaire, the same analysis method for interview data was applied. For the quantitative data of the questionnaire, the percentages were calculated to see if the problems that interviewees encountered are also met for a larger group of people.

4 RESULTS

According to the setup of the research questions, the results of the interviews and survey were categorized into three categories. The first category presents the problems people may encounter during menstruation. The second category

demonstrates the user experience of the current dysmenorrhea treatment products. The third category illustrates people's desires for future dysmenorrhea treatment products.

4.1 Results of interviews

4.1.1 Discomforts encountered during menstruation.

The results show that all participants have experienced dysmenorrhea and think that dysmenorrhea has influenced their life such as working or studying. Regarding what kinds of discomforts they have encountered during menstruation, other than menstrual pain or cramps, bad appetite, tiredness, body coldness, breast distending pain, difficulty to fall asleep, and bad mood as well happen. Besides, some participants feel bothered by period leaks.

4.1.2 Used products to help with dysmenorrhea.

Regarding the products the participants have used to help with dysmenorrhea, three participants have taken Ibuprofen, one kind of NSAID. They are very satisfied with this pharmaceutical product. However, one participant mentioned that she does not want to take NSAIDs because she is afraid that there will be a side effect. Two participants also mentioned that NSAIDs may influence stomach health. Besides, some participants will take traditional Chinese herb medicine or drink ginger tea to help with dysmenorrhea. One impressive thing is that one of them mentioned that she will drink ginger tea only when she still has the energy to cook the tea when she has menstrual pain. One participant mentioned that she will take a foot bath when suffering from dysmenorrhea and three participants have used hot water bottles or heating pads.

4.1.3 Desired products or functions of existing products.

The first participant wants a self-heating reusable belt that can provide massages and be remotely controlled by a mobile phone to adjust temperature and massage strength. Additionally, she wants an app that can remind her to change sanitary napkins. She wants it because it is unhealthy to use the same sanitary napkin for a long time, but she will easily forget to change it when she is busy. The second participant wants a thermostatic foot bath machine that can provide foot massages and an app that can remind her that her menstruation is coming soon. So that she can try to have a regular schedule to prevent dysmenorrhea. Although there are apps that can track menstrual cycles, they did not give a reminder automatically. The participant thinks that is inconvenient. The third participant hopes the design of sanitary napkins can be improved to better prevent period leaks. She also looks forward to more pharmaceutical research about treatments of dysmenorrhea because she thinks taking painkillers is not a long-term solution. She also mentioned that streaming media where people can watch series might be good for people with dysmenorrhea because it might divert attention. The fourth participant wants more cost-effective tampons because she thinks tampons or sanitary napkins cost a lot of money, which affects her economy. The fifth participant did not mention any products or functions that she want to have.

4.2 Results of survey

4.2.1 Discomforts encountered during menstruation.

Fig. 1 shows that more than 90% of the participants feel that dysmenorrhea has influenced their working or studying, while more than 70% of the participants feel very tired during menstruation. Fig. 2 illustrates that 85% of the participants feel bothered with period leaks.

4.2.2 Used products to help with dysmenorrhea.

Most of the participants have used NSAIDs. Some participants have used heating products such as heating pads, Vetekudde, heat-generator, and hot water bottles. Some participants have used TENS products and muscle relaxers.

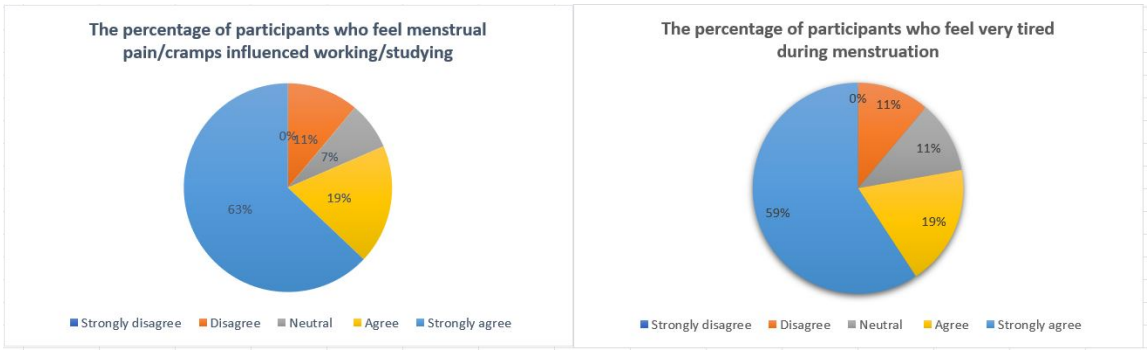

Fig. 1. Left: I feel that menstrual pain or cramps influenced my working/studying. Right: I feel very tired during menstruation

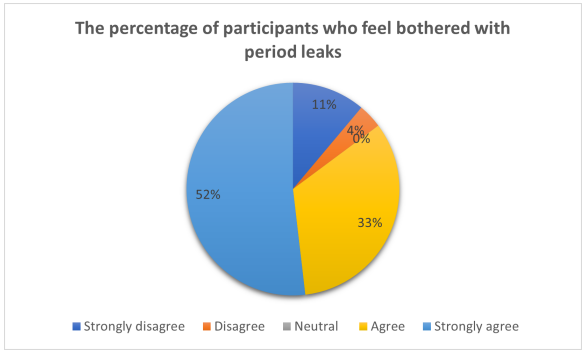

Fig. 2. I feel bothered with period leaks.

Some participants have used contraceptives. For the period leakage problem, some participants have used menstrual cups or some other similar products. More than 70% of the participants feel satisfied with the products they have used.

4.2.3 Desired products or functions of existing products.

First, some participants want stronger pain killers that can last for a longer time and has no side-effect. Secondly, some participants think products such as TENS and vetekudde can help reduce the uncomfortableness but not the menstrual pain. Thirdly, a participant mentioned that nothing can help with mood swings, coldness, and low blood pressure. Some participants want the products to be improved to better prevent period leaks. Fourthly, the prediction of menstrual tracking apps is not accurate. For their desired products, a participant wants a real-time menstrual tracker app. A heating belt whose temperature can be adjusted by a mobile phone is also needed. Fifthly, the guidance of what tampon and pantyliner that suits the users best are needed. Something that can force the muscles to stop contracting to stop cramps is needed. Besides, some participants want harmless drugs that can help with dysmenorrhea or can prevent leaking without taking hormones to stop the menstruation. Also, some participants would like something that helps balance hormone and PMS symptoms, while some would like something to decrease the amount of bleeding. Additionally, dysmenorrhea index testing or a machine that can measure how strong the menstrual pain is desired.

5 DISCUSSION

According to the presented results, most of the participants are satisfied with the products they have used to help with dysmenorrhea. Thus, the answer to **RQ1a** is that the user satisfaction of existing remedies or products that help with dysmenorrhea is pretty high. However, there is something that can be improved of the existing products. Other than the medical products, the shortcomings of the existing products are that they can help reduce uncomfortableness but not directly the pain, and they cannot help with the physical and mental effects that menstruation has on the body. HCI designers may improve the existing non-medical products by adding features to mentally support people based on different users' preferences or develop products that can provide physical supports.

Regarding **RQ1b**, for medical products, people would like to have more harmless and more effective medicine. For non-medical products, people would like to have products that can either provide thermostatic heat or measure the pain level. Other than products that can directly help mitigate the effect of dysmenorrhea, people would like to have products that can help with period leakage. These answers inspire that there are many possibilities for technologies to help people with dysmenorrhea, which answered **RQ1**. Firstly, products that can provide adjustable thermostatic heat and can be controlled remotely may be designed. Secondly, pain measurement techniques may be applied to help people better understand their dysmenorrhea experience. Thirdly, products that can better prevent period leakage or help with reducing bother of period leakage may be designed. Finally, HCI products that can help support people's studying or working or help reduce tiredness will be very helpful for all people during menstruation.

We can see that the problems of the current products for dysmenorrhea presented in Section 2 indeed bother users. Firstly, as the possible organ damage risk mentioned in [2], this study showed that people are concerned about the harmful influence NSAIDs might have on their health. Secondly, people prefer to possess a physical product that can provide adjustable constant heat when having dysmenorrhea. While not being able to provide adjustable constant heat is one of the main shortcomings of Undu [11, 12]. In addition, similar to some previous work [15, 23, 25] within the HCI field, the results of this study shows that it is possible to design products that help people with dysmenorrhea with HCI technologies. The results show that people would like more physical support with dysmenorrhea, which may be feasible by using the heat or pulse technologies demonstrated in [25] or by getting inspirations from the Menarche Bit [23]. Besides, the results show that people who menstruate might need economical support since sanitary napkins or tampons cost a lot of money. For this kind of support, the washable sanitary napkins produced by 3D printing skills [15] might help. Nevertheless, there is one finding that contradicts some related work. As presented in [13, 21, 24, 27], TENS technology can effectively help reduce menstrual pain. However, one person mentioned that TENS cannot directly help reduce menstrual pain. This result indicates that the TENS products might need to be improved.

The main limitation of this study is that the amount of collected data within this study is small. The number of participants is not large enough.

6 CONCLUSION

In conclusion, technologies can help with dysmenorrhea from different aspects. One aspect is to provide direct physical support for body discomforts. The other aspect is to provide mental support or other kinds of support for decreasing the effect dysmenorrhea has on life. Menstrual health can be improved when the influence of dysmenorrhea is reduced or eliminated. In further studies, based on the demonstrated results, the researcher will choose a core design challenge and move forward to the ideation and prototyping stages.

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REFERENCES

[1] Mariagiulia Bernardi, Lucia Lazzeri, Federica Perelli, Fernando M Reis, and Felice Petraglia. 2017. Dysmenorrhea and related disorders. *F1000Research* 6 (2017).

[2] Samik Bindu, Somnath Mazumder, and Uday Bandyopadhyay. 2020. Non-steroidal anti-inflammatory drugs (NSAIDs) and organ damage: A current perspective. *Biochemical Pharmacology* 180 (2020), 114147. https://doi.org/10.1016/j.bcp.2020.114147

[3] Nadia Campo Woytuk, Marie Louise Juul Søndergaard, Marianela Ciolfi Felice, and Madeline Balaam. 2020. Touching and Being in Touch with the Menstruating Body. In *Proceedings of the 2020 CHI Conference on Human Factors in Computing Systems* (Honolulu, HI, USA) *(CHI '20)*. Association for Computing Machinery, New York, NY, USA, 1–14. https://doi.org/10.1145/3313831.3376471

[4] Edoardo D'anna, Francesco M Petrini, Fiorenzo Artoni, Igor Popovic, Igor Simanić, Stanisa Raspopovic, and Silvestro Micera. 2017. A somatotopic bidirectional hand prosthesis with transcutaneous electrical nerve stimulation based sensory feedback. *Scientific reports* 7, 1 (2017), 1–15.

[5] Daniel A. Epstein, Nicole B. Lee, Jennifer H. Kang, Elena Agapie, Jessica Schroeder, Laura R. Pina, James Fogarty, Julie A. Kientz, and Sean Munson. 2017. Examining Menstrual Tracking to Inform the Design of Personal Informatics Tools. In *Proceedings of the 2017 CHI Conference on Human Factors in Computing Systems* (Denver, Colorado, USA) *(CHI '17)*. Association for Computing Machinery, New York, NY, USA, 6876–6888. https://doi.org/10.1145/3025453.3025635

[6] Sarah Fox, Noura Howell, Richmond Wong, and Franchesca Spektor. 2019. Vivewell: Speculating Near-Future Menstrual Tracking through Current Data Practices. In *Proceedings of the 2019 on Designing Interactive Systems Conference* (San Diego, CA, USA) *(DIS '19)*. Association for Computing Machinery, New York, NY, USA, 541–552. https://doi.org/10.1145/3322276.3323695

[7] William Gibson, Benedict M Wand, Catherine Meads, Mark J Catley, and Neil E O'Connell. 2019. Transcutaneous electrical nerve stimulation (TENS) for chronic pain-an overview of Cochrane Reviews. *Cochrane Database of Systematic Reviews* 4 (2019).

[8] Julie Hennegan, Inga T Winkler, Chris Bobel, Danielle Keiser, Janie Hampton, Gerda Larsson, Venkatraman Chandra-Mouli, Marina Plesons, and Thérèse Mahon. 2021. Menstrual health: a definition for policy, practice, and research. *Sexual and Reproductive Health Matters* 29, 1 (2021), 1911618.

[9] Sarah Homewood. 2018. Reframing design problems within women's health. (2018).

[10] Avril M Houston, Anisha Abraham, Zhihuan Huang, and Lawrence J D'Angelo. 2006. Knowledge, attitudes, and consequences of menstrual health in urban adolescent females. *Journal of pediatric and adolescent gynecology* 19, 4 (2006), 271–275.

[11] Charlie Katrycz, Robin Linton, Katherine Porter, and Graham McLaughlin. 2019. Loonskin Labs. https://www.loonskinlabs.com/, accessed 2021-11-22.

[12] Charlie Katrycz, Robin Linton, Katherine Porter, and Graham McLaughlin. 2019. UNDU: WEARABLE MENSTRUAL PAIN MITIGATION. https://www.jamesdysonaward.org/en-CA/2019/project/undu-wearable-menstrual-pain-mitigation/, accessed 2021-11-22.

[13] Gabriela R Lauretti, Raquel Oliveira, Flavia Parada, and Anita L Mattos. 2015. The new portable transcutaneous electrical nerve stimulation device was efficacious in the control of primary dysmenorrhea cramp pain. *Neuromodulation: Technology at the Neural Interface* 18, 6 (2015), 522–527.

[14] Livia. 2020. SWITCH OFF YOUR PERIOD PAIN AND SWITCH ON LIVIA. https://mylivia.com/.

[15] Joselyn McDonald, Siyan Zhao, Jen Liu, and Michael L. Rivera. 2018. MaxiFab: Applied Fabrication to Advance Period Technologies. In *Proceedings of the 2018 ACM Conference Companion Publication on Designing Interactive Systems* (Hong Kong, China) *(DIS '18 Companion)*. Association for Computing Machinery, New York, NY, USA, 13–19. https://doi.org/10.1145/3197391.3205405

[16] MONTHLI. 2021. PERIOD PAIN HAS MET ITS MATCH. https://lovemonthli.com/pages/how-monthli-works.

[17] Ovira. 2021. Instant, drug-free period pain relief. https://ovira.co.uk/.

[18] Vaibhav Pandita, Vidya Ajila, G Subhas Babu, Shruthi Hegde, and Mohamed Faizal Asan. 2021. Transcutaneous Electrical Nerve Stimulation: A Review of Dental Applications. *Journal of Health and Allied Sciences NU* (2021).

[19] Beurer EM 50 Menstrual Relax. [n.d.]. Beurer EM 50 Menstrual Relax Your assistant when it comes to menstrual pain! https://www.beurer.com/web/us/products/medical/electrostimulation/tens-ems/em-50.php.

[20] Sheryl A Ryan. 2017. The treatment of dysmenorrhea. *Pediatr Clin North Am* 64, 2 (2017), 331–342.

[21] HA Schiøtz, M Jettestad, and D Al-Heeti. 2007. Treatment of dysmenorrhoea with a new TENS device (OVA). *Journal of Obstetrics and Gynaecology* 27, 7 (2007), 726–728.

[22] Marie Louise Juul Søndergaard. 2020. Troubling Design: A Design Program for Designing with Women's Health. *ACM Transactions on Computer-Human Interaction (TOCHI)* 27, 4 (2020), 1–36.

[23] Marie Louise Juul Søndergaard, Marianela Ciolfi Felice, and Madeline Balaam. 2021. *Designing Menstrual Technologies with Adolescents*. Association for Computing Machinery, New York, NY, USA. https://doi.org/10.1145/3411764.3445471

[24] Akinbo S.R.A., Tella B.A., Olisah A.J., Ajayi G.O., Alamu D., and Oshundiya B. 2007. Effect of transcutaneous electric nerve stimulation (TENS) on hormones profile in subjects with primary dysmenorrhoea-a preliminary study. *South African Journal of Physiotherapy* 63, 3 (2007), 45.

[25] Anna Ståhl, Martin Jonsson, Johanna Mercurio, Anna Karlsson, Kristina Höök, and Eva-Carin Banka Johnson. 2016. The Soma Mat and Breathing Light. In *Proceedings of the 2016 CHI Conference Extended Abstracts on Human Factors in Computing Systems* (San Jose, California, USA) *(CHI EA '16)*. Association for Computing Machinery, New York, NY, USA, 305–308. https://doi.org/10.1145/2851581.2889464

[26] Martin Tomitsch, Cara Wrigley, Madeleine Borthwick, Naseem Ahmadpour, Jessica Frawley, A Baki Kocaballi, Claudia Núñez-Pacheco, and Karla Straker. 2018. *Design. think. make. break. repeat. A handbook of methods.* Bis Publishers.

[27] Nazan Tugay, Türkan Akbayrak, Funda Demirtürk, İİ Ilkim Çıtak Karakaya, Özge Kocaacar, Umut Tugay, Mehmet Gürhan Karakaya, and Fazlı Demirtürk. 2007. Effectiveness of transcutaneous electrical nerve stimulation and interferential current in primary dysmenorrhea. *Pain Medicine* 8, 4 (2007), 295–300.